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Bibliometric Analysis of Smart Public Governance Research: Smart City and Smart Government in Comparative Perspective

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Abstract: The concept of smart public governance (SPG) is gaining attention among researchers, policymakers, and practitioners around the world, especially in response to the modernisation of public administration through emerging technologies in both local (smart city) and national (smart government) levels. Spurred by the noticeable lack of understanding of the SPG concept, the paper aims to comprehensively examine the SPG research by considering the characteristic differences between the smart city and smart government concepts. Bibliometric analysis is based on the Scopus database, containing 775 documents published in the last two decades and facilitated by several established and innovative bibliometric approaches. The results reveal the growth of SPG research over time. Despite the smart city concept being the dominant focus in the SPG research, the smart government concept has been becoming more relevant in recent years, as indicated by some prominent documents published in reputable journals like *Government Information Quarterly*. Moreover, Anglo-Saxon countries are chiefly engaged in SPG research. However, New Zealand and South Korea are identified as countries with a stronger focus on the smart government concept. The results show the smart city concept is connected with several smart-related initiatives (e.g., smart transportation, smart living, smart energy, etc.), while the smart government concept is primarily associated with smart (de)regulation and smart grid. The findings may add to the understanding of the future development of SPG research, on both local and national levels.

Keywords: bibliometric analysis; public administration; smart public governance; smart city; smart government



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1. Introduction

Due to globalisation, demographic, social, economic, and technological changes, societies, and their governments have constantly faced new challenges since the 21st century. These challenges are most often related to the third industrial revolution (marked by the accelerated transition of the world economy to renewable energy sources), reducing government spending and debt repayment, increased market speed, and lagging behind timely interventions in traditional legislation. These challenges have placed additional demands on the public governance system (Scholl and Scholl 2014; Gaule 2014). As a result, many countries worldwide have begun to increasingly look for effective and efficient ways to meet modern challenges. One of the most critical challenges today, for example, is related to citizens' growing needs and expectations. Their expectations have been strongly shaped by the use of new digital technologies, globalisation's impact, and the desire for increased cooperation between citizens and other stakeholders (OECD 2020a, 2020b). Governments are expected to be proactive and, above all, to deal quickly with economic and social pressures and complex public policy problems. This has led to the recent emergence of smart public governance (SPG) as a way of governments' effort to meet these challenges (Scholl and Scholl 2014; Šiugždinienė et al. 2017). SPG is one of the few areas where an academic contribution is often mentioned at the smart city level, but relatively little is known

about it at the smart government level. Although the clear objective of SPG is to improve the public governance system, there is still no consensus in the scientific community on its definition (Bolívar and Meijer 2016). This is not surprising because the SPG concept arose in the scientific literature recently, meaning it has not had much time to develop its conceptual foundations. This makes it quite challenging to finally settle on a definition of SPG, since it covers the entire governance process, including government structures and processes (Šiugždinienė et al. 2017). For the purposes of this paper, we propose to define SPG as a *modern approach to public governance that uses sophisticated information technologies to transform processes (interventions) between public administration and citizens with the aim of increasing collaboration, interaction, co-production, improving decision-making, and to achieve results that meet the needs of citizens (that is generating public value)* (Criado and Gil-Garcia 2019; Webster and Leleux 2018; Pereira et al. 2018; Gil-Garcia 2012). The basic notion is that SPG offers a broad perspective that includes the importance of information and communication technologies and collaboration between the state and the citizens and forms the basis for achieving the results of creating public value.

From the very beginning, we found ambiguity in the literature regarding understanding the notions associated with SPG. It would be difficult to begin a bibliometric analysis of SPG without usually starting with at least a brief epistemological analysis of other related terms. It is essential to distinguish between terms related to the SPG concept (e.g., smartness, smart city, smart governance, smart government), and between government and governance. This paper first reviews the literature concerning the aforementioned concepts, with the review helping to clarify what is encompassed by the SPG concept.

In the age of new technologies (ICTs), one of the main challenges is their development and use in the public sector. In fact, digital technologies have spread rapidly in more developed countries, leading to a situation that looks very different from a decade ago. Infrastructure and access are just two starting points for understanding the contribution of ICTs to development (Šiugždinienė et al. 2017; Gil-Garcia et al. 2015; Bolívar 2021). ICT nowadays plays a vital role in how the public governance system responds to economic and social pressures, as also seen in the implementation of smart government as one of the (further) development phases of e-government (Misuraca et al. 2020; Ravšelj et al. 2022). Although ICT helps governments improve political participation, implement public policies, and provide public services, researchers at the central government level do not pay as much attention to this topic. Too often, the concept is linked to certain phenomena on the level of smart cities, such as observing emerging e-government trends, improving local democracy, and creating a network that gives people access to government-related e-services (Gil-Garcia et al. 2015; Bolívar 2021; Castelnovo et al. 2015). In this context, ICTs are a key tool for cities to tackle challenges and problems in a more efficient, effective, and sustainable way—it is a smart way. Cities must take advantage of the vast potential of ICT to develop smart approaches and more practical solutions to challenges, as this leads to the development of smart cities (Alexopoulos et al. 2021). Caragliu et al. (2011) consider the smart city as a city that invests in social and human capital and modern infrastructure. Such cities encourage sustainability and a high quality of life for their inhabitants. Much literature is available on the conceptualisation of the smart city concept. The above definition is just one example of this conceptualisation (Alexopoulos et al. 2021; Meijer et al. 2016; Macconi et al. 2020). Even though the concept is not new in the literature (the concept was first known in the literature as the digital city, switching to the intelligent city alongside the concept of a knowledge society (Komninos 2011; Albino et al. 2015)), authors believe that the concept of a smart city is still soft, bridging, and descriptive. This is due to the continuous development of the concept due to innovations related to the use and application of ICT (Mulder 2021) and sustainable development strategies (Komninos 2011; Mora et al. 2018; Schaffers et al. 2011). Several studies are attempting to identify the significant smart city elements, and one of them that is always present is governance (Pereira et al. 2018; Giffinger et al. 2007; Ruhlandt 2018). In the social sciences, especially in public administration, the concept of governance has been prevalent in debates since

