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Document Version
Accepted author manuscript

Published in:
Digital Government: Research and Practice

DOI:
10.1145/3580000

Publication date:
2023

License
Unspecified

Citation for published version (APA):
Kristensen, K., & Andersen, K. N. (2023). C-suite Leadership of Digital Government. *Digital Government: Research and Practice*, *4*(1), 1-23. Article 3. https://doi.org/10.1145/3580000

C-suite Leadership of Digital Government

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Despite decades of digitalization in day-to-day government operations and in the governance of the public sector, there is a major research gap in understanding the nature of digital government leadership (DGL) and th diversity in how top managers are leading the digital transition and transformation of government. Based on a structured literature review and in-depth inductive analysis of previous research within the domains of e-government, information systems, and public administration research, this article explores how the C-suite level of government is leading the digitalization. In the article, we propose a definition of DGL and a leadership framework to capture the nexus and direction of leadership. Also, the article proposes distinct leadership roles and actions to forward digital government.

CCS Concepts. Applied computing –- E-government.

Additional key word and phrases: Digital government, leadership, top management, role of managers, digital transformation, digitalization, ambidexterity.

1 INTRODUCTION

During the infant days of the e-government era, the business process reengineering wave swept through the management vocabulary with strength similar to the waves of disruption [1-3]. Managers were supposed to play a key role in leading the change [4, 5] and managerial actions in the right form and doses could help overcome organizational barriers for transformation [6].

The optimistic tone on government transformation was echoed in the waves of digital era governance with the focus of the transformation potential related to the use of the internet and the emerging digital X era with IoT, blockchain, robots, and AI as the apparent potent radical transformative boosters. In the classic article "New public management is dead – long live digital era governance" published in the early years of the new millennium, Dunleavy et al. [7] ring the storm bell, and ten years later summon the public sector to "… completely embrace and imbed electronical delivery at the heart of the government business model, whenever possible" [8]. Equally strong words were used by chairman Schwab of the World Economic Forum in 2016, when he described the use of new technologies (i.e., IoT, AI, sensors, robots etc.) as "the fourth industrial revolution" and continued: "We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another" [9]. The acclaimed transformation has been associated with for example smart cities [10], algorithmic bureaucracy [11], predictivity and profiling of citizens within public health care, law enforcement, and crime labs [12, 13], and platform government [14, 15].

Yet, it is highly contended whether radical transformation of government can be documented and in whether impacts of the assumed transformation have occurred in the areas planned when acquiring new technologies [16]. Moreover, Wilson found that new technologies will be adopted by public sector

2691-199X/2023/1-ART1 $15.00
http://dx.doi.org/10.1145/3580000

organizations "... only when the new, sophisticated bit of technology is consistent with existing tasks ... if the new technology requires a redefinition of core tasks it will be resisted" [17].

Possibly linked to the lack of evidence of transformative strength and direction, managers have expressed frustrations when it comes to leadership of digitalization. The iconic paper on "Computers and the frustrated chief executive" from the late 1970s illustrates well why managers can be at odds using IT as a change facilitator for incremental and more radical changes of government: "Top managers' current frustration with [computers] is primarily grounded in the perceived lack of specific benefits … and in operational problems" [18]. Although potential benefits of new technologies include general improvements of interactions, government is highly focused on enhancement of capabilities (i.e., efficiency, effectiveness, and information quality) [19] to decrease costs and reduce administrative burdens for companies and citizens [20].

Contrasting the focus on *management of digital government (DG)*, for example IT project management and IT mediated leadership (e-leadership) to achieve these goals, *leadership of DG* has been only marginally researched despite an entire research field on public sector leadership to build upon.

A range of studies have called for attention to top management leadership [21-26] and their ability to cope with the high speed of digital change and deep shift in organizational culture [27]. Also, several conceptual studies and literature reviews have aimed to synthesize general themes and methods etc. within digital government (DG), e-government and e-governance, impact of e-government [28-31], and Information and Computer Technology (ICT) mediated leadership [32, 33]. Yet, there is great uncertainty on how to understand, theorize, and provide research-based input to practice on the leadership of digitalization. Particularly there is a research gap on how DG is led by the C-suite (CEOs, CIOs, CDOs, CFOs, CPOs, etc.) executive level of government.

Against this backdrop of research, the key research question in this article is how C-suite managers are leading the digitalization of the public sector. In pursuing this objective, we explore the nature of digital government leadership (DGL) with two sub-questions: 1) How are the C-suite level of government leading digitalization? and 2) How can the leadership and the associated roles be conceptualized?

We explore these questions by synthesizing top leadership literature from the public administration field and studies on digital change in key e-government and information systems journals into a conceptual Digital Government Leadership (DGL) framework. Thus, our article is in the sweet spot, or *crossroad* [30] as Gil Garcia et al. characterized it, between digital government research and public management research aiming to stimulate more collaboration between the research communities and to bring awareness of how leadership unfolds in theory and practice.

The article is structured as follows. First, we establish our conceptual understanding of public sector leadership and digital government. The foundation outlined in this section will be our platform for a comprehensive literature review of articles published in leading e-government, information systems, and public administration journals. Secondly, we present the applied methods and processes for mapping key concepts in the DGL literature and how we have crystalized the key elements in the proposed DGL framework. Thirdly, we outline a DGL framework, which categorizes the core DGL concepts of what public leaders do when leading digitalization according to the reviewed literature.

Fourthly, motivated by the work on engaged scholarship [34], we bridge the gulf between theory and practice, which in much academic literature is either omitted or limited to a few paragraphs at the very end of research papers or included as part of the motivation of the research papers. As we fully acknowledge that there might be implications for practice also of more theoretical papers without authors explicitly suggesting possible implications, we have allocated a larger part of the paper to discuss the results and conclude the article by outlining possible implications for practice and further research. In the section on implications for practice, we present various roles of top managers and outline actions we have identified in the literature for possible inspiration for C-suite leadership.

In the appendices to the article, we have included a detailed account of search details and results (Appendix A), methodological characteristics of the included articles in the review (methods, geographical location, unit of analysis, and leadership focus (Appendix B), and the concept matrix generated through our in-depth inductive literature review (Appendix C).

2 PRIOR RESEARCH ON PUBLIC SECTOR LEADERSHIP AND DIGITAL GOVERNMENT

Our point of departure for investigating how C-suite managers are leading the digitalization of the public sector is to contextualize the DGL with regards to general management research, leadership theories, and the general work on government and governance. Also, our research builds upon prior research to define e-government and e-governance. Thus, we aim to understand and exercise DGL on top of the shoulders of the research within these domains. For example, an explicit definition of e-government and e-governance helps focus the research mapping of DGL, distillate the components of DGL, and the possible forward actions leaders can apply to stimulate DGL. In this article we will therefore analyze the specific DGL-literature upon the comprehensive backbone of literature and insights derived within these areas. By taking this approach we aim at contributing with knowledge to these fields and to be on safe grounds when proposing implications for practice as an outcome of the literature review later in this article. Thus, we will in this first section outline how we view the link between the digitalization of government and the extensive literature of leadership and management. Also, we will explicate how we conceptualize the difference between government and governance.

