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Digital Transformation and Knowledge Management in the Public Sector

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Abstract: Digitizing public services is, at the moment, an essential necessity for numerous governments around the world. An improved government through digitization will not only have a growing effect on businesses, but it will also be able to intensify citizen engagement and push for economic growth. During the last 10 years more countries have progressively begun to provide digital services to their citizens. Therefore, in order to address this development, the purpose of this paper is to analyze the evolution of the digital government literature in order to describe the aspects of digital transformation in the public sector and how it is related to knowledge management. In this study the methodology is quantitative and it is based on a review and a survey made with the main goal being the estimation from several collected data on how the digital transformation process in the Public Administration takes place and what its relationship is with knowledge management. The review study is based on articles found on Scopus database and it addresses the role that digital government research plays in the theory and practice of knowledge management. In the survey study, 54 employees working for the services of the two governmental areas of the Portuguese Ministry of the Environment were surveyed. The results show that the research on the theme is still at an exploratory stage due to the lack of studies relating digital government to knowledge management effectiveness in the public sector. The results also show that the success of digital government seems to be related with the quality of the organizations' knowledge management, complementing each other for significant improvements in the public sector. In terms of originality, this study aims to contribute and stimulate data-driven discussions regarding the impacts of the digital transformation in the public sector and their relation with the implementation of knowledge management practices. The results offer insights into future research needs.

Keywords: digital transformation; knowledge management; digital government; public sector; public administration

1. Introduction

Digital transformation is a necessity for the modern enterprise, whether public or private, due to the strength and vertiginous speed with which digitalization has entered and has taken over our lives, which has meant that many organizations have not been able to adapt to it yet. The main and

most important reason for this state of affairs in organizations is the lack of knowledge or trained personnel, which could allow them to understand how to cope with this change. While many public administration services have made great progress, the full potential of digital adaptation remains untapped. The digital government panorama changes continually to reflect how the government tries to find innovative digital solutions in social, economic, and political areas and how it could transform the decision-making process [1–3].

The current rising necessity of organizational change is altering, through digital transformation, the way governments look at knowledge management practices to address social needs or improve service delivery effectively. Understanding and predicting these changes is extremely important for policymakers, government executives, researchers, and all those who prepare, devise, implement, or evaluate digital government decisions [4].

In [5], three benefits of knowledge management in digital governance were identified: the enhancement of government competence, the increase in quality of government service, and the promotion of a healthy government development. Thus, this supports the idea that the success of digital government depends heavily on knowledge management.

Knowledge management came to the forefront due to the need for public and private organizations to make more rational and effective use of their knowledge [6]. As the authors state in [7], knowledge management "may potentially offer a competitive advantage and help develop knowledge-intensive economies".

Therefore, knowledge management is an important and specific issue in the research context of the public sector. The authors in [8] affirm that "the public sector is influenced by a growing need for: competition, performance standards, monitoring, measurement, flexibility, emphasis on results, customer focus and control". It seems that "knowledge management for government is no longer a choice, but an imperative if economies are to survive in the era of privatization, liberalization, and globalization" [9]. According to the authors in [10], knowledge management "has the potential to greatly influence and improve public sector renewal processes". Indeed, within the public sector, knowledge management "is a powerful facilitator in the current push for greater efficiency in all areas" [11].

Nevertheless, in [10] it is argued that "the development of a knowledge management culture within the public sector is more challenging than in the private sector". The study in [12] supports this argument by highlighting that "organizational goals in public organizations are typically more difficult to measure and more conflicting than in private organizations and are affected differently by political influences".

According to [13], knowledge management has been an object of attention of the academic community, public decision-makers, consultants, and business people since the beginning of the 1990s. A study published in the Journal of Knowledge Management, reports that the importance of knowledge management in the public sector is growing as a research area. It points out that the low level of international cooperation between the authors and the small number of comparative case studies show that the literature is fragmented [14].

Deliberately, systematically, and holistically managing knowledge can increase awareness of the benefits to individuals and organizations. However, there seems to be a lack of knowledge management awareness in the public sector. This can be severely detrimental in the process of digital transformation and in the effective implementation of knowledge management initiatives in organizations seeking to increase performance.

One of the purposes of this paper is to present a structured literature review of the digital government and knowledge management in public administration. In addition, as this article consolidates a body representative of the digital government literature, it can also be used to define and integrate future research in the area. The scientific literature review was carried out in support of an exploratory research, which consisted of analyzing the effect of digital transformation on knowledge management practices in Portuguese Public Administration.

Thus, the study has the following objectives: to verify if the digital transformation has changed the way the public organization carries out the knowledge management processes and to effectively identify knowledge management practices related to the digital transformation process. Therefore, the research question was: what is the relationship between the implementation of digital transformation and the use of knowledge management practices in public organizations?—and the research hypothesis is: the digital transformation process has an impact on knowledge management practices and, knowledge management, in turn, is a critical factor in the success of digital transformation.

Furthermore, to fulfill the objectives and hypothesis defined by the exploratory research, in the literature review are analyzed several studies in order to understand the definitions, origins, and peculiarities of digital transformation and knowledge management in the public sector. The literature review reveals who has already written and what has been published on the subject, what aspects have already been addressed, and which aspects are least addressed on the research topic.

This paper is composed of several sections: Section 2 presents the literature review methodology and Section 3 addresses the questionnaire methodology; Section 4 presents the literature review results and their analysis. Section 5 presents the results and the analysis of the survey and, finally, in Section 6 a conclusion that offers a future research agenda and limitations is presented.

2. Literature Review Methodology

2.1. The Structured Literature Review

This article employs a variant of a structured literature review to answer the research question addressed in the introduction. The methodology is similar to other recent reviews of the literature [14–18]. A structured review of the literature critically identifies, selects, and evaluates the research in order to answer a formulated question [19]. Performing a literature review is a formal way of synthesizing available information from available primary studies relevant to a set of research questions. It involves planning a well-thought-out research strategy that has a specific focus and answers those questions.

The literature review follows a clearly defined protocol where the criterion is prominently stated before the review is made. It is a comprehensive and transparent survey based on databases and grey literature that can be replicated and reproduced by other researchers. The review identifies the type of information researched, criticized, and reported within known time frames. Search terms, search strategies (including database names, platforms, search dates), and thresholds are all included in the review. As stated in [20], "greater clarity about the terminology and methods surrounding literature reviews will help researchers identify when and how such revisions can be made".

In this article the methodology of structured literature review is applied in order to share the results of other studies that are within the scope of the research, relate a study to the broader current dialogue in the literature on a topic, filling gaps and expanding previous studies, and finally, provide a framework to establish the importance of the study and an indicator to compare the results of the study with other outcomes.

According to the methodology of structured literature review, several authors [15,17,18] formulated the following main steps:

1. Define the research questions.
2. Write a research protocol for the review.
3. Determine the articles to include and carry out a comprehensive bibliographic search.
4. Develop a coding framework.
5. Code the articles and ensure reliability.
6. Analyze critically and discuss results.

Therefore, this article presents a comprehensive review of digital government articles published in the Scopus database from 2000 until the beginning of 2019. The following subsections describe the methods applied to the development of the literature review.