the end of the 20th century. The popularity of the concept of governance in contrast to the related (but narrower) concept of government (Brajnik 2016; Fukuyama 2013; Rhodes 1996; Rosenau 2003) can be attributed to the fact that governance is a broader concept involving a large number of actors and is not always related to government or under official government (Katsamunska 2016). Katsamunska (2016) states that in the social sciences, especially in public administration, the governance concept has been prevalent in discussions since the end of the 20th century. The author attributes the concept's popularity, in contrast to the linked (yet narrower) notion of government (Brajnik 2016; Fukuyama 2013; Rhodes 1996; Rosenau 2003), to the fact that governance is a broader concept that includes a larger number of actors and is not always linked to the government or under the authority of the formal government. Nevertheless, the concepts of governance and government still appear frequently in the literature as synonyms (Bannister and Connolly 2012; Larsson and Grönlund 2014; Rossel and Finger 2007). However, nowadays, there is an attempt between scholars to draw a line between them (Brajnik 2016; Rhodes 1996; Fazekas and Burns 2012). The government is an institution or body in the executive branch of government, which as part of the governance, holds an authoritative function with which it formulates obligations and rules. The government thus refers to formal procedures and institutions created by societies to express their interests, resolve disputes, and implement public decisions (John 2001). Yet, the concept of governance is extensive and open and involves both governmental and other actors (Brajnik 2016). Nevertheless, various scholars interpret those two notions differently, which leads to terminological disorientation in the long run (Scholl and AlAwadhi 2016). The latter problem could be rectified if scholars explained at the beginning which approach to the concept they have chosen, and which version is the basis for their contributions (Möltgen-Sicking and Winter 2019). Many digital initiatives have already been launched to establish service delivery models using disrupting technologies (e.g., blockchain, artificial intelligence, Internet of Things) under the umbrella term of smart government (Scholl and Scholl 2014; Gil-Garcia 2012). Hence, smart government is viewed as the next step in e-government (Schedler et al. 2019), a notion that emerged during the time of widespread use of the internet, the automatization of government agencies, and the establishment of e-transactions with citizens (Charalabidis et al. 2019). Pereira et al. (2018) note that a problem even bigger than the lack of clear definitions of the terms described above is that these often overlap in the literature. Scholars argue that concepts like smart government, smart governance, and smart city are fascinating mainly because of the smartness that city, governance, and the government would like to achieve with ICT advancement. The bedrock for smart governance may thus be seen as the ability to utilise smart and adaptive acts (Scholl and AlAwadhi 2016). In contrast, the smart government could refer to the implementation of technologies emerging in the new era caused by innovation in the public sector (Gil-Garcia et al. 2014).

Finally, despite broader academic discussions of different smart concepts, it is essential to ask what this smartness encompasses there in the first place. Smartness initially emerged as a desired feature of cities and devices and then government and governance, leading to many different views on the concept itself in the literature (Gil-Garcia et al. 2014). The expansion of the study of smart technologies to other scientific fields and sciences (albeit still primarily a technological concept) has given the concept of smartness its multidimensional characteristics (Criado and Gil-Garcia 2019). By this logic, the growing role of smart technologies today is considered to be technologies that allow users to connect to internet networks (Papadopoulou and Maniou 2021). Despite this very simplistic interpretation of smart technologies, the Internet of Things, artificial intelligence, blockchain technology, machine learning, and cloud computing are now considered to be ambassadors of smart technologies, sometimes referred to as disruptive or emerging technologies (Kankanhalli et al. 2019; Wirtz and Müller 2019). As a result, governments and societies around the world have begun to pursue policies that are increasingly geared toward smarter digital government as the only way to deal with advanced technology.

SPG is a concept that can be implemented locally and nationally. However, the literature on smart cities and smart government contains relatively little information about the evolution of the SPG concept. This paper uses bibliometric analysis to look at the frequency of the notion in research on smart cities and/or smart governments in order to acquire a fresh picture of how the concept of SPG has evolved over the past two decades. The main objective of this paper is to conduct a thorough analysis of SPG research by comparing and contrasting the characteristics of smart city and smart government concepts. Accordingly, the paper tackles the following research question: How has the concept of SPG developed in the contexts of smart government and smart cities? Given the lack of understanding of SPG in the existing literature on smart cities and smart government, the answer to this question will serve as the foundation for a new interpretation of the SPG notion. This new knowledge will provide an opportunity to understand future studies of SPG research and the similarities and differences in the development of the concept on both local and national levels.

The remainder of this paper is structured as follows. The Section 2 presents a literature review of existing and recent bibliometric studies on SPG. Section 3 outlines the materials and methods applied in the paper. The Section 4 presents in detail the results of the bibliometric analysis, while the Section 5 discusses the particular main conclusions. The bibliometric paper entails a bibliometric analysis of the development of SPG over the past 20 years to capitalise on its momentum. Accordingly, the paper aims to comprehensively examine SPG research within smart government and smart city contexts by using established and innovative bibliometric approaches. To provide the conceptual basis, we propose four objectives: (1) to examine the trends in publications and citations, (2) to identify the most relevant and impacting countries, journals, and authors, (3) to explore research hotspots and authors' collaboration, and (4) to determine which "smart" related words are relevant in smart city and smart government publications.

2. Literature Review

Based on the Scopus database, in the smart city context, [Mora et al. \(2017\)](#) conducted the first bibliometric analysis with a view to recognising what was happening during the first two decades of research on the smart city and improving understanding of the evolution of this fast-emerging research area. They discovered that smart cities as a research field started to grow in 2009, while Europe and North America were shown to contribute the most to the knowledge hub in the aforesaid area. A year later, a bibliometric analysis by [Janik and Ryszko \(2018\)](#) was conducted to explore how the literature on smart cities had developed since the smart city concept had in recent years gained considerable attention from researchers, practitioners, and policymakers worldwide. The results of their bibliometric analysis revealed that after 2010, a growing trend in the number of publications and citations in the smart city field was observable in the academic literature, given that the number of publications before then was negligible. The previous year was also determined by another bibliometric analysis by [Wamba and Queiroz \(2019\)](#). The 2018 analysis adds little novelty to the smart city field and argues that the most productive countries are Italy, China, the USA, and Spain, while computer science-based journals were the most common smart city publications.

The bibliometric study by [Chugunov et al. \(2018\)](#) was the first study to examine the smart city and smart governance research areas over roughly 30 years. The authors argued that the concepts above were still looking for an identity in the academic literature. The results suggested that smartness is an interdisciplinary area spread across different domains. Still, there are many more publications devoted to the smart city research field based on the result.

Six bibliometric analyses were conducted in 2019, all describing the prolific authors, sources and countries, the most cited papers, and interesting research directions. The first bibliometric smart city analysis that year by [Zhao et al. \(2019\)](#) argued that after 2014 rapid development was observed in the smart city field. The authors maintain that *Sustainability*,

Sustainable Cities Soc., and *Cities* emerged as core journals among smart city documents, as determined by another bibliometric study in the same year (Guo et al. 2019). Further, China, the USA, Spain, and Italy were recognised as top countries with the highest number of publications ranked by several bibliometric studies (for instance Wamba and Queiroz 2019; Zhao et al. 2019; Guo et al. 2019; Moradi 2019). In addition, Zhao et al. (2019) place smart city research documents into three clusters, where one cluster represents the pros and cons of smart city development in the future. In the authors' view, Kitchin's study "The real-time city? Big data and smart urbanism" and Holland's study "Critical interventions into the corporate smart city" are the two primary studies in this cluster. Apart from general and more encompassing bibliometric studies, a bibliometric study focused on urban development in Latin America was performed by Fernandes et al. (2019). For Latin American countries, the rise of smart cities began in 2013, the year we also determined in our bibliometric analysis to be when the rapid growth of the SPG documents started. Another bibliometric study in the same year discovered that the scientific community in the smart city research field had tended to concentrate on the seven focus areas: the economy, environment, information technology, Internet of Things, smart governance, smart citizens, and transportation (Moradi 2019). Finally, a 2019 bibliometric analysis by Parlina et al. (2019) investigates Indonesian institutes' smart city research field. Applying different bibliometric approaches, the authors noted that on the subject matter of smart cities the research focus in their space goes in the direction of e-services, (smart) transportation, big data, smart city development (economic and sustainable impact), along with (smart) energy.