Roman et al. have defined [32] and operationalized [33] the concept of e-leadership to describe the use of ICT-mediated communication between leaders and followers as a tool for leadership. This implies social processes with the aim to influence thinking, attitudes, and cultural behavior within the organization by use of technology, which require e-leadership skills related to communication, social, change, teams, tech savvy, and trustworthiness [32]. Yet, our focus is on leadership of technology in the public sector, not on leadership processes involving technology. Hence, we define public sector leadership in general terms as "the process of (1) providing the results required by authorized processes in an efficient, effective, and legal manner (2) developing and supporting followers who provide those results, and (3) aligning the organization with its environment" [35].

Public sector leadership comes in many formats and activities [35-38] and with several theoretical (overlapping) layers. Van Wart outlines five main arenas for public sector leadership theory: Management (leading for results), transactional leadership (leading the followers), transformational leadership (leading organizations), horizontal and collaborative leadership (leading systems), and

ethical leadership (leading with values) [37]. In our forward work on identifying specific research on DGL we rely on this broad-spectrum perspective the activities and formats of leadership. By doing so, we aim at capturing a broader and potentially also more relevant pool of research.

In our article we use "public sector" and "government" interchangeably. However, we do distinguish whether the digitalization is within government boundaries or part of governance. Grönlund and Horan summarize a simple distinction that government has to do with what is happening within the government organization, while governance refers to the whole system involved in managing society [39]. Bovaird and Löffler further clarify that public governance is "how an organization works with its partners, stakeholders, and networks to influence the outcomes of public policies" [40]. The term "governance" has gained traction in relation to information technology but is used inconsistently with different meanings [39, 41].

The e-government and e-governance literature is by large focused on changing operation, communications, routines, etc. to reach a predetermined goal such as increasing the public value through improvement of public services, administration, and social values. [42]. The concepts of e-government, e-governance, and digital government have evolved to describe the use of information technologies in the public sector [41, 43, 44]. Scholl defines e-government as "the use of information and technology to support and improve public policies and government operations, engage citizens, and provide comprehensive and timely government services" [45]. He identifies the research to be focused on electronic and transformational government, ICT's, e-democracy, and e-participation [46].

Gil Garcia et al. take a broader stance with more focus on the involvement of stakeholders: "DG as a phenomenon involves new styles of leadership, new decision-making processes, different ways of organizing and delivering services, and new concepts of citizenship" [30]. Following this argument, Gil Garcia et al. define DG as: "The public sector's use of information and communication technologies (ICTs) with the aim of improving information and service delivery, encouraging citizen participation in the decision-making process, and making government more accountable, transparent, and effective" [30]. Building on this definition of DG, this article adds the dimension of public leadership to explore the nature of DGL.

While e-leadership is mainly focused on leadership and competencies at the individual micro level [32], e-government and e-governance have focused on institutional levels by for example addressing the institutional level of government policies and the collaboration with other institutions, citizens, etc. to generate public value [42]. The concept of DGL is providing a link between the individual and the institutional level of public leadership of digitalization.

3 METHOD

The empirical foundation of this paper is a comprehensive in-depth literature review on digital government leadership. Guided by the proposed structured review method advocated by Webster and Watson [47] and following the examples of other researchers within the field [30, 31, 42] and their selection of journals, we focused the research on top research journals to prioritize depth and quality. Hence, we limited the search to published and early access articles in four leading public administration journals (Public Administration (PA), Public Administration Review (PAR), Journal of Public Administration Research and Theory (JPART), and Public Management Review (PMR)) and four

leading e-government/IS journals (Management Information Systems Quarterly (MISQ), European Journal of Information Systems (EJIS), Government Information Quarterly (GIQ), and Digital Government: Research and Practice (DGOV)).

When reviewing literature from the two research communities of PA and e-gov/IS we followed the recommendation of Cronin and George to first treat each of the research communities individually before integrating these [48]. Within the PA-journals we assumed all articles to be within the public sector domain. Hence, we searched on "information technology" and "digital" in combination with "leadership" and "management". For the e-gov/IS-journals we assumed all articles to be within the e-gov/IS domain and searched on "public" and "govern*" in combination with "leadership" and "management". In our initial search we included full articles, proceeding papers, editorials, and reviews, while book reviews were excluded. This search generated 520 articles, with 25% (n= 129) in the PA-field and 75% (n=391) within the e-gov/IS-field. In Appendix A we have included details of the search process.

The abstracts of the 520 identified articles were analyzed and included if the article covered all three dimensions of the review – digital, government, and leadership. We excluded reviews, editorials, viewpoints, theorizing, modelling, and conceptualizing articles based on secondary data. Whereas most articles have some relevance for leadership, much fewer articles explicitly consider the leadership dimension. Articles with none or vague explicit considerations on leadership or management of DG were excluded. Besides, articles focused on project management of IT-projects at a technical project level were considered out of the scope for this review.

While we used the software tool silvi.ai to allow for multiple reviewers and tracking the process of inclusion/exclusion of each article, we did not use any AI functionalities. The first author examined all articles, while the second author spot checked articles and all the finally included articles aligning judgements. The screening of the abstracts resulted in forty-six articles from PA-journals and fifty-four articles from e-gov/IS-journals – in total one hundred articles. A full text examination of the hundred articles further reduced the number of articles to eleven from PA-journals and twenty from e-gov/IS-journals. The final list of thirty-one included articles is listed in Appendix B. Thus, roughly one third of the DGL articles are within the PA-field and two-thirds within the e-gov/IS-field.

During the screening of the articles, the main topics of 489 excluded articles (520 articles in the initial round minus the thirty-one articles in the final basket of the analysis) were recorded. The most frequent topics were adoption and diffusion of IT, digital innovation, data-/information management, employee-/tech relation, project management, and impact of IT and e-democracy aspects such as citizen participation, transparency, digital divide, and use of social media.

Conceptual articles based on inductive coding risk having a bias with regards to research fields, methodology, geography, etc. [47, 48]. In order to provide transparency on this concern, Appendix B outlines the patterns across the batch of thirty-one included articles, while the subsequent analysis focuses on the content of the articles. 35% of the articles rely on quantitative methods, 32% qualitative methods, and 33% a mixture of qualitative and quantitative methods. The PA-articles are distributed almost evenly on method, which deviate from the finding of Gil Garcia et al. that PA primarily use quantitative methods to study DG [30]. The majority of e-gov/IS-articles use qualitative methods such as interviews and observations. USA is the most frequently studied country with the rest of the articles

fairly spread globally. However, we found no articles on DGL in emerging economies and least developed countries. The US bias and lack of inclusion of emerging economies is parallel to general limitation for DG literature [42]. The units of analyses in the articles are governments at national, regional, and especially the local level. Most articles concern general (or unspecified) leadership, and few articles specifically concern the C-suite level of management, which is a major research gap, as DG is no longer a restricted domain of IT-leaders but highly dependent on top management [26, 49]. As revealed above, there are imbalances in the methodological characteristics of the articles. Yet, we do not regard the articles to have significant biases and we find it justified to proceed with the analysis of the content of the articles.

Following the Webster and Watson suggestion of a concept-centric approach [47], the final set of articles were categorized into key concepts to identify sub-areas of DGL. Following grounded theory and open coding principles [50] twenty-nine concepts were crystalized. The initial coding round was done by "letting data speak" and adopting original concepts from the articles. Through the second round, axial coding [50] was applied clustering the concepts by rereading the articles, looking for concepts and their context. Through multiple rounds of iterative analytical processes between data display, reduction, and conclusions [51], the initial twenty-nine concepts were reduced to ten final concepts. In Appendix C, we have displayed the detailed concept-matrix distributed on articles whereas Figure 1 displays the initial twenty-nine concepts (smaller fonts) and the ten final concepts (larger and bold-faced font). For example, decision-making includes three of the initial concepts (portfolio management, investments, and decision processes and content).