2.2. Research Protocol

A research protocol provides a step-by-step guide for conducting literature reviews, which may include systematic reviews, scope reviews, and meta-analyses. According to the authors in [21], "it is essential to write a protocol stating the review question, the methods to be used, the types of study and projects that the reviewer intends to find, and by what means and how studies will be evaluated and synthesized".

Therefore, research protocols are essential to ensure high-quality literature reviews. However, defining a protocol comprises many aspects, such as the formulation of research questions, definition of a search strategy and the adequate sources where to find primary studies, specification of the inclusion and exclusion criteria to be used in the selection of studies, and characterization of the process to be used to extract, synthesize, describe, and categorize the selected studies, extracting data and making quality evaluations.

The protocol should contain specific guidelines for identifying and selecting articles relevant to the review as well as outlining review methods for the entire process.

Following these suggestions, a written protocol was developed, describing the identification of the keywords, the source of information, the support tools and the main information searched in the documents. In this way, steps were defined in the research protocol, such as the construction of the collection of articles (Sample I); filtration process; scientometric analysis; content analysis (Sample II), and finally, the construction of gaps and research opportunities. A manual coding procedure was also developed, which indicated which information to recover from each paper, since "manual coding has advantages compared to computer-aided coding because when words with similar meanings like 'human capital' and 'employees' are found, they can be understood in their real sense and encoded accordingly" [15].

Thus, the review protocol is essential to reduce bias in the review process and limit overlap with existing reviews. It also provides an outline for the review process that helps plan and anticipate challenges that may arise during the review.

2.3. Literature Research

For the paper selection, a bibliographic research methodology was adopted based on the analysis of the already published literature, in the form of books, articles, and grey literature, which included knowledge management, digital government, and public administration as the primary research areas.

For the identification of the keywords, several attempts and searches were made in advance until the correct constructions could be chosen. More than 15 research builders were researched and interrelated. It was verified that with the term "digital transformation" the research in the databases returns few studies, detecting a gap in the literature. Alternatively, constructions with terms with similar meaning as "e-government" and "Digital Government" were made.

Regarding the search through keywords, it was carried out in January 2019 in the Scopus database, and a manual coding procedure was adopted to ensure that no articles were lost during the research. Based on the data set, the titles, abstracts, and keywords of all articles published in the periods from 2000 to the beginning of 2019 were examined, and articles containing knowledge management and digital government aspects from a public administration perspective were selected. During the search of documents in the database, a low number of results were observed. Only articles published in the English language were selected.

From this research, an initial group of 69 relevant articles was selected and, of these articles, a final group of 30 articles was used, which are depicted in Table 1.

Table 1. The 30 found articles addressing digital transformation.

Reference	Title
[22]	A multi-methods study exploring the role of stakeholders in the digital preservation environment: The case of Ghana.
[23]	Preserving the digital heritage of public institutions in Ghana in the wake of electronic government.
[24]	What lessons can be learned from the US archivist's digital mandate for 2019 and is there potential for applying them in lower resource countries?
[25]	The issues and considerations associated with BIM integration.
[26]	Transnational digital government research collaborations: Purpose, value, challenges.
[27]	Public sector readiness for digital preservation in New Zealand: The rate of adoption of an innovation in records management practices.
[28]	Information sharing in and across government agencies: The role and influence of scientist, politician, and bureaucrat subcultures.
[29]	Technology as a tool of transformation: E-cities and the rule of law.
[30]	Document logistics in the public sector: Integrative handling of physical and digital documents.
[31]	Digital government and public management research: Finding the crossroads
[32]	Archivists 2.0: Redefining the archivist's profession in the digital age.
[33]	Government workers say goodbye to paper
[34]	Creating value through managing knowledge in an e-government to constituency (G2C) environment
[35]	Success factors for public sector information system projects: Qualitative literature review
[36]	Solon: A holistic approach for modelling, managing, and mining legal sources
[37]	Knowledge brokering in the web 2.0 era: Empirical evidence of emerging strategies in government agencies
[38]	The fourth industrial revolution, agricultural, and rural innovation, and implications for public policy and investments: A case of India
[39]	Exploitation and exploration strategies to create data transparency in the public sector
[40]	Ensuring interoperability of geographic information in local government and inspire
[41]	Knowledge management in the public sector: Communication issues and challenges at local government level
[42]	E-governance in agriculture: Digital tools enabling Filipino farmers.
[43]	Digital records keeping to information governance in Estonian local governments
[44]	Integrating knowledge management tools for government information
[32]	Organizational learning from service innovation in the public sector of Dubai
[45]	Case studies on digital government
[46]	Knowledge management system for governance: Transformational approach creating knowledge as product for governance
[47]	A conceptual framework for effective appropriation of proactive public e-services
[48]	E-government initiatives and information management in two local government authorities
[49]	The e-governance concerns in information system design for effective e-government performance improvement
[50]	ICT and PA: A marriage made in heaven?

According to [20], "rapid growth literature reviews have resulted in an infinity of terminology to describe approaches that, despite their different names, share certain characteristics, namely, collecting, evaluating, and presenting evidence of available research".

According to this research, the term "digital transformation" consists of organizational change that uses digital technologies and business models to improve the organization's performance and customer experience. The term e-government consists of the use of information technologies in the internal processes of government, in the delivery of state products and services to both citizens and industry, and in the use of electronic tools and information technologies to approximate government and citizens. The view of e-government as a resource rationalizer seems to be linked to an older, more generalist conception of what digital government is today. For this reason, the search strategy used the terms "Digital Government", "Knowledge Management", and "Public Sector" as keywords.

From the search of those keywords in the Scopus database, 69 results showed up, 39 of which were excluded: 6 because they were in duplicate and 33 because they were outside the scope of the investigation, as it can be seen in Figure 1. The filtering process resulted in sample I, which included 30 articles of studies on digital government, and in sample II, which is composed of 10 articles that were analyzed according to the criterion of the existence of a relationship with knowledge management. In order to obtain sample II, the final 30 selected articles from the databases were filtered using a scientometric analysis, followed by a detailed analysis of the content of the articles by categories, selecting those that were within the scope of the investigation. This sample is composed of 10 articles that contain aspects of knowledge management within the digital government studies.

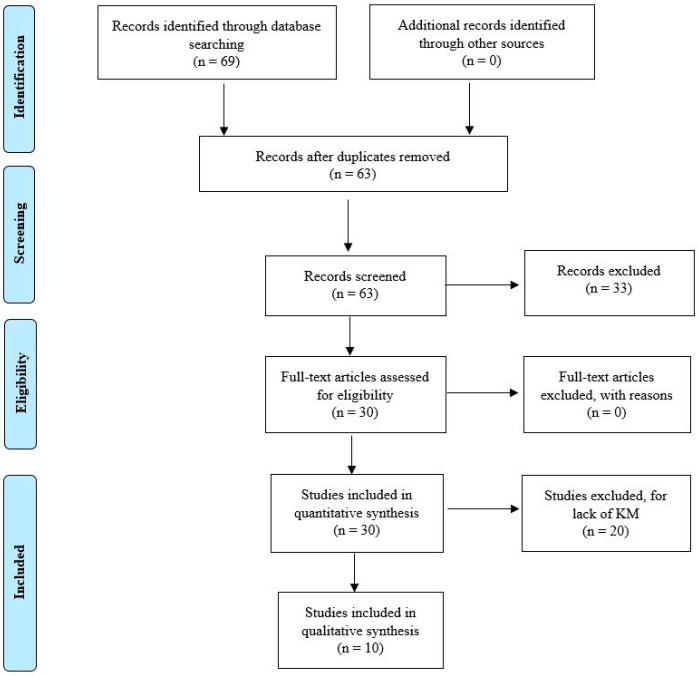

Figure 1. Flow diagram representing the collection of articles in databases and filtering process.