In more recent bibliometric studies in 2020, we observe six more studies on the subject of smart cities. Three bibliometric analyses provided insight into the distribution of authors, countries, sources, and essential journals and research interests. The USA, China, Spain, the United Kingdom, and Italy stand out in this bibliometric analysis as countries contributing the most to smart city research (Janik et al. 2020; Liu and Xu 2019; Pérez et al. 2020). Further, Pérez et al. (2020) state that the journal *Sustainability* has emerged as one of the most influential ones, and the journal *Cities* as one in which the most articles in the research area of smart cities are published. Nevertheless, since 2013 steady growth in smart city studies can be noted in China's academic literature (Liu and Xu 2019). The last bibliometric analysis by Janik et al. (2020) indicates that smart city research covers the social sciences, computer science, and engineering. Meanwhile, *Sustainable Cities Soc.*, and *Sustainability*, for instance, were recognised as the most productive sources. The author also found that the smart city research area is multidimensional because it covers various topics. The following three bibliometric analyses argued that after 2010 and 2011, we might observe a growing trend in the number of publications in the smart city research area (Zheng et al. 2020; Zhou et al. 2020; Wu et al. 2020). However, the development of new technologies has drawn attention to smart city themes in technology and policy (Zhou et al. 2020). Regarding this research, hotspots in smart cities measure smartness, energy efficiency, big data, the Internet of Things, sustainability, and urbanisation (Zhou et al. 2020; Wu et al. 2020).

The literature review reveals a significant lack of bibliometric studies addressing SPG. Existing bibliometric studies have thus far commonly described the prolific countries, sources and authors, the most cited papers, and interesting research directions (e.g., subtopics). After reviewing the literature, it is evident that considerable bibliometric literature has focused on the smart city concept, while much less effort has been made to examine the smart government concept within SPG research. Moreover, the literature review shows a significant lack of bibliometric study on the topic, thereby hindering a comprehensive understanding of SPG.

3. Materials and Methods

To deal with the stated objectives, we considered comprehensive bibliometric data on SPG research from Scopus, the world-leading bibliographic database of peer-reviewed literature. The choice of Scopus was based on the idea that it has a more extensive database than its competitors, like Web of Science (WoS) (Falagas et al. 2018). The initial search in both

databases confirmed this since Scopus retrieved more documents for the intended search conditions than WoS. In addition, WoS has been described as a database that significantly underrepresents the scientific disciplines of the social sciences and the arts and humanities compared to the Scopus database (Mongeon and Paul-Hus 2016). Further, a similar search query in the WoS database yielded 200 documents related to SPG research, representing 24.96% of all 801 documents concerning SPG research from the Scopus database. Of these, just 27 are connected to the research area of public administration. The Scopus database thus seems to be more relevant and tailored to the needs of a bibliometric analysis of SPG research. Scopus' advanced online search engine was used to retrieve bibliometric data on May 26, 2021. The search strategy was based on the title and abstract and a keywords search that considered SPG-related search keywords and was limited to the social sciences subject area. Accordingly, the following search query was utilised: TITLE-ABS-KEY ("smart gov*") OR (TITLE-ABS-KEY ("smart cit*") AND TITLE-ABS-KEY ("governance") AND (LIMIT-TO (SUBJAREA, "SOCI"). Finally, additional checks for other possible SPG-related keywords such as "smart state" were conducted, revealing that all corresponding and relevant documents are already captured in the abovementioned search query.

Based on the above search query, a database of 801 documents associated with SPG research was obtained. The relevance of this database was tested by manually reviewing the documents retrieved over two consecutive steps. In step one, duplicate documents were removed, while in the second, two documents without the word "smart" appearing in the title, abstract, or keywords were excluded from the database. Finally, the following procedure was applied to distinguish documents related to "smart city" from "smart government". Documents with "city" or "cities" in the title, abstract, or keywords were classified as documents related to "smart city", whereas the remaining documents were classified as documents associated with "smart government". After completing the multiphase process presented in Figure 1, 775 documents were identified in Scopus as relevant for SPG research, whereby 710 of them were related to "smart city" and 65 to "smart government".

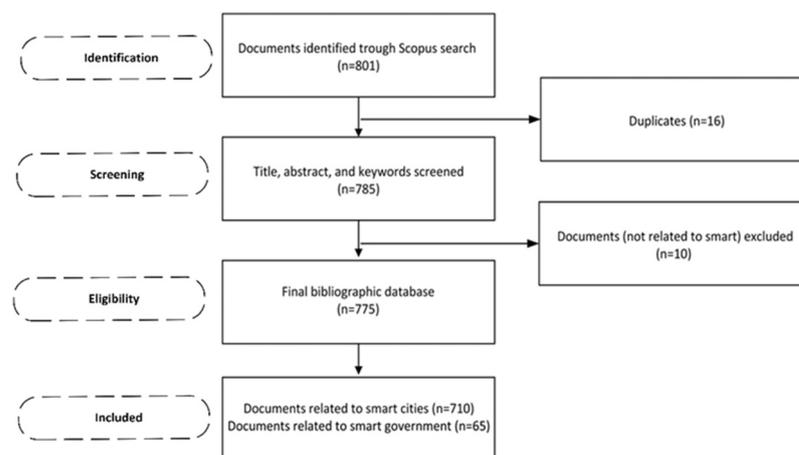


Figure 1. Flowchart of determining the Scopus search.

After obtaining the relevant bibliometric data on SPG research from Scopus, various bibliometric approaches and software tools were applied. The bibliometric analysis is primarily based on the number of documents and citations, additionally supplemented with the contents extracted from the titles, abstracts, and keywords. As regards to a descriptive overview, descriptive statistics were extracted and calculated with the Biblioshiny application (Moral-Muñoz et al. 2020), while frequency analysis was performed using the Python data analysis libraries Pandas and Numpy (McKinney 2012) and visualised with the use of Python's most potent visualisation library, Matplotlib (Hunter 2007). These Python libraries were also used to examine the scientific production of the most relevant countries, sources, and authors. Regarding network analysis, the keyword analysis was facilitated with VOSviewer (Van Eck and Waltman 2010) in terms of a keyword co-occurrence analysis

and the Biblioshiny application (Moral-Muñoz et al. 2020), with the latter being used to construct and visualise a Sankey diagram. Further, the authors' collaboration was facilitated with VOSviewer (Van Eck and Waltman 2010). Finally, association intensity was assessed using the mentioned Matplotlib (Hunter 2007).

4. Results

4.1. Descriptive Overview

Table 1 presents an overview of the characteristics of scientific literature on SPG research utilised in this bibliometric analysis. Our study relies on 775 documents written by 1678 individual authors and published in 356 sources between 1999 and 2021. The majority (74.44%) of these documents have at least one citation in the Scopus database, with a single author having written one-third of them (33.70%). Finally, documents related to smart cities had more citations in the scientific literature (14.57) than those related to smart government (11.51).

Table 1. Overview of characteristics of scientific literature on smart government and smart city.

Bibliometric Items	Smart City	Smart Government
Timespan	2000–2021 *	1999–2021 *
Documents	710	65
Documents with at least one citation	516	46
Single-authored documents	240	22
Number of authors	1533	145
Sources (journal, books etc.)	307	49
Author's keywords	1837	223
Authors per document	2.16	2.23
Average references per document	49.38	49.68
Average citation per document	14.57	11.51

Note: * Documents published by May 2021 were included in the bibliometric analysis on SPG research, with the first document on smart city and smart government being published in 2000 and 1999.