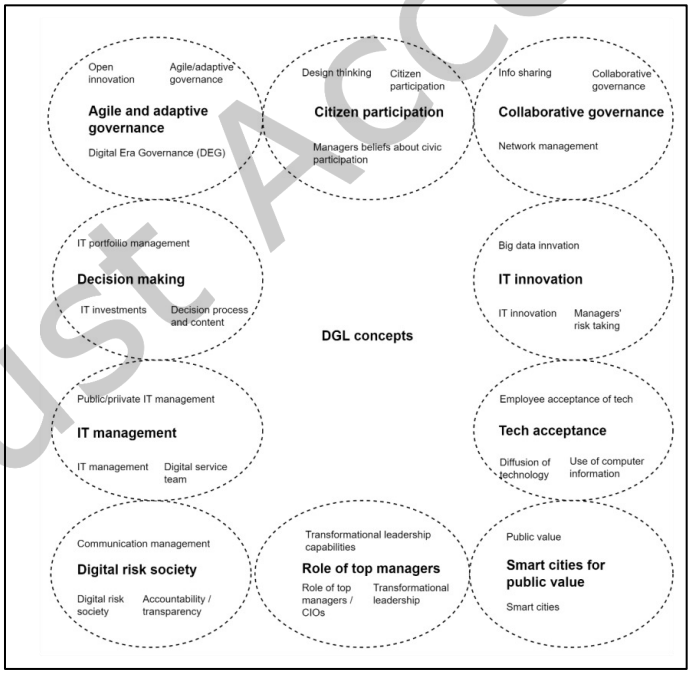

Figure 1. Overview of DGL concepts: Initial and final concepts.

Guided by solid methodological approaches [47, 48, 50, 51] to ensure a systematic process of searching, coding, clustering, and conceptualizing, we have arrived at ten key DGL concepts. Figure 2 presents the total number of articles with citations of each concept, and the distribution on e-gov/IS-journals and PA-journals. Articles from PA-journals are broadly occupied with eight of the ten key concepts, in particular "citizen participation", while the articles from e-gov/IS-journals are spread across all concepts with the most focus on "role of top managers". This distribution of articles underlines that even though research fields of PA and e-gov/IS origins from different positions, they have a significant pool of common interests in the research field of DGL. Two of the concepts are derived from the IS/e-gov journals only (IT management and agile organization) indicating more focus on these aspects of leadership in this subset of journals. Also, there is a greater variety of concepts used and nine of the concepts have more coverage in the IS/e-gov journals. The only area where PA-journals have more studies is within tech acceptance.

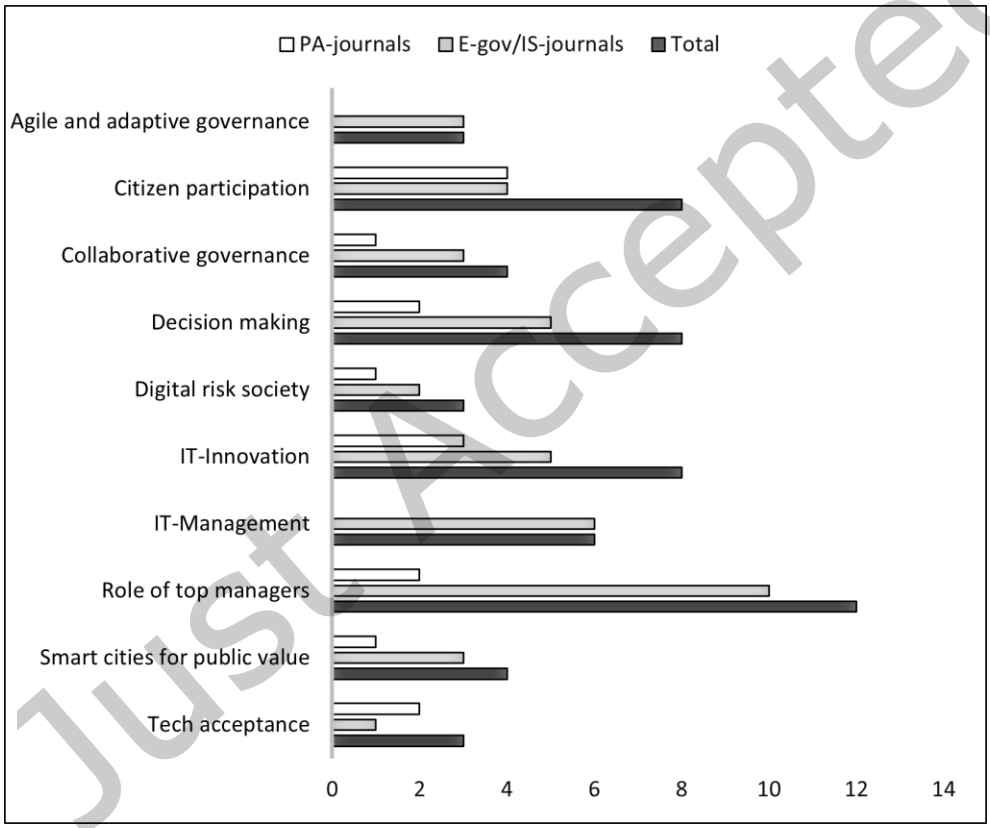

Figure 2. Concepts distributed on E-gov/IS-journals and PA-journals (N)

4 FINDINGS

We have derived ten concepts presented in Figures 1 and 2, which outlined different aspects of leadership of digital government. The essence of each of the ten concepts are summarized below, and the characteristics are further unfolded in section 4.1.

The concept of *agile and adaptive organization* concerns the need for dynamic and flexible ways of governing and organizing digital government, including integrative approaches founded in the concept of Digital Era Governance by Dunleavy et al. [7]. *Citizen participation* focuses on the involvement of citizens in public digitalization with the aim to adapt public services to citizens, companies etc. and to mobilize resources from the community. Besides, several of the articles are rooted in design thinking approaches. *Collaborative governance* is about sharing data and working with other public agencies, companies etc. to perform public tasks, which is further described in section 4.1. *Decision making* concerns the process of preparing and taking decisions on IT-investments, portfolio management etc. Applying a critical lens, the concept of *digital risk society* discusses management approaches to concerns of citizens and media about digitalization of society, digital events as data breaches and the consequences for issues as equal access to public services, trust, ethics, accountability, and transparency of government. The concept of *IT-innovation* encompasses elements as leading gradual and radical innovation of IT-systems, new use of big data as well as the risk taking of public managers and organizations by introducing emergent technologies. *IT management* covers a wide range of both strategic and more operational management tasks related to governance, development, procurement, monitoring, architecture and security of government IT and specific IT-projects sometimes involving private suppliers. The approach to IT management is often technical and applying various management tools. The *role of top managers* involves functions and actions of top managers, which are further detailed in section 5.1. The concept *smart cities for public value* concerns the use of digital technologies in leading urban development projects, which often involves non-government stakeholders and strive to achieve public value from a citizen perspective. Lastly, *tech acceptance* refers to the resistance of public employees towards using digital technologies and the managerial strategies to overcome the skepticism, to diffuse and to anchor technology in government processes.