2.4. Developing a Coding Framework

The coding framework is based on advanced research frameworks developed by several authors [14–16,18,51]. A formal and systematic approach was adopted by adapting the analytical framework to the data set in order to extract the relevant information. As a result, seven categories were created to systematize the coding, as it can be observed in Table 2.

Table 2. Research framework and main results.

Category	Variables	Articles	%
Authors, institution, year	Authors	61	
	Institution	40	
	Years	2000–2019	
Document type	Conference Paper	15	50.0
	Article	10	33.3
	Review	2	6.7
	Book	1	3.3
	Book Chapter	1	3.3
	Editorial	1	3.3
	Totals	30	100.0
Jurisdiction	Central government	19	63.3
	State/regional	2	6.7
	Local government	7	23.3
	Public business enterprise (PBE)	1	3.3
	Other	1	3.3
	Totals	30	100.0
Location	Europe/UK	14	46.6
	Australasia	1	3.3
	North America	7	23.3
	South America	0	0.0
	Africa	2	6.7
	Asia/China	4	13.3
	Other	2	6.7
	Totals	30	100.0
Research method	Quantitative cross-sectional	1	3.3
	Case study	7	23.3
	Literature review–normative	3	10.0
	Action research	1	3.3
	Qualitative study	9	30.0
	Quantitative study	2	6.7
	Mixed methods	4	13.3
	Other	3	10.0
	Totals	30	100.0
Framework	No framework-model used	2	6.7
	Applies or considers previous framework-model	27	90.0
	Proposes a new framework-model	1	3.3
	Totals	30	100.0
Theme	Digital preservation	3	10.0
	Information technology	8	26.7
	knowledge management strategy	4	13.3
	Knowledge innovation	3	10.0
	Management of elements and processes	3	10.0
	Personal and organizational learning	1	3.3
	Organizational culture	1	3.3
	Information management	6	20.0
	Other	1	3.3
	Totals	30	100.0

By looking at Table 2 it is possible to observe that the first category classifies them by journal. The main goal is to analyze the evolution of literature: citation scores were used to measure the impact of articles, authors, and journals.

The second category is a division of the sample by type of document that has been most used in the digital government literature since the year 2004.

The third category is jurisdiction based on different levels of government, rather than the broader organizational types found in [15]. In general terms, government jurisdictions are country-specific, while public organizations are comparable across countries. Therefore, by analyzing government jurisdictions, the goal is to understand publication standards and find out if differences in national contexts and data accessibility exist.

The fourth category is the location. Thus, when analyzing a location, the objective is to understand the extent to which the literature supports the development of digital evolution as well as knowledge-intensive economies.

The fifth category is the search method used. Digital government research is still reaching an epistemological consensus among the authors since the main strategies lead to the development of multiple research methods. The goal is to understand what methods have been used in digital government research.

The sixth category is framework-model. This category is derived from [52]. The main objective of the analysis of the framework used is to understand if the literature is proposing new specific models and if it applies or considers the previous framework-models, or if it does not use framework-models for the public sector at all.

The seventh category is the research theme. By analyzing the themes of the selected articles, it was possible to identify areas of interest for other scholars, new research opportunities, and to better understand the scientific dialogue.

After analyzing the articles in sample I and, according to the objective of the development of the review, the category "Focus" used by [14] was removed and the category "Research Theme" was added, giving a clearer information on the evolution and focus of the digital government literature. The classification for this category is similar to that of [52].

3. Results of the Literature Review and Discussion

The following subsections present results that attempt to answer the following research questions: the first—research question 1—"What is the evolution and focus of the digital government literature?"; the second—research question 2—"What is the future of research in digital government?"; and, the third,—research question 3—"How does digital government literature relate to knowledge management?".

To do this, gross counts were used, as shown in Table 2. In addition, when issues were found that needed more research and criticism, a more in-depth analysis was conducted based on the combination of the descriptive results, deepening specific questions found in the articles.

3.1. Authors, Institution, Year

Analyzing the evolution of articles on digital government in public administration, the results show an increase. The literature search identified 30 relevant articles, of which 73.3% were published after 2010, suggesting a growing trend. The years included ranged between 2000 and 2019, but in the interval 2000–2003, as well as for the years 2006, 2008, 2013, and 2015, no relevant articles were found for the study as shown in Figure 2. The year that has the highest number of publications is 2018 (5 articles) and it is also worth mentioning the years 2017 (3 articles) and 2016 (4 articles). This shows, once again, the growing tendency for studies on digital government. Nevertheless, despite the increase in the number of publications per year, the reduced number of documents and a significant shortage of literature about digital government is still evident.

Thus, by observing Figure 2, some of the more recent articles are from 2018 to 2019 [22,31,42,53] and some of the oldest are from 2004 to 2007 [28,33,44].

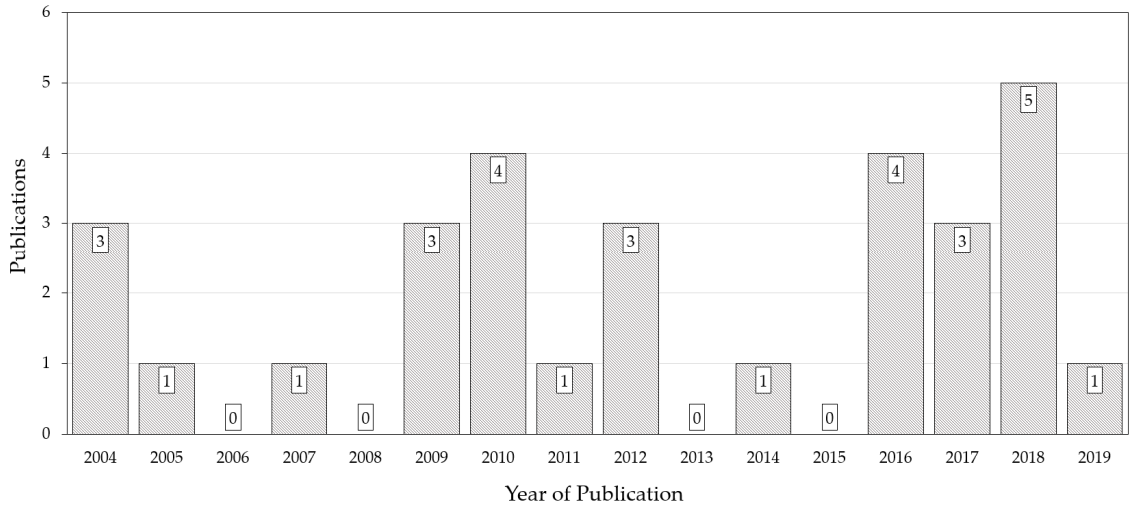

Figure 2. Representation of the total publications by year.