Figure 2 presents a frequency analysis of the number of documents and cumulative citations by year of SPG research. Overall, in the period under observation between 2013 and 2020, 683 articles concerned with SPG research received a total of 50,295 cumulative citations. The analysis showed SPG research had established itself as a new scientific inquiry area by 2013 and has since been a fast-growing area. However, according to the results in Figure 2, we divided the SPG research area's development into three subperiods. Before 2013, barely any documents addressed smart concepts; an article by Odendaal (2013) stands out regarding the number of citations (164). Initially, in the first subperiod (2013–2014), the distribution increased slightly to 40 documents, with relatively slow growth (8 per year), amounting to 2082 citations. The second subperiod (2015–2017) is characterised by a steady rise (45 per year), with many more documents (185) and 16,593 cumulative citations. In contrast, the 2018–2020 period is characterised by tremendous growth in the number of documents (458), with an average increase of 83 documents per year and 30,619 cumulative citations. Due to the rising trend in the number of documents and citations, the SPG field is in a phase of rapid growth.

Table 2 lists the ten most-cited publications in the SPG literature indexed in the Scopus database. Most references in the smart city field are made to the article "The Real-Time City? Big Data and Smart Urbanism" written by Kitchin (2014). This paper helped provide a framework regarding how various smart cities need to incorporate digital devices into their infrastructure to produce big data. The paper entails a critical analysis of various existing projects and their effects on the significance of big data and smart urbanism in

smart cities around the world. The paper was indeed spotlighted in several bibliometric studies (Mora et al. 2017; Fernandes et al. 2019; Zhou et al. 2020; Wu et al. 2020) as one of the most cited articles. This means that 2013 may be considered the earliest burst of SPG research publications, which corresponds with the growing trend in the number of documents and citations shown in Figure 2. The article by Savoldelli et al. (2014) entitled “Understanding the e-government paradox: Learning from literature and practice on barriers to adoption” appeared first, observing smart government filed with 105 citations. The paper describes barriers to the adoption of e-government and is critical of the implementation of e-government that had hitherto focused more on technological and operational issues than institutional or political topics.

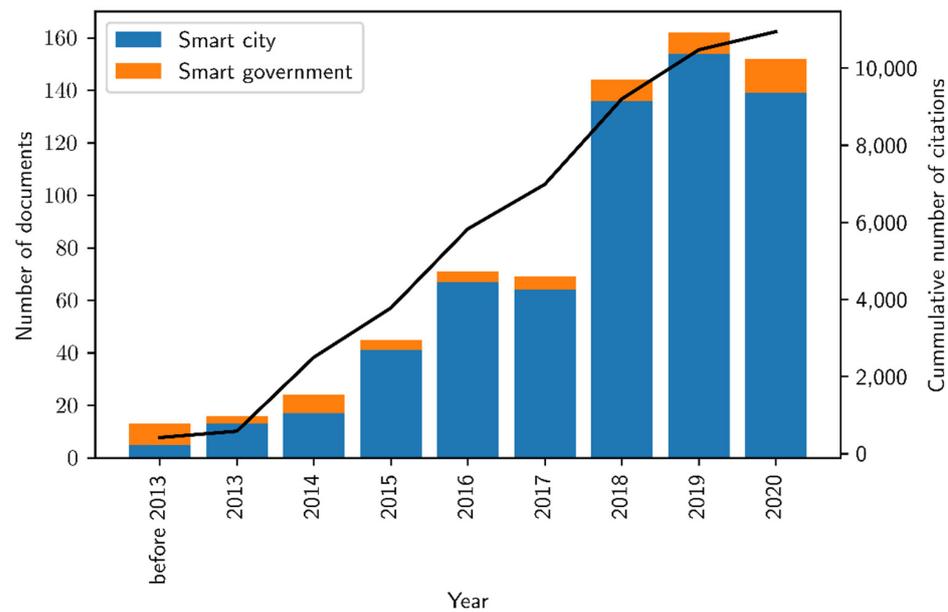


Figure 2. Distribution of publications and citations by year (2013–2020).

Table 2. Most relevant documents by number of citations in SPG literature (1999–2021).

Authors and Year	Document Title	Source Title	Cited by	
(Kitchin 2014)	The real-time city? Big data and smart urbanism	<i>GeoJournal</i>	1052	Smart city
(Meijer and Bolívar 2015)	Governing the smart city: a review of the literature on smart urban governance	<i>Int. Rev. Adm. Sci.</i>	436	
(Silva et al. 2018)	Towards sustainable smart cities: A review of trends, architectures, components, and open challenges in smart cities	<i>Sustainable Cities Soc.</i>	343	
(Hollands 2015)	Critical interventions into the corporate smart city	<i>Camb. J. Reg. Econ. Soc.</i>	301	
(Shelton et al. 2015)	The ‘actually existing smart city’	<i>Camb. J. Reg. Econ. Soc.</i>	288	
(Gabrys 2014)	Programming environments: Environmentalism and citizen sensing in the smart city	<i>Environ. Plann. D Soc. Space</i>	267	
(Savoldelli et al. 2014)	Understanding the e-government paradox: Learning from literature and practice on barriers to adoption	<i>Gov. Inf. Q.</i>	105	Smart government
(Mellouli et al. 2014)	Smart government, citizen participation and open data	<i>Inf. Polity</i>	59	
(Kankanhalli et al. 2019)	IoT and AI for Smart Government: A Research Agenda	<i>Gov. Inf. Q.</i>	40	
(Johnston 2010)	Governance infrastructures in 2020	<i>Public Adm. Rev.</i>	40	

Note: The presentation includes the 6 most relevant documents (with over 250 citations) addressing smart city and the 4 most relevant smart government documents (with over 40 citations).

A comprehensive analysis of the top ten SPG research publications showed the most cited publications largely focus on modern efforts to conceptualise and develop smart cities using ICT. We also observe documents concentrated on building a (smart) governance model that is more open, transparent, and participatory in terms of the support of various emerging technologies.

4.2. Scientific Production

The most relevant corresponding author country, sources, and authors in SPG research are identified based on documents published and citations received in the 1999–2021 timeframe. We can largely detect two groups of countries in SPG research (Figure 3). Eight countries have over 600 citations, covering 73.8% of all documents and 81.3% of all citations in SPG research. While the United Kingdom, with 79 documents and 1606 citations, stands out overall, the United States and Ireland are prominent with respect to the number of citations. This suggests that these Anglo-Saxon countries engage the most in SPG research. A much lower average number of documents (26.2) and citations (18.7) is observed for a group of 12 countries. Still, this group of less relevant countries in SPG research with the average year (2017.2) of a publication is more concentrated on smart city. A comparison of the smart city and smart government dimensions shows that 15 of the 20 countries have a proportion of smart city exceeding 90%, which together covers 79.1% of all documents and 66.1% of all citations in smart city documents within SPG research, with the average year of publication being 2018. In smart government documents, the United States stands out for the number of documents (11) and citations (133), while South Korea and New Zealand have the biggest share (33.34%) of smart government documents with the average year of publication being 2013.