The above section illuminates that DGL is an assorted box of components and a unconsolidated research field with a multitude of focus areas and approaches. With the ambition to qualify the understanding of how C-suite managers are leading the digitalization of government, we will in this section propose a DGL framework, which contributes to categorizing the DGL literature and to offer a framework of reference to scholars and practitioners.

Based on our inductive coding and analysis of the DGL articles, we found an emerging pattern in the fragmented literature by categorizing the ten concepts according to leadership direction and leadership mode. The *leadership direction* of focus, being either inward or outward of the government institution, is inspired by the governance literature shifting focus from internal processes in government institutions to external governance processes involving NGOs, interorganizational networks, private companies, and other actors in society [52-54]. This distinction reflects the sovereign state being replaced by the idea of decentered governance based on interdependence and trust between government and other institution [52].

In line with this development a large part of the early literature on leading digitalization is focused on inward leadership of the government institutions, while there has been an increasing focus in theory and practice on the outward orientation of leading collaboration in the governance of digitalization [39, 40]. This is also the tendency in the reviewed DGL literature, which implies public leadership of digitalization being not entirely an internal discipline but also encompassing leadership of the collaborations with other government institutions, citizens, NGO's, private companies, and society in general. This wider outward perspective may provide a more needs based holistic [7] and agile response to complex society problems, but it may also come with managerial or even democratic costs depending on approach, context, etc. [52, 55].

The second dimension, *leadership mode*, concerns the distinction between transition-transformation suggested by Anderson and Anderson as part of the change management literature [56]. Transition has to do with leadership of a relatively simple and linear process from state A to state B focusing on structures, technologies, and work processes. In contrast, transformation is focused at agile and circular learning processes requiring shift in human behavior and mindset. The outcome of transformation is initially unclear, but the focus of change is a radical overhaul of the strategy, structure, processes, and culture of the organization [56]. Naturally, not all IT-leadership - involve transition or transformation. The somewhat tedious issues of daily maintenance and improvements of digital solutions account for a big chunk of resources and management attention to digitalization. However, digitalization is a process of change [57] and digitalization is widely considered a key driver for changes in the public organizations and leadership roles [7, 58, 59]. This is also reflected in the DGL literature, where digital change is at the core of the research field.

The two dimensions outlined above compose the proposed DGL framework. In Table 1 the DGL concepts are distributed along the two dimensions (direction and mode of leadership) according to the content of the articles forming the basis of the concepts. Further, each of the four categories are provided with the number of articles contributing to the category and a label summarizing the essence of the literature: Exploitation (decision-making, tech acceptance, and IT management), collaboration (collaborative governance), innovation (IT-innovation), and exploration (citizen participation, smart cities for public value, agile and adaptive governance, and digital risk society). These categories encapsulate what top public leaders do to lead digitalization.

Table 1. Direction and mode of C-suite digital government leadership

		Mode of leadership	
		Transition	Transformation
Direction of leadership	Inward	**Exploitation** 1. Decision making 2. Tech acceptance 3. IT management (N = 16 articles)	**Innovation** 4. IT-innovation (N = 8 articles)
	Outward	**Collaboration** 5. Collaborative governance (N = 4 articles)	**Exploration** 6. Citizen participation 7. Smart cities for public value 8. Agile and adaptive governance 9. Digital risk society (N = 12 articles)

4.1 Leadership components: Exploitation, collaboration, innovation, and exploration

4.1.1 Leading digital exploitation

Exploitation compromises topics with a relatively straight forward transition process within government institutions. The research on exploitation addresses acceptance, IT management, and decision-making.

Several articles concern acceptance and adoption of technologies and find that C-suite managers are highly dependent on support staff and involvement of specialists and wide organizational support in the adaptation phase. This appears to be true in the early days of computing in government and in the more recent digitalization. In an early longitudinal study Kraemer et al. outline management styles of use of computer-based information and find that computer-based information is increasingly perceived useful by managers, in particular for *control of financial resources* and less for *management of operations* [60]. Managers having support staff to interpret computer-based information are more satisfied with the use than "hands on"-managers doing the extraction and data analysis themselves, which points to the need for "information brokers" to increase the managers' adoption of computer-based information [60].

Contrasting top-down views of effective leadership, Vonk et al. point to the risk that top management decisions on strategies for technology diffusion may lead to low compliance and unintended outcomes, while involvement of specialists in diffusion strategies enhance compliance, because top managers do not have insight into daily practices of the specialists intended to adopt the technology [61]. Along the same lines Coulthart and Riccucci find it critical for the adoption of big data analytics that front line employees are involved in trial-and-error processes to make the technology relevant for their tasks [26].

Several studies identify challenges and critical factors for effective IT management and development. Among the key findings are the need for active buy-in from top and middle level managers as decision makers, to outline not only short-term operational but also long-term strategic goals and planning procedures for IT integrated with the organization's mission and goals, to provide necessary funding for IT and implementation, to align operational processes and projects in the entire

organization with IT, and to build IT capabilities, culture and acceptance of IT among organizational members [49, 62-64].

In many of the studied public organizations these factors are lacking, which causes less effective use of IT and a degree of frustration with IT projects and results [49]. However, Reinwald and Kraemmergaard provide a case study of a mature e-government model, which has developed an extensive web portal for the citizens by successfully engaging top and middle level managers and other stakeholders, the most critical factor being to have the top management act as proactive initiator rather than passive stakeholder [65]. Mergel reviews the creation of digital service teams across seven countries to avoid large scale IT failures, and it is demonstrated how governments through digital service teams hope to accelerate digital transformation by replicating and scaling successful practices towards complex problems [66].

Based on input from IT managers, De Tuya et al. found that the lack of technical insight into IT infrastructure etc. in many decisions making processes on IT portfolios and investments hampers the benefits to government and community [49]. This result represent what Nielsen and Pedersen call a "technical rationality" in IT decisions, while other decision-making styles are summarized as political, intuition, or coincidence [67]. Like De Tuya et al. above, it is argued that technical rationality plays a limited role in IT portfolio decisions, but contrary to De Tuya et al., Nielsen and Pedersen find evidence that technical rationality is an ideal not compatible with the organizational contexts and individual behavior. Hence, they suggest taking a more pragmatic approach to IT decisions by recognizing other decision-making styles than technical rationality [67].

Lim and Tang find that entrepreneurial leadership from senior management is key to decision intelligence, quality, and speed in the case of web portals [68]. Bozeman and Pandey find that the decision content is important to the decision process and that "technical" IT decisions take longer time and are considered more stable than "political" cutback decisions, but that even IT decision are not purely technical but contain political aspects [69].

Following similar pragmatic approaches several studies demonstrate the value of design thinking, stakeholder involvement, and distribution of decision power in IT decision processes [70-72]. Even if IT investment decisions are approved by top management, internal and external contextual factors influence the initiation and development of IT investment decisions, which makes design of stakeholder involvement especially important in the early stages [73].

4.1.2 Leading digital collaboration

The relative few articles within the category of collaboration concern collaborative governance, network management, and information sharing. The sub field recognizes the limitations of public organizations to perform their tasks entirely in their hierarchical structures without involving other government agencies, civil society, private companies, etc., and the key leadership task is therefore to manage the collaboration between public and other institutions effectively. This requires setting common data standards, developing mutual trust, and combining human and technological resources [74].