Regarding the analysis of authors, as shown in Table 2, in 30 articles, there are a total of 61 authors/coauthors, showing a significant number of authors who participated in the digital government literature. However, according to Table 1, only two of these authors have more than one publication, showing few dominant authors in the digital government research. The most prolific ones are Kofi Koranteng Adu [22], with two articles published in 2016 and 2018, and Gil-García et al. [31], with two articles published in the years 2011 and 2018.

The main reason for examining these authors and their citations is to verify the superstar effect that sometimes occurs when a small fraction of researchers or institutions produce the highest number of studies and attract a disproportionate number of quotations [54–56]. Although there is a significant fraction of 61 researchers and 40 institutions, there is not a large number of studies led by the same authors or institutions. Thus, in this analysis, the evidence of disproportionately influential individuals was not studied. As an alternative, it opted for the articles with the highest number of publications and their respective authors, according to Table 3.

Table 3. The 12 most cited public sector digital government articles.

Paper	Title	Citations
[34]	Creating value through managing knowledge in an e-government to constituency (G2C) environment	65
[28]	Information Sharing in and Across Government Agencies: The Role and Influence of Scientist, Politician, and Bureaucrat Subcultures	40
[44]	Integrating knowledge management tools for government information	25
[27]	Public sector readiness for digital preservation in New Zealand: The rate of adoption of an innovation in records management practices	13
[29]	Technology as a tool of transformation: e-Cities and the rule of law	11
[43]	Digital records keeping to information governance in Estonian local governments	9
[32]	Archivists 2.0: Redefining the archivist's profession in the digital age	8
[45]	Case studies on digital government	6
[31]	Digital government and public management research: finding the crossroads	4
[24]	What lessons can be learned from the US archivist's digital mandate for 2019 and is there potential for applying them in lower resource countries?	3
[23]	Preserving the digital heritage of public institutions in Ghana in the wake of electronic government	3
[25]	The Issues and Considerations Associated with BIM Integration	2

The article with the most significant number of citations (65) was written by Koh, C.E. et al. [34] and was published in the Journal of Computer Information Systems in 2005. This article, from the University of North Texas, uses as research method a case study about central government focused on information technology and knowledge management. The case study focuses on government agencies due to their challenges in the progression of digitalization, caused by the size and complexity of government structures and the large amount of information these government agencies maintain. Thus, the article proposes that government agencies should go through an evolutionary path as they progress from an introductory digital presence to more complex forms of interaction with constituents. It highlights key facilitators that enable a steady progress by changing how citizens interact with government, increase accessibility to information, and increase efficiency in the public sector.

The article with the second highest number of citations (40), written by Drake, D.B. et al. [28], was published in the Social Science Computer Review in 2004. This article uses an exploratory method and an interdisciplinary study on central government, focusing on issues related to information sharing within and between three public bodies. The study illustrates key points about information sharing among subcultures and some implications for research and practice.

The article written by Prokopiadou, G., et al. [44] has the third highest number of citations (25) and was published in the Government Information Quarterly in 2004. This article uses as research method a qualitative study regarding central government in which it introduces a digital library architecture for the management and delivery of information produced or disseminated through public services. The study notes the lack of advanced information standards and tools and emphasizes public sector challenges such as the presence of fragmented and dispersed information, legislative and administrative diversity, administrative hierarchy, and discrepancies in the implementation of policies at central, regional, and local levels. Furthermore, the study aims to highlight the importance of government information for business transactions, decision-making, and for providing information about organizations to citizens.

The articles with a number of citations ranging between 10 and 15 can be found in [27,29] and were published in Government Information Quarterly and Information Systems: People, Organizations, Institutions, and Technologies, respectively. These articles use, as a qualitative research method, studies about central government and local government, with a focus on digital preservation, information technology, and information and knowledge sharing.

With less than 10 citations, there were seven documents published between 2007 and 2018.

The article of [43], through a qualitative study, provides an overview of the developments in local governments of Estonia in the last 10 years with the objective of introducing the Electronic System of Document and Records Management as the central governance system. This article describes the development of the digital governance model, the first results in terms of implementation of its modules, and other plans on the introduction of information governance in local governments.

In addition, the articles of [24,32], both published in the Records Management Journal, study local and central government in Sweden and in the USA and their focus is on the professional practice of archivists involving information technology and the archivist's digital mandate. The research methods used were mixed and included empirical studies, interviews, literature review, and case studies.

The article in [31], published in the Public Management Review in 2018, is the most recent article appearing in Table 3 of the most cited in sample I. This article analyzes previous studies on the digital government community along with a systematic review of recent articles, published in leading US and European public administration journals, in order to identify and compare the key characteristics of these academic communities, including their top researchers, theories, topics, and methods. From a perspective of public management, digital government could be considered an essential aspect of innovation, coproduction, transparency, and the generation of public value.

From the remaining articles, several research methods were identified, such as case studies, literature review, quantitative cross-sectional, and mixed methods. The studies involve, mostly, central governments and focus on information technology and information management, covering

a several number of themes, such as project management, which studied the Building Information Modeling (BIM) methods for storing data and asset information using object-oriented modelling of infrastructure [25], digital preservation, and digital community.

Additionally, after the analysis, it was also possible to conclude that six of the documents in Table 3 are conference papers, and some of them were published in the same papers: two articles, written by [27,44], were published in the Government Information Quarterly and another two articles, written by [24,32], were published in the Records Management Journal.

Regarding the summation of the number of citations per year, the years from 2015 to 2019 were considered. It was verified that the number of citations of sample I has a higher incidence in the years 2017 and 2018 with 20 citations in each of the years. In addition, 2019 already has three citations, showing that since 2017 there seems to have been a growing interest in the research of digital government. The years 2015 (14 citations) and 2016 (16 citations) have a similar number of citations. The set of articles contain 73 citations in total since 2015, as it can be seen in Figure 3.

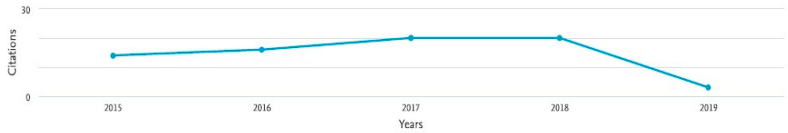

Figure 3. Citations by year (2015–2019) of most cited public sector DG articles.

3.2. Document Types

The documents selected in sample I have different types: 15 are conference papers, 10 are articles, 2 are books or book chapters, and 1 is an editorial. As shown in Figure 4, the most significant percentage belongs to conference articles (50%), followed by articles (33.3%), both of which show a trend in the type of documents of the digital government literature.

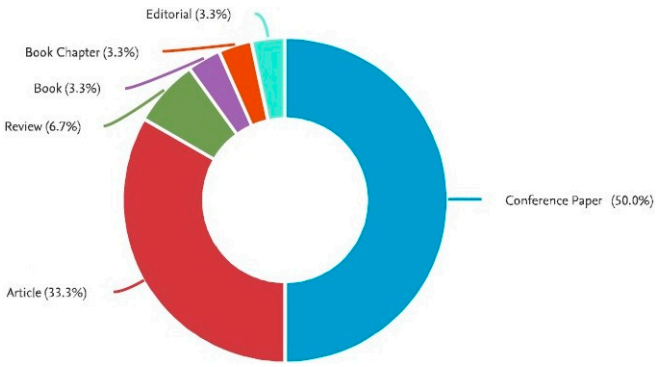

Figure 4. Classification of documents by type.