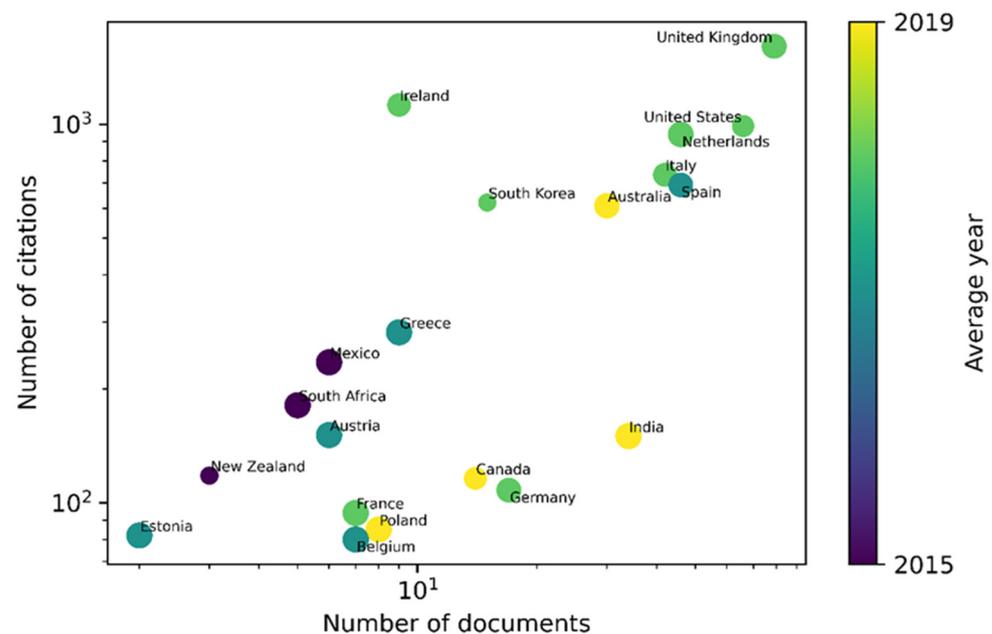


Figure 3. Most relevant countries by number of documents and citations in SPG research (1999–2021). Note: Additional information is provided by the size of a circle reflecting the share of smart city research (e.g., New Zealand and South Korea have the smallest share of smart city documents).

Further, five different journals: (*Cities*, *Sustainability*, *Inf. Polity.*, *Sustainable Cities Soc.*, and *Gov. Inf. Q.*) are detected as the most relevant sources whose h-index is more than 9. Together, they account for 50.6% of all documents and 41.5% of all citations in SPG research and have 2018.4 as the average year of publication (see Figure 4). *Public Adm. Inf. Technol.* is the most influential source, responsible for the highest number of documents (41). Along with *Cities* and *Gov. Inf. Q.*, *GeoJournal* emerged to be the journal with the most citations.

The last journal shown in Table 2 is a publication that contains the most cited smart city document written by Kitchin (2014), covering 99.7% of all citations of the journal. There is also a group of 14 sources with a 100% proportion of smart city, representing 74.4% of all sources observed in the SPG research. In addition, there is one journal (*Comput. Environ. Urban Syst.*) with the oldest average year of publication (2003) that accounts for 100% of all citations of the article by Odendaal (2013); the only report with a relatively high number of citations (164) between 1999 and 2012. With respect to smart government, *Gov. Inf. Q.* is the most influential source, accounting for 52.6% of all documents and 75.6% of all citations, along with an average year of publication (2016) in smart government within SPG research. This journal is shown in Table 2 as a publication that contains the most frequently cited smart government document written by Savoldelli et al. (2014).

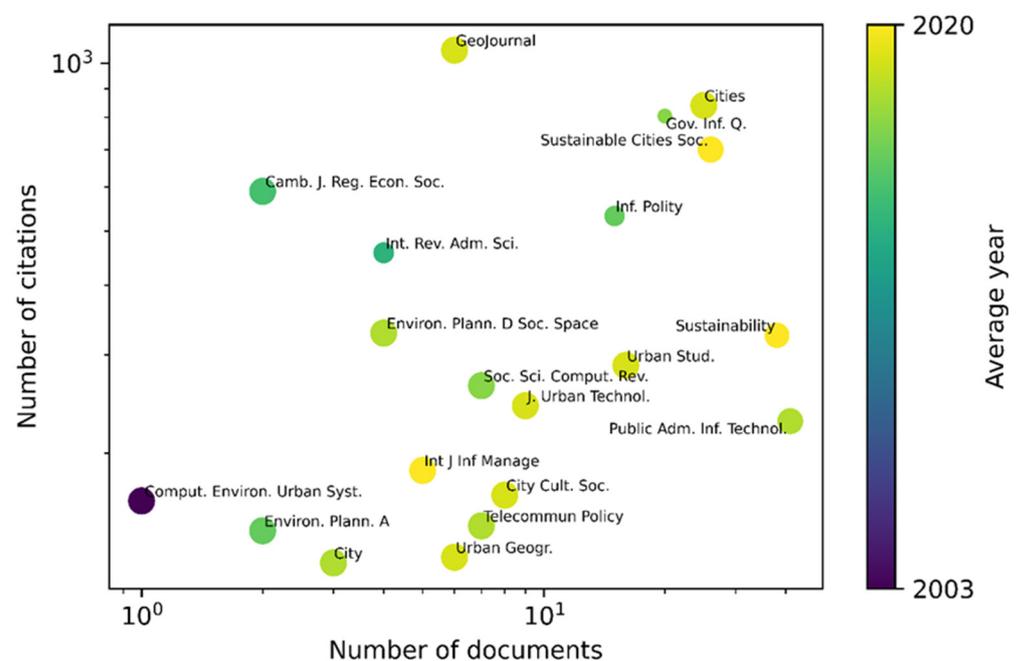


Figure 4. Most relevant sources by number of documents and citations in SPG research (1999–2021). Note: Additional information is provided by the size of a circle reflecting the share of smart city research (e.g., *Gov. Inf. Q.* has the smallest share of smart city documents).

Finally, the most influential author in SPG research is Gil-Garcia J. R. (University at Albany, USA) with 10 different documents attracting 570 citations (h -index = 7). He is followed by Rodriguez Bolívar M.P. (University of Granada, Spain) with the highest number of documents (13) who attracts more citations (615) and has a lower h -index value (6). Still, it may be observed that by number of citations the most influential author is Kitchin, R. (Maynooth University, Ireland) (see Figure 5). Therefore, the most cited smart city document of his listed in Table 2 is found in 94.6% of all citations in SPG research. Moreover, Meijer A. (Utrecht University, Utrecht, The Netherlands) and Wiig A. (Chr. Michelsen Institute) have more than 500 citations in SPG research. The presented group of 11 authors has a moderate average number of citations (42.1) in SPG research, with 2016.9 being the average year of publication. These authors' research concentrated only on smart city. Four authors in this group: (Janssen M. (Delft University of Technology, Delft, The Netherlands); Misuraca G. (University of Naples, Italy); Zhang J. (Tsinghua University, China); Savoldelli A. (University of Verona, Italy) are responsible for 80% of the documents and attract 95.6% of all citations in smart government. They also play an essential role in the smart government part of SPG research. As shown in Table 2, these are the most relevant documents in terms of citations in smart government as published in the period under study between 1999 and 2021.