Gil Garcia et al. find that the benefits of info sharing projects rely on how leaders handle impediments. It is especially important to avoid a control management style, setting clear goals, and aligning realistic expectations to the collaboration between government and other institutions [75].

Other studies find that collaborative governance projects have the potential for raising innovativeness if they involve civil society and private sector and adopt a public value perspective rather than aiming to optimize benefits of the government institutions involved [71, 76].

4.1.3 Leading digital innovation

The innovation category concerns new approaches to digital transformation. Several studies underline the necessity for top management support and leadership for digital innovation because the public sector constitutes a risk averse environment [21, 24, 26]. Among the tasks of C-suite managers are to strategically align the digital innovation at the front end with the mission and goals of the public institution [26]. At the national level a similar connection needs to be established between state-initiated initiatives, such as an open innovation platform, and the mission and goals of the public institutions intended to use the platform [77]. Besides, open innovation platforms are confronted with many external, intra- and inter-organizational barriers, which top management must pay attention to.

Magnusson et al. investigate the concept of organizational ambidexterity within IT governance, which refers to the need of organizations to exploit existing opportunities to achieve efficiency, but at the same time to explore new opportunities to innovate [78]. Efficiency tends to marginalize innovation, but at the same time informal "shadow innovation" arises in the organization to comply with the efficiency requirements etc. Hence, efficiency and innovation can fuel each other [78].

Other mechanisms for leading digital innovation are open innovation labs, where experimentation is facilitated before IT investment decisions [71], partnerships between government and e.g., semi-public utility companies for IT enabled innovation of smart cities [76] and digital service teams to act as catalysts for change and applying methods comparable to innovation labs [66].

4.1.4 Leading digital exploration

The category of exploration encompasses transformative digitalization with a focus on the participation of external stakeholders such as citizens, NGO's, universities, companies, etc., which increases complexity and the need for attention to human behavior and processes. Sub fields are agile and adaptive governance, citizen participation, smart cities for public value, and digital risk society.

Mergel summarizes the limitations of the classic approach to most IT development, which follows planned sequential phases taking a top-down waterfall approach to development and implementation [24]. This approach does not work well in complex IT projects with uncertainty in the project and the environment, because it is not possible to respond to changing needs, and because end users are not involved before the final stage. In contrast to this linear process, agile and adaptive approaches involve end users from the very start and frequently update plans to incorporate learning from fast failure [24]. It is suggested to apply a two-layer model composed of a basic layer of policies and another management layer, where the management oversees the processes and provides resources and leadership to the organization [24].

Wang et al. study how government interacting with companies, NGOs, and universities can adapt rapidly to changes in the environment and find three types of adaptive governance – polycentric, agile, and organic, differentiated by the distribution of accountability and decision-making power, which has implications for the strategic design of IT governance [72]. Along the same thinking Soe and Drechsler demonstrate how agile and adaptive governance with engagement of multiple public and private stakeholders can add public value, because the agile approach allows to test emergent technologies and new partnerships before embarking on large scale investments [71].

The DGL literature is rich on examples of benefits and limitations of external participation. Luk confirms that involving stakeholders (users, legislative council members, and government agencies) affects the success or failure of e-government, because government and stakeholders are intertwined [23]. Leaders promoting stakeholder participation get a better understanding of the stakeholders' environment and easier access to overcome problematic bureaucratic attributes (rigidity, hierarchy, and risk-aversion) and, thus, better changes to succeed with the e-services. Besides, if stakeholders have incentive to support implementation of e-government services, there is a positive impact on the likelihood of success [23].

CIOs acting as institutional entrepreneurs can mobilize community and provide legitimation of technology [25], while combination of access to e-participation of citizens and strong political leadership can increase citizens satisfaction, transparency, and transform working procedures in bureaucracy [79]. However, citizen participation comes with increased complexity, possible disagreements, and workload for the bureaucrats, which makes managers' commitment and values about civic participation important to overcome these barriers [79, 80].

The concept of smart cities is not clearly defined, but often has to do with highly innovative use of digital technologies for public value purposes with a citizen centric approach, multi actor involvement, and a strong bias towards urban technical challenges [76], as for example the mobility from the ferry terminal through City of Tallin [71]. The public value paradigm claims public values such as legality, equity, transparency, and accountability to be a prime objective of public administration [81-83]. Digital technology is an important source for public value, and the recommended methods are focused on collaboration between public sector organizations, private sector, and civic society to create mainly three types of public value: Service quality, effective governance, and trust of citizens [49, 71, 76].

Sancino and Hudson demonstrates how engagement of citizens, universities, companies, and NGOs in smart cities' projects may improve innovation for public value in a citizen centric approach, but that even if citizens are central to the purpose of more than hundred smart city projects in Amsterdam, the citizens themselves are seldomly involved actively as project partners [84]. Four modes of smart cities leadership are identified: Smart cities as digital government, digital driver for economic growth, as an open platform for digital socio-political innovation, and as an open platform for digital economy [84].

Examining drivers and barriers for citizen participation in open innovation platforms, Mergel finds that apart from legal and other external barriers, there are also interorganizational barriers such as organizational culture and managers beliefs about citizen participation. Only if aligned to the mission and having an open culture in the organization, will the organization adopt digital platforms for involvement of citizens and gain free or low-priced knowledge to solve government problems [77].

A case study at local government level from South Korea finds that e-government initiatives such as broad casting senior staff meetings and providing open access to government documents increase transparency and citizens' trust [79]. Another study draws the attention to the distribution of accountability in government and non-government collaborations e.g., when engaging with Chinese tech firms like Tencent, and finds different outcomes related to the distribution of accountabilities [72].

Nqwenyama et al. show how a combination of media propelled public fear of hacking, security breaches, and surveillance, combined with distorted public communication, easily can erode trust in societal institutions and democracy, and argue that this threat needs to be mitigated by policies, legislation, and strategies to defend the rights of citizens against digital risks derived by modernization of society [85].

4.1.5 Key lessons from the literature

Across the concepts and contributions from the 31 sample articles some lessons stand out. Digital exploitation is full of pitfalls like procuring, organizing, managing and implementing the use of technology to deliver results. This requires considerable interest and backing from the top management even though many operational decisions may be delegated. Failures with digital transition are frequent, but nevertheless leading digital exploitation seems to be the simplest form of DGL. Leading digital collaboration adds to the complexity because the top management in addition to internal challenges also need to understand and align with the data, values, drivers, impediments, and goals of external collaboration partners. To deal with this complexity, the literature suggests the leadership to downscale control and focus on creating trust and common goals.

Leading digital innovation involves radical transformation and, thus, finding ways to question existing procedures and overcome risks. This requires not only the backing of the top management, but also a clear mission to align innovative initiatives with and a top management actively accepting failures, promoting innovative cultures and structures. Leading digital exploration with external stakeholders may be even more challenging. Agility and adaptation are necessary to work with both private companies, academic institutions and non-professionals such as citizens towards an initially unclear outcome. Hence, the literature suggests top management also act as institutional entrepreneurs to create a vision, align internal and external stakeholders, mobilize communities, stimulate human behavior and openness about the use of digital technology.