3.3. Jurisdiction

According to Table 2, the main focus of the digital government literature is central governments (63.3%), followed by the local governments (23.3%). There are also other attributes such as state/regional and public business enterprise (PBE) in 10% of documents. However, in coding the articles, the lines between what is a central government function and a state/regional function are sometimes blurred or nonexistent because different countries have different structures.

3.4. Location

Analyzing the criterion location, the results show that Europe/UK is the most studied region, with 19 articles representing 46.6% of the studies, followed by the North American region with 7 articles representing 23.3% of the studies. The Asia/China region, with 4 articles, represents 13.3% of the sample. No articles were found regarding South America. Digital government research articles include

various countries, such as the Philippines, Estonia, Australia, China, USA, Greece, India, Ghana, Sweden, Germany, Norway, and New Zealand. According to this analysis, a great variety of countries that study digital government in different contexts can be highlighted. With the emergence of articles from several countries, the possibility of international comparisons regarding differences and common guidelines of digital government research is growing.

The most significant number of articles was identified in the Europe/UK region, covering the years 2009 to 2018, with Sweden being the most analyzed country. The US is also the country that continues to produce more articles regarding the North American region. The results also show that, since 2017, the Asia/China region is growing in published studies (13.3%), which may be due to the growing importance of Asia in terms of the global economy. In addition, studies about India are increasing and focus mainly on universities and research centers. Locations like Australia, where one study was found in 2018, South America, which has no studies and Africa, with studies from 2016 and 2018, are under-represented and under-researched. Finally, a study from New Zealand addressing Oceania region was published in 2009. Figure 5 represents the articles published per location. However, nine studies were left out of this classification, due to the fact that they were either theoretical or the location was not disclosed.

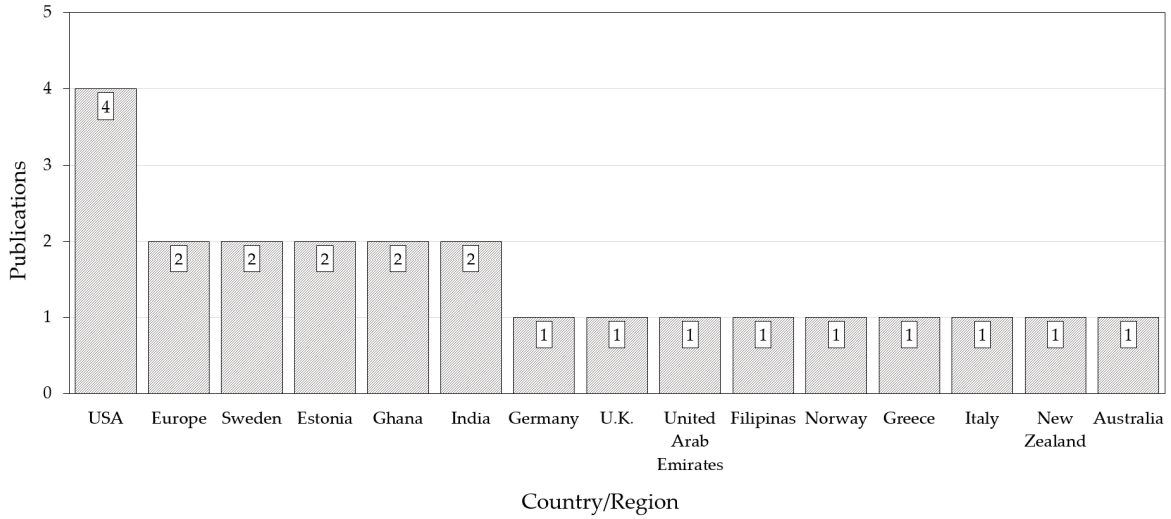

Figure 5. Classification of the published articles by location.

3.5. Research Methodology

Qualitative approaches represent 30.0% of sample I (9 articles) and are the most used and representative approaches in digital government research. The case studies are the second most used approach, with seven articles representing 23.3% of the sample. In the analysis of the research method of the articles, it was difficult to classify them by specific attributes due to the existence of a mixture of methods. From 2009 until 2018, the articles contained four mixed methods and three other methods, highlighting the existence of a significant fraction of studies that do not use a specific research method.

According to Table 2, approaches such as quantitative cross-sectional and action research represent only 6.7% of the sample (only 1 article per research method). The quantitative studies represent 6.7% with two articles, and the literature review represents 10% with three articles.

3.6. Framework

The digital government literature focused mainly on the use of existing frameworks (90%). The development of new frameworks concentrated only 3.3% of the studies and 6.7% of the articles did not use specific frameworks. Thus, this can be an evidence of the interest of researchers in the issue of digital government.

3.7. Themes

The analysis of the results of the research themes shows that eight articles (26.7% of the sample) focus on information technology and six articles (20% of the sample) focus on information management. The third most analyzed issue is the knowledge management strategy, with four articles representing 13.3% of the sample. The subjects "digital preservation", "knowledge innovation", and "management of elements and processes" have three articles each and together represent 10.0% of the sample. Less analyzed themes, like "organizational learning" and "organizational culture", represent the remaining 10% of the studies.

The distribution of themes shows that the topics are scattered. Analyzing the evolution over time, the results show that the theme of "information technology" has been approached between the years 2004 to 2019 with a higher incidence in the articles from the year 2018. This growing trend is due to the importance of information technology in the process of transformation in the public sector. From 2012 until 2017, the research focused more on the theme of "knowledge management strategy".

To complement the themes of the selected articles, the articles of the sample were also analyzed according to the research areas addressed. Table 4 and Figure 6 show that the areas of research "Computer Science" and "Social Sciences" were included 27 times representing 44% of the sample, followed by "Business, Management and Accounting" and "Decision Sciences", which were included 14 times, representing 28%. The remaining areas were included eight times, representing 18% of the sample.

Table 4. Documents by subject area.

Subject Area	Number
Computer Science	15
Social Sciences	12
Business, Management and Accounting	8
Decision Sciences	6
Engineering	3
Agricultural and Biological Sciences	1
Chemistry	1
Earth and Planetary Sciences	1
Economics, Econometrics and Finance	1
Mathematics	1

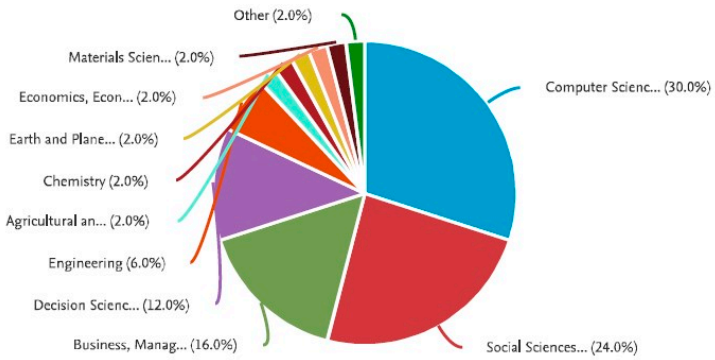

Figure 6. Documents by subject area.

3.8. Content Analysis (Sample II)

Sample II, as seen in Table 5, was constructed with 10 studies from the content analysis of sample I, in order to answer the third question in the study—How does digital government literature relate to knowledge management?