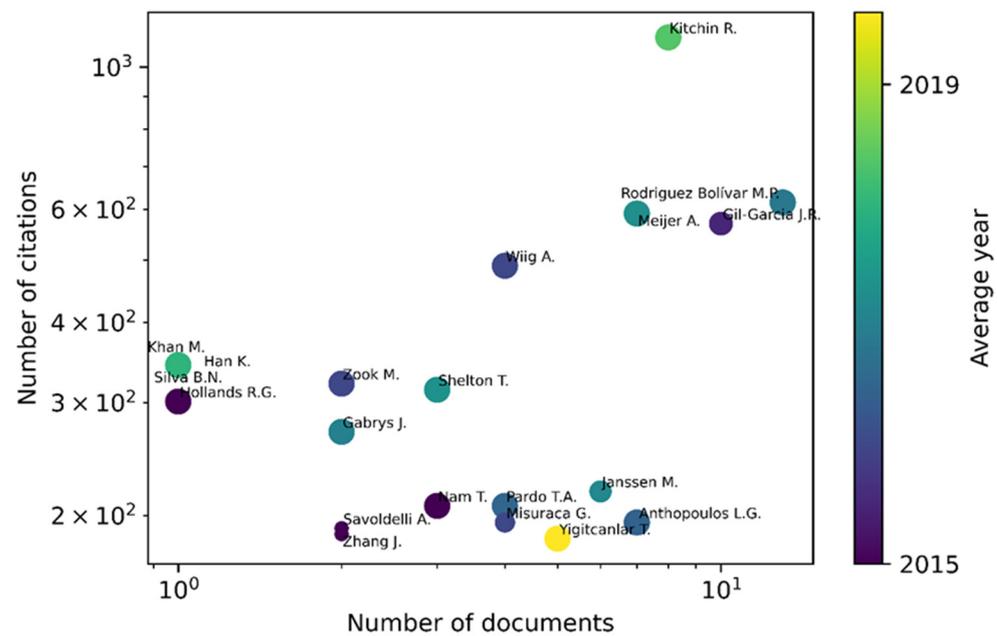


Figure 5. Most relevant authors by number of documents and citations in SPG research (1999–2021). Note: Additional information is provided by the size of a circle reflecting the share of smart city research (e.g., Savoldelli A. and Zhang J. have the smallest shares of smart city documents).

4.3. Network Analysis

Tables A1 and A2 in Appendix A provide a detailed synopsis of the research hotspots, including the top keywords related to smart city and smart government research in the SPG area. The networks shown in Figure 6a,b illustrate five distinct clusters, each representing a subfield of research in the SPG literature. The nodes represent keywords, while the links between specific keywords display the number of documents in which the co-occurrence relations between keywords occur. Note that the node size characterises the number of documents it has produced related to a smart city or smart government (node degree). The link width is proportional to the co-occurrence among keywords (edge weight), while a node's colour indicates the group to which a particular keyword belongs (Wu et al. 2020; Wang et al. 2020).

Figure 6a refers to the authors' 40 most frequent keywords. As shown there, the document co-occurrence analysis allows smart city research to be divided into five clusters, covering the four leading subfields in smart city research: (1) smart city and smart city governance, (2) urbanisation, (3) sustainability, and (4) ICT and participation/collaboration. When considering the time dimension, certain terms appear to be more important at the beginning of the third observed period (governance, e-government, smart government, big data, etc.). Smart city, smart governance, sustainability, and ICT, for instance, appear to be more invaluable somewhere in the middle of the third period. The Internet of Things, urban development, and citizen participation are terms that become important at the end of this period. The most emphasised themes in SPG smart city research were further examined by analysing the evolution of themes (see Figure A1 in Appendix A). The results show that e-government (including the related terms smart government, and e-governance), along with sustainability (including planning, climate change, and green infrastructure) themes, have well-developed internal and external ties (i.e., they are motor themes—upper-right). Public value and social media themes have well-developed internal ties but marginally significant and external relations (i.e., they are highly developed and isolated themes—upper-left). Following them are smart technologies and COVID-19 themes, which have low centrality and density, suggesting they have weakly developed internal and external ties (i.e., they are regarded as emerging or declining themes—lower-left). Finally, technology (including open data, participation) and smart city (including governance, smart governance, urban

governance, and Internet of Things) have high centrality and low density, indicating these themes have weakly internal but strong external ties (i.e., they are basic and transversal themes—lower-right). The result after using several bibliometric approaches revealed the significant diversity of the co-occurrence author keywords of the smart city-related documents in the SPG literature. This finding emerged from other bibliometric studies but not in relation to SPG (Janik et al. 2020; Wu et al. 2020).

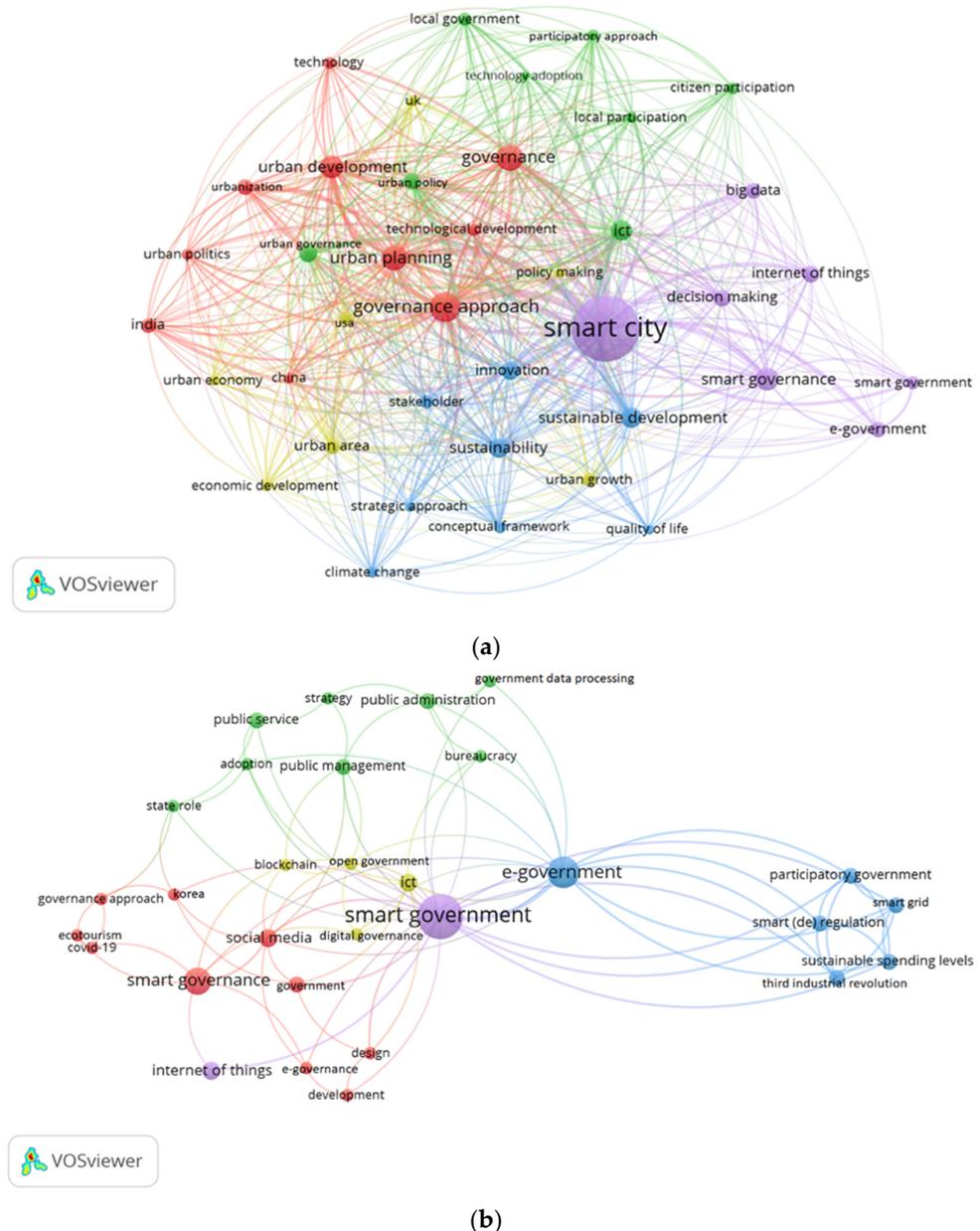


Figure 6. (a) Authors’ keyword co-occurrence network (min. 3 occurrences) in SPG smart city research. (b) Authors’ keyword co-occurrence network (min. 2 occurrences) in SPG smart government research.