5 DISCUSSION AND IMPLICATION FOR PRACTICE

The four categories in the DGL framework (exploitation, collaboration, innovation, and exploration) outline what public top leaders do in order to lead digitalization. In this section the framework is supplemented by corresponding digital leadership roles of top managers presented as four archetype "professions" with associated actions and examples, which are inspired using "personas" in design literature [86, 87]. In line with this literature, the aim is to communicate abstract leadership roles through means of identification with professions. The roles and actions are founded in the DGL literature and our inductive coding and analysis, but we have in the labeling of roles added images of

each of the roles. Afterwards we summarize the key findings of our research and conceptualize the crosscutting issue of the role of top managers by proposing a definition of DGL.

5.1 C-suite leadership roles and actions in digitalization

Keen provides an early example of the dichotomy between control and enabling leadership, as he demonstrates how traditional roles of execution of political decisions and monitoring data is not sufficient in a state organization like the British National Health System [88]. Top management must also outline an information strategy and enable the implementation e.g., through reducing uncertainties for local entities by aligning interests with financial and other incentives [88].

Caudle et al. note that r top managers in public organizations are more focused on agenda setting than actual information management, because they refer to political bodies and have more stakeholders to involve than their private sector counterparts [62]. Kraemer et al. focus on the manager's own use of computer-based information and find that managers' perception of usefulness of computer-based information relies on information brokers. Hence, IT systems should be designed with these information brokers in mind and not the managers [60].

Other and newer studies assign a more strategic and engaging role to the C-suite managers, who must spearhead the digital transformation process [e.g., 25, 65, 89], because the change from delivering e-government services to radical digital transformation of government is complex, involves high transformation costs, requires long-term commitment, authority, and understanding of the whole government strategy [89]. Tassabehji et al. label this role *institutional entrepreneurship* encompassing to mobilize the community, resources, and to create a coherent vision as well as storytelling of narratives of success stories [25].

In this perspective the many actions to be undertaken by top managers include to articulate the vision, strategy, and setting clear goals [23, 25, 49, 63, 64, 68], to ensure political "air cover" and long-term commitment [24, 25, 65], to safeguard customer focus by highlighting transparency and mobilizing the community and stakeholders [24, 25, 64, 65], assign the necessary resources [25, 63, 64], to integrate digital development into other activities [24, 90], stimulate a culture of IT acceptance and collaboration in the organization [23, 24, 64, 65], and to avoid external barriers (e.g., legislation) [23].

In Table 2, the above roles of top managers are condensed and distributed among the categories of the DGL framework according to our assessment of match between each category and the leadership roles. Within each category, key leadership actions derived from literature are highlighted. Furthermore, we have applied four illustrative images to capture the essence of the role of C-suite managers in each category: The farmer, the diplomat, the inventor, and the entrepreneur. In the following sections we detail the associations we attribute to each of the images of leadership.

Table 2. Images and actions of C-suite digital government leadership

		Mode of leadership	
		Transition	Transformation
Direction of leadership	Inward	**Exploitation - the farmer** Actions: Plan, optimize, manage, structure	**Innovation - the inventor** Actions: Promote and ignite innovation and align with mission and goals of organization
	Outward	**Collaboration – the diplomat** Actions: Align goals, negotiate, coordinate, collaborate	**Exploration – the entrepreneur** Actions: Articulate vision, mobilize, stimulate human behavior and culture

The exploitation role of top managers is labeled *the farmer* to illustrate the daily strive to efficiently exploit current opportunities by optimizing the benefits of the resources and reducing costs. This role requires long term investments, detailed planning, nurturing and management of soil, animals etc., as well as ongoing improvement of processes, structures, and output as well as optimizing the balance between exploitation of current and long-term opportunities. An example of this role is provided from Taiwan's Bureau of Foreign Trade, which demonstrates how transition of IT-infrastructure is driven by national policies but need careful implementation at agency-level [64].

The collaboration role is labeled *the diplomat* as the diplomat represents own organization and engages in setting agendas, aligning goals, coordinating, and monitoring activities across organizations with external collaboration partners and without pursuing personal gain. This role requires ongoing consultations with the home organization, leadership in and out of the organization, promotion of gradual improvements, and a pragmatic attitude to negotiate common ground and governance structures for the joint activities. The role is exemplified by the case study involving local and county governments from Nebraska and Iowa states in joint transportation data and planning, which underlines the need to develop standards and mutual trust [74].

The innovation role is labeled *the inventor because* the inventor aims to promote and ignite innovation of new and radical solutions and align these with the goals of the organization. This may be done through changes in the input resources, structures, technologies, processes, and the human mindsets of the organization. Besides unconventional and visionary thinking, this role requires changing management skills to inspire and enable people in the organization to contribute to innovation, and a shift from traditional towards emerging processes and solutions. An example is the United States Border Patrol applying big data, which also requires tapping into informal knowledge networks of employees [26].

The exploration role is labeled *the entrepreneur* to illustrate the risky drive towards untouched ground to explore future opportunities by teaming up with other stakeholders providing finances, knowledge, or in other ways contributing to the quest. This requires trust, courage to fail, and empathy to mobilize stakeholders and stimulate entrepreneurship, cultural change, and support not only within the organization but also among the stakeholders. An example of this is the case of agile trials with public and private participation striving to improve smart mobility in the ports of Helsinki and Tallin [71].

The four C-suite leadership roles and the associated actions can co-exist, and leaders will balance and apply the roles according to situation and context. Thus, our proposal is not to label a specific

leader to be within one category only. Rather there will over time be actions and elements from each category in all leadership positions. Hence, the role of top management needs to be conscious about in which role to position themselves in specific situations and how to balance the distribution of their roles and attention to categories in general. It may therefore prove helpful to use the framework as a joint reference for a discussion within top management practitioners about: How do we as top management distribute our attention to the various roles and actions in leading digital government? – and should it be changed in the future?

5.2 Towards a definition of DGL

Our mapping of digital government leadership has revealed a diverse landscape of ontological, epistemological, and methodological stances including qualitative research, positivistic quantitative analysis [80], critical analysis of discourses [85], and grounded theory building research [65]. In this melting pot of research, most articles take an optimistic or pragmatic middle stance. It may be surprising that the DGL literature is not taking a more critical perspective [30, 46], because the public and research debate about transparency, ethics, misuse of big data, surveillance, etc. [e.g. 91] have flourished. Apart from few exceptions [68, 79, 85], critical approaches have not yet been covered in the DG literature focused on leadership.

The leadership of digital government can in our view be conceptualized as a balance act between gradual transition and radical transformation of government as illustrated in Figure 3. While transition follows a linear approach from state A to state B, transformation follows a more circular approach from state A to an initially unknown outcome.

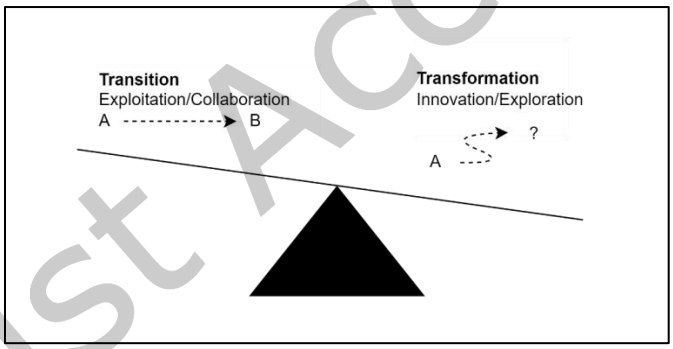

Figure 3: Balancing transition and transformation in DGL

In balancing these, there is a strong focus on exploitation (the North-West corner in Table 1) of anticipated inward oriented benefits in decision-making processes, technology acceptance, and IT management. Also, there is a key focus on exploration (South-East corner in Table 1) covering transformation of outward oriented mechanisms with regards to citizen participation, smart cities, digital risks, and agile governance procedures. The categories of collaboration and innovation play a less clear role.