Table 5. Documents by keyword "knowledge management".

Year	Author(s)	Title	Jurisdiction	Location	Research Method	Themes	Ref.
2018	Rahman and Al Joker	Organizational learning from service innovation in the public sector of Dubai	Local government	Asia/China (Dubai)	Case study	Organizational learning, organizational culture, service innovation, transformation, intelligent government, politics, strategic learning	[53]
2017	Shilohu Rao, Goswami and Chaudhary	Knowledge Management system for Governance: Transformational approach creating knowledge as product for Governance	Central government	Asia/China (India)	Qualitative study	knowledge management strategy, knowledge management, transformational growth, multidimensional aspects, transformation	[46]
2016	Matheus and Janssen	Exploitation and exploration strategies to create data transparency in the public sector	Central government	Other	Case study	Innovation, Ambidexterity, data transparency, efficiency	[39]
2016	Bataw, Kirkham and Lou	The Issues and Considerations Associated with BIM Integration	Central government	Europe/UK (United Kingdom)	Mixed methods	Information Technology, Methods Building Information Modeling (BIM), Storage, Information Management, Project Management	[25]
2012	Lamari and Belgacem	Knowledge brokering in the web 2.0 era: Empirical evidence of emerging strategies in government agencies	Public business enterprise (PBE)	North America (EUA)	Mixed methods	knowledge innovation, digital innovation, knowledge brokers, government agencies, knowledge management strategies	[37]
2012	Pappel and Saarmann	Digital records keeping to information governance in Estonian local governments	Local government	Europe/UK	Qualitative study	Information Technology, Electronic Document and Records Management System, process and workflow management, knowledge management, effectiveness	[43]
2010	Ndlela	Knowledge management in the public sector: Communication issues and challenges at local government level	Local government	Europe/UK (Norway)	Qualitative study	Knowledge management, communication, knowledge transfer, organizational culture	[41]
2010	Eiermann and Walter	Document logistics in the public sector: Integrative handling of physical and digital documents	Local government	Europe/UK (Germany)	Quantitative study | qualitative approach | Case study	Document logistics, information management, communication	[30]
2005	Koh, Ryan and Prybutok	Creating value through managing knowledge in an e-government to constituency (G2C) environment	Central government	North America (EUA)	Case study	Digital presence, accessibility to information, government agencies, key facilitators	[34]
2004	Drake, Steckler and Koch	Information Sharing in and Across Government Agencies: The Role and Influence of Scientist, Politician, and Bureaucrat Subcultures	Central government	Other	Exploratory and interdisciplinary study	Organizational culture, information sharing, communication, organizational culture	[28]

For the article selection, criteria for title and abstract analysis was used along with the application of keyword filtering to knowledge management. The objective was to analyze the content by verifying how knowledge management is present in studies of digital government and how they are related, comparing the main characteristics of knowledge management approach in digital government research, theories, topics, and methods. Their similarities and differences present opportunities for more dialogue between digital government and knowledge management scholars, who can produce synergies to increase the production and dissemination of knowledge.

From this analysis, it was verified that the authors in [53] have published a study that addresses organizational learning and citizen-centered service innovation in the federal and local governments of Dubai. This case is presented in the context of the rapid transformation of the Dubai eGovernment into a smart government that began in 2013. The goal was to outline possible policy and strategic learning more driven by demand and service improvement initiatives.

The authors in [46] have published an article that addresses knowledge management as a phenomenon established and applied in various disciplines for transformational growth. The study focuses on the India Digital Program, launched in 2015, which had the vision of "turning India into a digitally empowered society and knowledge economy". The document highlights the multidimensional aspects of the implementation of knowledge management for digital government, such as the need for knowledge management in a Federal Government system, along with its main objectives, with the main resources moving from structure to implementation.

The article of [39] analyses ambidexterity, which is the ability of an organization to be able to develop new products and innovate while continuing to provide and update its existing services. A case study, to understand better how the combination of exploitation and exploration can enable data transparency, was used.

In [25] the Building Information Modeling (BIM) methods in the UK government are studied as a critical aspect in the notion of "interoperability" between various software applications used in the design process and construction and a common data format for the efficient exchange of information. A mixed methods approach was used: questionnaire analysis and a secondary case study analysis.

The research presented in [37] is based on a representative sample of knowledge brokers from government agencies. The study goes beyond the rhetorical and hermeneutical analyses on this subject, to outline an empirical and factual view of emerging practices and strategies in knowledge intermediation within Québec's government agencies known for their wide use of Web 2.0 platforms and digital innovation.

The authors in [43] conducted a study that provides an overview of developments in local governments in Estonia over the last 10 years intending to introduce the Electronic Records and Records Management System as the central system of governance. It is emphasized that information systems have as their main objective in the public sector to store, manipulate, diffuse, and preserve knowledge to achieve the effectiveness of electronic governance.

In [41] the authors examined the major communication challenges, namely those faced by small municipalities in their efforts to implement knowledge management programs. The study data was extracted from a survey collected in a small municipality of Norway. The article highlights the role of appropriate and inadequate communication behavior patterns for knowledge transfer at local government levels.

In [30] the authors address the current state of document logistics in the public sector and identified current needs and potential trends for the near future using a quantitative study. In addition, a qualitative approach was chosen to further examine the findings of the study, gaining greater insight by conducting a case study with the federal state of Bremen, Germany. The related documents and information are considered an essential basis for communication in the public sector.

In [34] the authors propose that government agencies should go through an evolutionary path as they progress from an introductory digital presence to more complex forms of interaction with constituents. A path of progression is described, and its key facilitators are highlighted.

Finally, the authors in [28] present an exploratory and interdisciplinary study of issues related to information sharing within and between three public bodies, to illustrate the key points about information sharing among subcultures and some of its implications for research and practice.

After this analysis, it was verified that most of the articles do not present a research approach directly related to knowledge management but approach themes that can indirectly improve knowledge management practices within the public sector. The success of digital government depends on the quality of the organization's knowledge management and how they simultaneously complement each other. There is a lack of studies that relate digital government to the direct or strategic effect of knowledge management effectiveness in the public sector.

4. Quantitative Research Questionnaire Methodology

In the first phase of the research, an analysis of the literature was carried out, with the purpose of analyzing the digital transformation process and its relationship with knowledge management in public administration. To support the research hypothesis and meeting what is intended with this research, the choice of the scientific method fell on a quantitative study, which the authors considered more appropriate to answer the problem. Thus, through quantitative research the problem was quantified by generating numerical data, which can be transformed into usable statistics, to understand the behaviors, attitudes, opinions, and other actions of the sample and to generalize the results to a population. Therefore, with this quantitative method, it was intended to verify the effect of digital transformation on knowledge management practices in Portuguese public administration.

4.1. Sample

The research was carried out in two governmental areas, the General Secretariat of the Ministry of Environment (SGMAMB) and the Office of the Minister for the Environment and Energy Transition (MATE) belonging to the Ministry of the Environment of the Portuguese Government, which was chosen because it is part of the project Fujitsu's SmartDOCS® in the Portuguese Public Administration, which consists of the implementation and procedural management platform.

In the selection of the target audience, characteristics considered interesting within the scope of this study were analyzed. Collaborators directly involved in the process of implementing the digital transformation were selected, as this is a probabilistic convenience sample.