Figure 6b refers to the authors’ 30 most frequent keywords. However, here the network analysis relies on a total of just 65 smart government documents in the SPG literature. As shown in Figure 6b, document co-occurrence analysis leads to the smart government research being divided into five clusters, covering the five leading subfields in smart government research: (1) smart government, (2) public administration and public service, (3) ICT and open government, (4) e-government, and (5) smart governance. When the time dimension is considered, certain terms appear more important at the beginning of the

decade (for instance, participatory government, smart grid, smart (de)regulation). Accordingly, ICT, bureaucracy, development, e-government, and other related terms (i.e., smart government, government) seem to appear and become more important somewhere in the middle of the decade. For instance, the Internet of Things, blockchain, public service, COVID-19, smart governance, and other associated terms (i.e., e-governance, digital governance, open government) are terms that became important at the end of the decade. The most emphasised themes in SPG smart government research were additionally examined by analysing the evolution of themes (see Figure A2 in Appendix A). The results show that development themes have well-developed internal and external ties (i.e., they are motor themes—upper-right). Internet of Things themes have strong internal but weak external ties (i.e., they are highly developed and isolated themes—upper-left). This is followed by public service themes with low centrality and low density, suggesting they have weakly developed internal and external ties (i.e., they are seen as emerging or declining themes—lower-left). Finally, participatory government (including smart grid, smart (de)regulation), smart government (including e-government, ICT), and smart governance (including social media) have high centrality and low density, suggesting these themes have weakly developed internal ties but are important external ties. (i.e., they are basic and transversal themes—lower-right). The results reveal the focus of SPG smart government research varied in themes like smart government, smart governance, e-government, public administration, and public service.

The relationship between the sources (left column), main authors' keywords (middle column), and countries (right column) is visualised using the Three Field Plot. In our case, the previous relevant elements are shown in the diagram using differently coloured rectangles. According to Janik et al. (2020), the latter relies on the value of the total relationship emerging between the rectangular elements. Therefore, if a component has many relationships, the rectangle is taller. Figure 7 presents a diagram in the SPG research focused on the relationship between the sources, primary authors' keywords, and countries. Further, the analysis shows which sources the authors of SPG research had published the most often, which keywords by authors were used frequently in the SPG publications, and which countries based on the authors' contributions are the most dominant. The analysis of the sources, main authors' keywords, and countries saw one main author keyword leaping out (i.e., smart city). Two sources (i.e., *Sustainability* along with *Cities*) have a strong relationship with the main countries for SPG literature (i.e., the UK and the Netherlands). Thus, in SPG, research publications related to smart cities dominate, as already determined in a bibliometric study by Chugunov et al. (2018).

Figure 8 shows the co-authorship network, which reveals authors' collaboration in SPG research, where the nodes represent authors and the links to the co-authorship relations between authors. The analysis is prepared based on the Scopus database and reveals that collaborations between authors mainly occur within six different researcher groups, as shown in different colours. The first group (green colour) mostly writes on the themes of participation/collaboration (i.e., citizen engagement) in the smart city context. They are connected to the group of authors that in our co-authorship network is the most involved one. As a group in the centre of a co-authorship network (red colour), various topics related to the local government level are addressed but primarily sustainability, public value (i.e., citizen centrality), and participation/collaboration (i.e., citizen engagement). Further, Geertman, S. (Utrecht University, Utrecht, The Netherlands) is the most influential author in our co-authorship network. His group writes more than others about urbanisation themes (including urban planning, innovations, and smart energy) where emerging technologies (i.e., technology savviness) play an essential role. The collaboration between Meijer A. (Utrecht University, Utrecht, The Netherlands) and Bolívar M.P.R. (University of Granada, Spain) is already noted in previous research. Their paper is the second-most cited smart city document (see Table 2), observing the most relevant documents by number of citations in SPG research. The second two groups in our co-authorship network are more minor; nevertheless, Bolívar M.P.R., the researcher who published the highest number of records

in SPG research with fellow academics, writes on topics related to smart city governance. He also works with Gil-Garcia J.R. (University at Albany, USA) whose group is devoted to public value (i.e., citizen-centricity) topics. The last group in our co-authorship network (yellow colour) writes on the themes of emerging technologies (i.e., technology savviness) in the smart city and smart government field within SPG research.

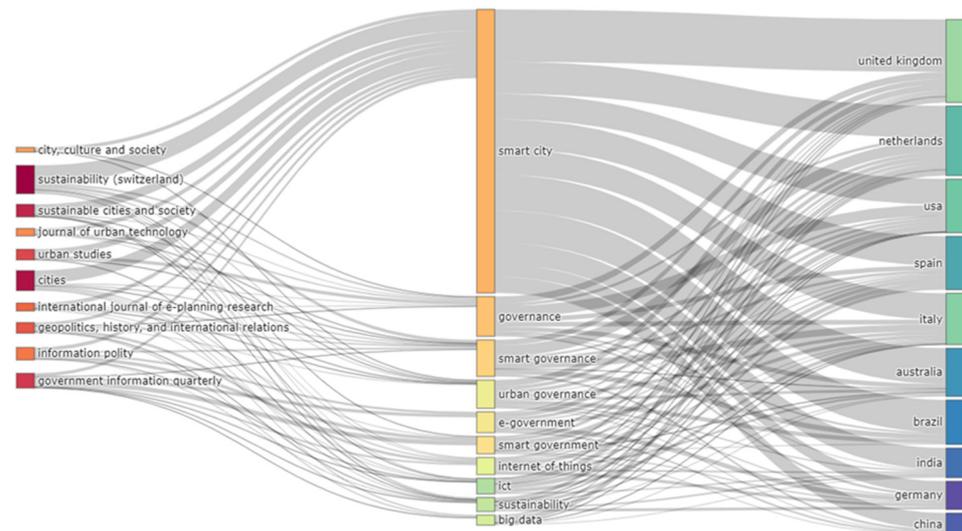


Figure 7. Three Field Plot: Relationship between the sources (left), main author keywords (middle), and countries (right) for SPG research. Note: The analysis is conducted on just (n = 488) articles and based on sources, authors’ main keywords, and countries.