One of the key observations from our mapping is the absence of studies focused on top leadership within the e-gov/IS- field. This may be due to that at least IS originates from the technical research

field of computer science and that digitalization for long was considered primarily a technical issue to be solved by IT-leaders rather than line or top leaders of the organization [49, 92]. Also, the public administration community has not yet fully incorporated digital leadership to be as important as leadership of for example fiscal resources and people [93]. This may be an overlooked aspect in PA research, or it may reflect that most countries have not yet come close to the vision of Margetts et al. "to completely embrace and imbed electronical delivery at the heart of the government business model" [8].

Also, our mapping of leadership has not identified research on how top leaders balance different forms of change with daily routines of digital management. The vital daily management of digital solutions claims vast resources and implies a range of problems such as IT-debt from legacy systems, system integrations, etc. Instead, the majority of research appears on exploitation and exploration through radical change. This fits well with the idea of organizational ambidexterity, where the leaders of the organization must exploit existing opportunities and at the same time explore new opportunities [94, 95]. It is worth noticing that exploitation is focused inward on transition of the governmental organization to optimize existing DG opportunities, while exploration is focused outward on transformative governance together with external stakeholders towards new DG opportunities.

Balancing exploitation and exploration require leading actors to balance inward/outward concerns, it also requires ontological considerations. Exploitation of DG follow a relatively structured and linear planning approach to issues such as IT management, IT adoption and acceptance, as well as decision processes [64]. Exploration acknowledges the complexity of the socio-technological environment of DG and applies a more circular and enabling approach to issues such as citizen participation, agile innovation, digital risk society, and smart cities for public value [24, 71].

To stimulate further research on digital government leadership, there is a need to clarify what DGL is. Orazi et al. define leadership as leading for results, leading followers, and aligning with the environment [35]. Standing on the shoulders of this definition of leadership and incorporating that the ambidextrous goals of exploitation and exploration are clearly articulated in the DGL literature, we propose the following definition of DGL:

DGL is to exploit existing digital opportunities to solve imminent challenges and to explore new digital opportunities to undertake the core mission of the public organization, while managing for results, leading followers, and aligning with the environment towards a clearly articulated vision.

Despite the complexity of the research field, this definition clearly outlines the key dimension and concepts and an operational way forward to study DGL in theory and practice. Also, it is notable that the four groups in our proposed DGL framework (exploitation, collaboration, innovation, and exploration) resonate well with the work on organizational change (transition and transformation) coined by Anderson and Anderson [56] and the literature on ambidexterity originated in organizational science [78, 94, 95].

6 CONCLUSION

The overall conclusions derived from this conceptual article on digital government leadership include methodological and substantial elements. With regards to methodological contribution there are two

key elements. Firstly, our ambition to contribute to theorizing about DGL took its point of departure in a theoretical sound body of literature on public management and e-gov/IS research. Secondly, through an extensive mapping and synthesizing of literature, the paper inductively generated a framework for public sector C-suite leadership of digital change.

In the paper we have applied a structured literature review approach with a replicable search-procedure and transparent coding process, where choices, the initial coding concepts, and the concept matrix are made explicit. Yet, searching, selecting, coding, and clustering into meta-concept can lead to exclusion of details and subject to biases of the authors. Other limitations are differences in how explicit articles account for their ontology, epistemology, methodology, and the empirical contexts, which makes it challenging to identify and document patterns in DGL research, where research on top management and political leadership is scattered on a range of concepts. Paying careful attention to the potential methodological limitations, the article offers three key substantial conclusions.

Firstly, the article proposes a definition of what digital government leadership is. *DGL is to exploit existing digital opportunities to solve imminent challenges and to explore new digital opportunities to undertake the core mission of the public organization, while managing for results, leading followers, and aligning with the environment towards a clearly articulated vision.* In balancing short-term and long-term objectives, leaders need to build on the potential within the organization and the external stakeholders. Yet, leaders need to articulate directly and with great clarity the vision and the assignment as they lead the digital change.

Secondly, the article points out the apparent paradoxical situation that while government can be associated with hierarchical and clear command-of-line, leadership of digitalization appears to be much more of a team effort within the organization and involving the surrounding stakeholders in a governance perspective. Taking this inclusive approach adds to the complexity of DGL, and it is therefore a key task of the C-suite management to determine which digitalization processes may be solved by relatively simple linear processes within the government and which digitalization processes require a more inclusive and circular approach to succeed and not least gain the necessary support from key stakeholders.

Thirdly, the article proposes an inductive driven conceptual framework to comprehend the leadership of digital transition and transformation of government. The DGL framework captures four clusters of concepts of leadership of digitalization (exploitation, collaboration, innovation, and exploration) and four corresponding leadership roles (the farmer, the diplomat, the inventor, and the entrepreneur) derived from e-gov/IS and public management literature. We strongly advocate for more collaboration between the two communities in order to elevate our understanding of the dynamics of DGL.

The North-West and South-East diagonal between exploitation and exploration in the DGL framework is the most prevalently articulated in the research we have analyzed. Although digitalization, and in particular the more recent waves of digitalization, is associated with finding new ways and elevating existing ways of communication and collaborating with citizens, companies, non-profit organizations, and other public organization, we find limited research on these areas. Also, the innovation category in our framework is less populated with studies that can qualify how leadership of

digital innovation is done and what the actions of leaders are when pursuing innovation of government or governance.

The proposed framework and roles can help box-in the challenges leaders experience and the decision options leaders must take within when pushing digitalization forward. Hence, the framework contributes with a framework of reference, or language, for scholars and practitioners to comprehend, discuss and navigate the quest of digital government leadership. We encourage other scholars to further research the four categories of the DGL framework through empirical studies on how the roles of top public managers are practiced. Also, we encourage the C-suite of managers to be inspired by the framework and roles when practicing leadership.

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APPENDICES

Appendix A. Search details and results

Four leading PA-journals and four leading e-gov/IS-journals were selected based on prior knowledge of likely outlets for DGL literature. Assuming all articles in PA-journals concern the public sector domain, we included key search words on information technology and digital in any combination with leadership and management. Also, we searched the same PA-journals for combinations with the related terms information and communication technology, e-government, e-governance, digital* which all had two or less extra results. For the e-gov/IS-journals we assumed all articles to be within the IS domain, so we searched on the key words public and govern* in any combination with leadership and management. Using govern* allowed for both the terms government and governance to be included.

The searches were conducted January 2022 using Web of Science, except for the journal of DGOV, where the search was conducted at the homepage of the journal and furthermore all articles 2020-2021 were screened. The initial search was on title and abstract in the year 2021 and backwards without time limit, because we also wanted to identify the roots of DGL, even though the context of older articles decades ago certainly has changed. Articles, proceeding papers, editorials, and reviews were included, while book reviews were excluded.