The target population has a total of 213 employees belonging to the services of the two governmental areas of the Ministry of the Environment, of which 54 employees constitute the sample of the study, which represents 25.35% of the target population.

At SGMAMB, comprising 113 employees, questionnaires were distributed to 37 employees, and at MATE, comprising 101 employees, questionnaires were distributed to 17 employees, corresponding to a percentage of 33.04% and 16.83% of the target population of each of the respective government areas. Questionnaire respondents were asked to indicate their gender, age, educational qualifications, years of work, function, and areas of work, in order to use these elements as characteristics of the sample, as it can be seen in Table 6.

The sample presented in Table 6 is composed of mainly females (75.93%), aged between 35 and 49 years (48.15%), and with more than 30 years of work in the studied organization (33.33%). The most frequent educational qualifications correspond to secondary education (10th to 12th years, 42.59%) and graduation (42.59%). SGMAMB integrates a greater number of employees (68.42%), the "administrative" function is the most frequently performed (46.30%), and, finally, the work areas with the highest incidence correspond to the advisory area (20.37%) and the administrative support area (18.52%).

Table 6. Research framework and main results.

Government Areas		SGMAMB		MATE		Total	
		Nr	**%**	**Nr**	**%**	**Nr**	**%**
Gender	Male	9	24.32%	4	24.53%	13	24.07%
	Female	28	75.68%	13	76.47%	41	75.93%
Age	From 18 to 24 years	0	0.00%	1	5.88%	1	1.85%
	From 25 to 34 years	0	0.00%	2	11.76%	2	3.70%
	From 35 to 49 years	18	48.65%	8	47.06%	26	48.15%
	From 50 to 64 years	18	48.65%	5	29.41%	23	42.59%
	Over 65 years	1	2.70%	1	5.88%	2	3.70%
Literary abilities	1st to 4th year of EB	0	0.00%	0	0.00%	0	0.00%
	5th to 6th year of EB	0	0.00%	0	0.00%	0	0.00%
	7th to 9th year of EB	1	2.70%	0	0.00%	1	1.85%
	High school (10th to 12th year)	13	35.14%	10	58.82%	23	42.59%
	Bachelor	1	2.70%	0	0.00%	1	1.85%
	Graduation	19	51.35%	4	24.53%	23	42.59%
	masters	2	5.41%	2	11.76%	4	7.41%
	PhD/Post Doc	1	2.70%	1	5.88%	2	3.70%
Years of work	Less than 1 year	0	0.00%	1	5.88%	1	1.85%
	Between 1 and 5 years	1	2.70%	1	5.88%	2	3.70%
	Between 5 and 10 years	2	5.41%	2	11.76%	4	7.41%
	Between 10 and 15 years	4	10.81%	3	17.65%	7	12.96%
	Between 15 and 20 years	7	18.92%	1	5.88%	8	14.81%
	Between 20 and 25 years	5	13.51%	2	11.76%	7	12.96%
	Between 25 and 30 years	6	16.22%	1	5.88%	7	12.96%
	More than 30	12	32.43%	6	35.29%	18	33.33%
Function	Administrative	14	37.84%	11	64.71%	25	46.30%
	Advisor	2	5.41%	4	24.53%	6	11.11%
	Senior Technician	13	35.14%	2	11.76%	15	27.78%
	Computer Specialist	4	10.81%	0	0.00%	4	7.41%
	Computer Technician	1	2.70%	0	0.00%	1	1.85%
	Division Supervisor	3	8.11%	0	0.00%	3	5.56%
Areas of job	Administrative-financial area	12	32.43%	0	0.00%	12	22.22%
	Advisory area	3	8.11%	8	47.06%	11	20.37%
	Training area	1	2.70%	0	0.00%	1	1.85%
	International Relations Area	4	10.81%	0	0.00%	4	7.41%
	IT area	5	13.51%	0	0.00%	5	9.26%
	Human resources area	7	18.92%	0	0.00%	7	12.96%
	Legal Advisory Area	4	10.81%	0	0.00%	4	7.41%
	Administrative support area	1	2.70%	9	52.94%	10	18.52%

4.2. Questionnaire

After the literature review and with a better perception of the state of the art and the importance of digital transformation and knowledge management in public organizations, next is the design phase of the issues that would be the basis of the questionnaires that were made available to a group of employees of the Ministry of the Environment.

The questionnaire focuses on estimating, from the collected data, how the digital transformation process in the Portuguese Public Administration takes place and what its relationship is with knowledge management.

In the elaboration of the questionnaire, an introductory note was added which displays the context of the request for collaboration, the guarantee of anonymity of participation, and the confidentiality of the provided information.

The questionnaire consists of 47 closed-answer questions constructed and organized in two groups allowing the assessment of the perceptions, opinions, attitudes, and behaviors of employees concerning the process of digital transformation and concerning knowledge management in the organization. Therefore, the questionnaire structure consists of two parts, the first consisting of seven questions regarding the characterization of the sample and the second with 47 questions regarding digital transformation and knowledge management.

The questions address issues such as the state of knowledge management or how the organization fosters the importance of digital transformation and knowledge management. Questions were also elaborated to show the relationship between digital transformation and knowledge management.

The choice of the most appropriate response format considered its advantages, such as ease of application, process, and analysis; ease and speed in the act of responding; presenting a low possibility of errors and working with several alternatives.

Thus, the answer to this questionnaire is based on a 5-point psychometric scale—the Likert scale. A response rate was applied that varies consecutively using scores from 1 to 5. The scale used in the questionnaire presents a series of five answer options, of which the respondent must select one of the following:

1. Totally disagree,
2. Disagree,
3. Neither Agree nor Disagree,
4. Agree,
5. Totally agree.

Additionally, in order to safeguard the bias of the collected responses, an option of "0–Don't Know" was created and added.

For the analysis and validation of the items, considering the respective meaning of each of the identified issues, they were structured in two representative groups of each of the identified dimensions:

1. Issues regarding digital transformation
2. Issues related to Knowledge Management practices

The data collection procedure was carried out in June 2019, and the questionnaire was made available in person at the organization's facilities and a response rate of 25.35% of the target population was obtained.

4.3. Methods

The data were treated using descriptive and inferential statistics, using the SPSS program (Statistical Package for the Social Sciences, Version 26.0; SPSS Inc., Chicago, IL, USA) and the effects with $p < 0.05$ were considered statistically significant.

In the first phase, the set of collected data was submitted and transformed operationally to a basic uniformly varied descriptive analysis.

The results obtained regarding the dimensions of Minimum, Maximum, Average, Standard Deviation, and Asymmetry regarding the totality of the variables observed in the two groups considered were analyzed: Digital Transformation and Knowledge Management.

The homogeneity of the basic variables of each of the groups of identified questions was analyzed to validate whether they demonstrate significant correlations with each other to proceed with the representation of this set of variables by a single variable, that is, one variable for each one of the groups—calculation of Cronbach's alpha index.

After validating the internal coherence expression of the set of responses for the variables in each group, the average response was calculated for all the variables in that group, in order to present, in a first approximation, the unit value underlying that group.

In addition, the main component analysis was carried out by calculating for each group the main component analysis in order to validate whether, with a variability of approximately 50%, it will make sense to represent the group of variables by the first component.

Additionally, the linear regression methodologies were applied to verify the existence of relationships between the created average variables.

5. Result Analysis

5.1. Statistical Characterization of Groups of Variables

After applying basic descriptive analysis methodologies to the two conceptual groups of variables that make up the questionnaire, taking into account their meaning, it was intended to validate the possibility of replacing each of these groups by a single variable, that is, one variable for every group, expressing their meaning.

However, as for the dispersion around the averages, only in exceptional cases does this value exceed 1, so it is possible to infer a remarkable homogeneity in terms of the obtained responses. The correlations between pairs of variables in the two groups were positive, although some of these values are not significant.

Therefore, it was possible to verify the high values of Cronbach's alpha coefficient (>0.7) for both groups of variables, which could improve if some variables were eliminated. These values are also supported by the percentage of total variance obtained for the global variables of each conceptual group, expressed in the analyzes of the first and second main components. It was also found that in both groups, the first component absorbs a large part of the total variability, as depicted in Table 7.

Table 7. Analysis of internal coherence and variance, explained by the first two main components, for each group.

Variable Group	Cronbach Alfa	% of Variance	
		1st CPP	2nd CPP
Digital Transformation	0.878	27.0	15.9
Knowledge Management	0.785	27.6	19.0

Thus, it was possible to verify that, underlying each of the two groups of variables, there is a variable that these observed variables are manifestations, which can be approximated either by the average value of the variables of each group (in the first approximation) or by the first main component respectively—both are linear combinations of group variables.

Furthermore, for reasons of interpretation, it was chosen to proceed with the representation of groups of variables by calculating the average.

5.2. Study by Regression of the Relationships Between Groups of Variables

Therefore, after validating the behavior of each of the groups of variables through a linear combination in order to represent each of the groups, the mean was used to represent the groups.

Thus, in this study it is attempted to estimate by linear regression, the possible linear relationships between the two mean variables representative of the respective groups of questions: DT_med and KM_med, as depicted by Table 8.

Table 8. Analysis of linear relationships, for each group.

Model	Explanatory Variables		Cte.	B_1	B_2	R^2
	KM_med	DT_med				
1		X	(N.S)	0.510 (S)	-	0.66
2	X		(N.S)	0.856 (S)	-	0.66

Legend: (N.S.)—Not significant, (S.)—Significant.

Therefore, it was possible to observe that both Digital Transformation (on average) and knowledge management (on average) present significant values (S.) of the respective coefficients.

The results show that R^2 values are reasonable, namely: 0.66 when considering the explanatory variable DT_med and also 0.66 when considering the explanatory variable KM_med. The regression model whose objective was to verify whether the model explains knowledge management as a function of Digital Transformation showed reasonable average results in the order of 60%, so it can be concluded that the introduction of digital transformation in the Ministry of the Environment has increased knowledge management.

5.3. Overall Discussion

The methodology applied in the exploratory research allowed us to prove the existence of a cause–effect relationship between variables related to digital transformation and variables related to Knowledge Management practices.

Based on the methods of multivariate data analysis, it was possible to validate the hypothesis of the work, in which, in the opinion of the respondents, the Digital Transformation process has a relevant effect on Knowledge Management practices. Furthermore, in turn, it was validated that knowledge management is a critical factor in the success of digital transformation.

For both groups of variables, it was possible to verify a positive asymmetry, meaning that respondents tend to choose high response values, generally above the central value (3), of the chosen Likert response scale—graded from 1 to 5, which corroborates this analysis.

Knowledge management proved to be a critical factor in the success of digital transformation in the public organization. According to literature, knowledge management is the process of creating, capturing, and using knowledge from an organization's intangible assets to improve [57]. Knowledge management, considering it as an intangible and precious asset of an organization, has gained relevance in the strategic positioning of organizations. Within Public Administration, knowledge management "is a powerful facilitator in the current drive for greater efficiency in all areas [11]". In this way, the authors in [10] states that knowledge management "has the potential to greatly influence and improve the renewal processes of the public sector".

Thus, it is concluded that the use of technology combined with the systematic use of knowledge increases efficiency, improves efficiency, and facilitates competence, creativity, and innovation in the studied public organization. In addition, knowledge management proved to be a process of leveraging and articulating the skills and knowledge of employees with the support of information technology [58].

The results of the study show the growing importance of digital government (DG) in the public administration, as measured by the increasing number of published papers and the identification of several key issues. However, there is low specialization because few authors write extensively about the public sector. This lack of cohesive literature is evidenced by the low citation rates.

Furthermore, the low levels of international cooperation between authors contribute to the fragmentation of literature. Some research themes and some geographic areas within the public sector theme are overanalyzed, and others are under-researched. Finally, researchers must rethink methodological approaches to make meaningful contributions to the literature to develop more critical approaches.

6. Conclusions

As a field of research, the digital government has emerged from several disciplines, including public administration, knowledge management and innovation, information technology, information management, element and process management, communication and organizational culture, among others. There have been several efforts in the last decade to outline this emerging academic community, assessing the growing body of research represented by new, revised publications each year.

In this study a review and survey were made with its main focus on estimating, from the collected data, how the digital transformation process in the Public Administration takes place and what its relationship is with knowledge management. The review study aimed to understand the role that digital government research plays in the theory and practice of knowledge management. In the survey study, 54 employees belonging to the services of the two governmental areas of the Portuguese Ministry of the Environment were surveyed.

Knowledge management could provide the overall strategy and techniques for eloquently managing digital government content in order to make knowledge more usable and accessible and keep it current. For the success of digital government, more studies should be carried out using appropriate methods and proposals for new research models, which include the knowledge management approach in the digital government literature. From a perspective of knowledge management, the digital government could be considered an essential aspect of innovation, coproduction, transparency, and the generation of public value.

With the intent to understand the relationship between the implementation of digital transformation and the use of knowledge management practices in public organizations and based on the methods of multivariate data analysis, it was possible to validate the hypothesis of the work, in which, in the opinion of the respondents, the digital transformation process has a relevant effect on knowledge management practices. Furthermore, in turn, it was validated that knowledge management is a critical factor in the success of digital transformation. The regression model disclosed that knowledge management as a function of digital transformation showed a reasonable average outcome in the order of 60%, so it can be concluded that the introduction of Digital Transformation in the Portuguese Ministry of the Environment increased Knowledge Management.

Furthermore, it has been found that the terms used in digital governance studies diverge from other terms that have the same meaning as e-government, which makes bibliographic research challenging. In addition, studies with the term digital transformation are scarce, so digital transformation studies and studies of the terms to be used in the digital government literature may be a possible direction for researchers.

As a result of this study, some research agenda topics were found, such as: studies on knowledge management in the process of digital transformation in public administration; case studies in public organizations that have a high impact on the improvement of public services; studies with methodological approaches that contribute significantly to the digital government literature; structured literature reviews on the topic, including research in more databases in order to perform a more in-depth analysis of the literature of digital government; and international comparative studies.

Several limitations can be highlighted. Firstly, the public sector documents were found only in the Scopus database, which could potentially ignore, involuntarily, some relevant articles on digital government and knowledge management studies. Nevertheless, the selection is a comprehensive and representative sample of the digital government literature.

In addition, this study was based on the analysis and interpretation of results, which can sometimes be subjective. Other researchers using the same data may present different interpretations and conclusions.

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