Table A1. Number of initial articles distributed on E-gov/IS and PA- journals: Results of initial search (N)

PA-journals	Articles
Public Administration (PA)	10
Public Administration Review (PAR)	58
Journal of Public Administration Research and Theory (JPART)	15
Public Management Review (PMR)	46
Total PA-articles	129
E-gov/ IS-articles	
MIS Quarterly (MISQ)	58
Government Information Quarterly (GIQ)	270
European Journal of Information Systems (EJIS)	57
Digital Government: Research and Practice (DGOV)	6
Total E-gov/ IS – articles	391
Total articles PA + E-gov/IS	520

The abstracts of the initial 520 articles were screened and later full text analyzed. The sorting, filtering, and analytical phases were processed in the software tool silvi.ai. We applied the following inclusion criteria: 1) Articles covering all three dimensions of the review – digital, government, and leadership, and 2) articles should be based on empirical data.

In the filtering process, we applied four sets of exclusion criteria: 1) Reviews, editorials, viewpoint, theorizing, modeling, and conceptualizing articles based on secondary data. Though relevant as background to explore the nature of DGL, these articles were excluded. 2) Articles with none or vague explicit considerations on leadership or management of DG. Whereas most articles have some relevance for leadership, few articles clearly and explicitly consider the leadership dimension. 3) Articles focused on project management of IT-projects at a technical project level, which is a separate research field considered out of the scope for this review. 4) Articles on different topics – e.g., articles with private sector focus. The search process resulted in a final sample of 31 included articles.

Appendix B. Methodological characteristics of the included articles

In order to provide transparency, Table B.1. shows the methodological characteristics of the thirty-one included articles. The journal representation is described in Appendix A. 35% of the articles rely on quantitative methods, 32% qualitative methods, and 33% a mixture of qualitative and quantitative methods. The PA-articles are distributed almost evenly on method, while the majority of e-gov/IS-articles use qualitative methods. USA is the most frequently studied country with the rest of the articles fairly spread globally. However, we found no articles on DGL in emerging economies and least developed countries. The units of analysis in the articles are governments on national, regional, and especially the local level. Most articles concern general (or unspecified) leadership, and few articles specifically concern the C-suite level of management.

Table B.1. Methodological characteristics of the included articles in the review

Articles	Journal	Method	Geographical location of research context	Unit of analysis	Leadership focus
PA-journals					
Coulthart and Riccucci 2021 [26]	PAR	Qual	USA	National	General
Sancino and Hudson 2020 [84]	PMR	Mixed	Global	Local	General
Chen and Lee 2018 [74]	PMR	Qual	USA	Regional/local	General
Mergel 2018 [77]	PMR	Mix	USA	National	General
Zhang and Feeney 2018 [80]	PAR	Quant	USA	Local	General
Ahn and Bretschneider 2011 [79]	PAR	Mix	South Korea	Local	Political
Lim and Tang 2008 [68]	PAR	Quant	South Korea	Local	General
Vonk et al. 2007 [61]	PAR	Mixed	Netherlands	Regional	General
Bozeman and Pandey 2004 [69]	PAR	Quant	USA	State	General
Moon and Bretschneider 2002 [21]	JPART	Quant	USA	National/regional/ local	Top/middle
Keen 1994 [88]	PA	Qual	UK	National	Top
E-gov/IS-journals					
Ngwenyama et al. 2021 [85]	EJIS	Qual	Denmark	National	General
De Tuya et al. 2020 [49]	GIQ	Qual	USA	Local	Top
Magnussonet al. 2020 [78]	EJIS	Qual	Sweden	National	General
Elnaghi et al. 2019 [89]	GIQ	Qual	United Arab Emirates	Local	General
Mergel 2019 [66]	GIQ	Qual	Global	National	General
Neumann et al. 2019 [76]	GIC	Qual	Switzerland	Local	General
Soe and Drechsler 2018 [71]	GIQ	Qual	Finland / Estonia	Local	General
Wang et al. 2018 [72]	GIQ	Qual	China	Local	General
Mergel 2016 [24]	GIQ	Qual	USA	National	Top
Tassabehji et al. 2016 [25]	GIQ	Qual	USA	Regional	Top
Frisk et al. 2014 [70]	EJIS	Qual	Sweden	National	General
Nielsen and Pedersen 2014 [67]	GIQ	Qual	Denmark	Local	General
Reinwald and Kraemmergaard 2012 [65]	GIQ	Qual	Denmark	Local	General
Luk 2009 [23]	GIQ	Qual	Hong Kong	National	Top
Tseng et al. 2008 [64]	GIQ	Qual	Taiwan	National	General
Xue et al. 2008 [73]	MISQ	Mixed	China	Local	General
Gil-Gacia et al. 2007 [75]	EJIS	Quant	USA	National	General
Fletcher and Bertot 1994 [63]	GIQ	Mixed	USA	Regional	General
Kraemer et al. 1993 [60]	MISQ	Quant	USA	Local	General
Caudle et al. 1991 [62]	MISQ	Quant	USA	National/regional/ local	General

Appendix C. Concept matrix

To make the transition from author-centric to concept-centric literature reviews, Webster and Watson [47] propose concept matrix, which shows the sources of different concepts. Following this approach, Table C.1 presents an overview of the ten DGL-concepts outlined in the method section and from

which of the included articles in the sample they are derived. Some articles contribute insight to several concepts, and some articles are mainly focused on a single concept.

Table C.1. Matrix of concepts and articles

	Agile and adaptive Governance	Citizen participation	Collaborative governance	Decision making	Digital risk society	IT-Innovation	IT-Management	Role of top managers	Smart cities for public value	Tech acceptance
PA journals										
Coulthart and Riccucci 2021						x				x
Sancino and Hudson 2020		x							x	
Mergel 2018		x				x				
Zhang and Feeney 2018		x								
Chen and Lee 2018			x							
Ahn and Bretschneider 2011		x			x					
Lim and Tang 2008				x				x		
Vonk et al. 2007										x
Bozeman and Pandey 2004				x						
Moon and Bretschneider 2002						x				
Keen 1994								x		
Subtotal	0	4	1	2	1	3	0	2	1	2
E-gov/IS journals										
Ngwenyama et al. 2021					x					
De Tuya et al. 2020				x			x	x	x	
Magnussonet al. 2020						x				
Elnaghi et al. 2019								x		
Mergel 2019						x	x			
Neumann et al. 2019			x			x			x	
Soe and Drechsler 2018	X	x	x	x		x			x	
Wang et al. 2018	X	x		x	x					
Mergel 2016	X					x		x		
Tassabehji et al. 2016		x						x		
Frisk et al. 2014				x						
Nielsen and Pedersen 2014				x						

	Agile and adaptive Governance	Citizen participation	Collaborative governance	Decision making	Digital risk society	IT-Innovation	IT-Management	Role of top managers	Smart cities for public value	Tech acceptance
Reinwald and Kraemmergaard 2012							x	x		
Luk 2009		x						x		
Tseng et al. 2008							x	x		
Xue et al. 2008				x						
Gil-Gacia et al. 2007			x					x		
Fletcher and Bertot 1994							x	x		
Kraemer et al. 1993										x
Caudle et al. 1991							X	x		
Subtotal	3	4	3	6	2	5	6	10	3	1
Total	3	8	4	8	3	8	6	12	4	3