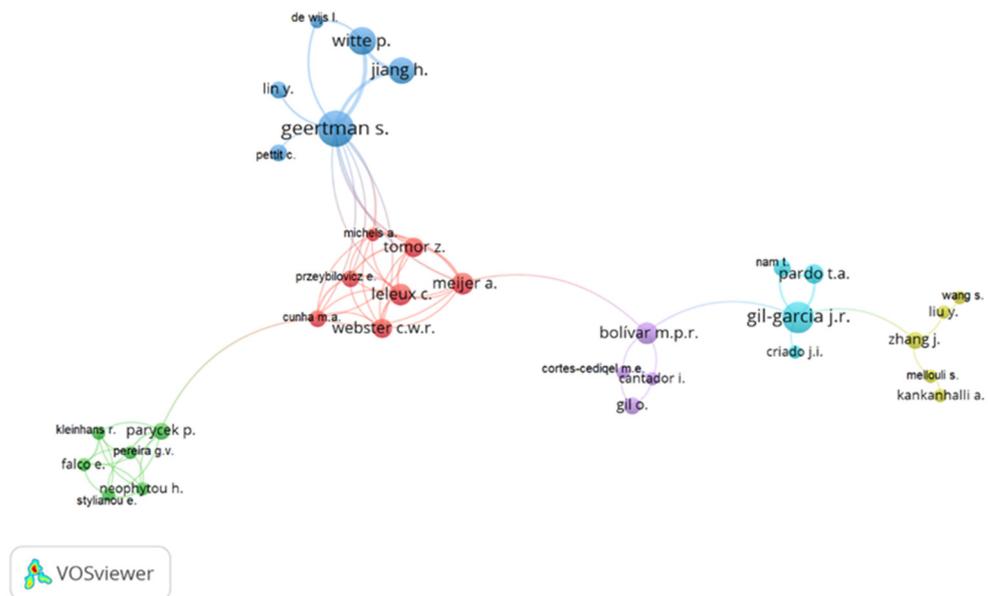


Figure 8. Co-authorship network showing authors’ collaboration on SPG research.

4.4. Association Intensity

Table 3 presents the intensity of association between smart city and smart government in the SPG publications. We observe three types of association that occur; namely, between those two binary variables: positive association (i.e., $Q = 1$), negative association (i.e., $Q = -1$), and no association, or more commonly known as the independent area (i.e., $Q = 0$). The core of the research entailed analysing all smart words recognised in each of the 775 documents on SPG research.

Table 3. Yule Q Association.

Yule Q Association	Smart Government	Smart City
(1.00)~(0.50)	smart (de)regulation (1.00) smart grid (0.54)	
(0.50)~(0.00)	smart service (0.46)	
(0.00)~(-0.50)	smart governance (0.22) smart technology (0.04)	
(-0.50)~(-1.00)		* smart transportation, smart living, smart community, smart city mission, smart urbanisation, smart region, smart environment, smart citizen, smart home, smart energy, smart education, smart tourism, smart nation, smart citizenship, smart island, smart society, smart contract, smart infrastructure

Note: The exact values of the associations are shown in parentheses the $q_{\text{association}}$ value of concepts marked with * is -1 .

Analysis showed that the word smart (de)regulation is entirely related to smart government, since it is positively associated with this binary variable. Based on the association value, smart grid and smart service are concepts that are still more related to smart government than smart city. This is also consistent with our previous discovery, where keywords co-occurrence (see Figure 6b) for smart government shows that the mentioned concepts were found in the analysis. Further, we may observe two concepts: smart governance and smart technology, based on their interconnection value. More associated with smart government but already very close to the independent area. Here we may conclude that smart governance and smart technology are often discussed in both smart government and smart city documents, as already concluded in [Criado and Gil-Garcia \(2019\)](#). Those authors also observed that smart technologies, along with strategies, may converge to form a smart government approach that is not only more efficient and effective but also more responsive and closer to the citizens. Finally, we observe that most of the smart words in the SPG publications (for instance, smart transformation, smart living, smart energy, etc.) are related to the smart city research area.

5. Discussion and Conclusions

This article has concentrated on the evolution of SPG as a new concept in studies that has gained a lot of scholarly and political weight. Following a review of various bibliometric studies conducted in previous years, we conducted an SPG bibliometric analysis that included both smart city and smart government research areas to help understand the evolution of two essential areas in the SPG field. More specifically, the bibliometric analysis presented here serves two purposes: (1) to give a better understanding of the evolution of the SPG concept over the last twenty years, and (2) to clarify the concept of smart public governance terminologically and by reviewing the literature, it can be compared with related (but more established) concepts such as public governance, (smart) cities, (smart) governments, and smartness since the SPG concept can be used in a variety of contexts. Moreover, such bibliometric analysis gives us the overall picture, mainly where there are gaps in our understanding of SPG evolution. This paper's primary contribution to the literature is to clarify the SPG concept and its differentiation between the very related concepts in the context of smartness. Against this background, the paper identified and analysed trends in publications and citations, the most relevant and impactful countries, journals and authors, research hotspots, authors' collaboration, and determined which "smart" related words are used in smart city and smart government publications.

Referring to SPG, [Bolívar and Meijer \(2016\)](#) pointed out that authors in their papers describe SPG in relation to ICT, collaboration and participation, decision-making processes, coordination, e-administration, and outcomes. Although SPG could be applied in a variety of circumstances, we attempted to contextualise it in relation to the national level. In a nutshell, we draw the conclusion that the SPG concept is a fragile one and therefore could be interpreted as a *modern approach to public governance that uses sophisticated information technologies to transform processes (interventions) between public administration and citizens with the aim of increasing collaboration, interaction, co-production, improving decision-making and to achieve results that meet the needs of citizens (that is generating public value)* ([Criado and Gil-Garcia 2019](#); [Webster and Leleux 2018](#); [Pereira et al. 2018](#); [Gil-Garcia 2012](#)).

The SPG notion has been discussed in the literature for more than twenty years. The evolution of the SPG concept in the literature is what has prompted us to believe that it is the correct moment to refresh the knowledge map and prepare it. Thus, this study went beyond more straightforward bibliometric analyses that only focused on smart cities and utilised cutting-edge bibliometric tools with the advancement of technology to demonstrate the evolution of the SPG concept over the previous two decades.

Overall, this picture of SPG research development is based only on articles published in the Scopus database between 1999 and 2021. However, it offers an overall understanding of the SPG research area and the SPG concept, which is still looking for its own identity in the academic literature. This approach brings greater clarity to the research landscape of SPG. The results suggested that the research on SPG has mainly grown since 2013, a consequence of the fast-growing smart city literature. Therefore, SPG is now considered an emerging concept whose maturity must be assessed ([Chugunov et al. 2018](#)). Since the concept emerged only recently, the scientific literature on SPG has been limited, not having time to develop its conceptual foundations. Further, it is the subject of constant change and rapid evolution, which is largely connected to ICT and its everyday use. In a nutshell, SPG is considered a modern approach to public governance, exploiting the potential held by emergent technologies to ensure public administration is modernised. Although scholars started researching the smart city field a long time ago, it remains unclear how this is reflected in the development of SPG.

Overall, the results of our descriptive overview of the bibliometric analysis show that 775 documents are related to SPG research in the Scopus database. Most records have at least one citation, while a single author wrote one-third of them. In contrast, documents on smart city are more often cited in the scientific literature than documents referring to smart government. The bibliometric analysis results also showed that the number of publications on SPG concepts was rising year after year. Still, we notice fewer smart government publications than smart city publications. Indeed, this is because scholars' study smart city-related concepts more often ([Sánchez-Teba and Bermúdez-González 2019](#); [Steenmans et al. 2021](#)) and, according to [Moradi \(2019\)](#), smart city as a field has been on the agenda since 1970. Following and upgrading the existing bibliometric approaches ([Caputo et al. 2021](#); [Kitsios et al. 2020](#); [Shams et al. 2020](#)) the analysis reveals interesting insights. The evolution of SPG research is divided into three subperiods: slight growth (2013–2014), steady growth (2015–2017), and tremendous growth (2018–2021). The top three countries are the United Kingdom, the USA, and Ireland in terms of article distribution. While Ireland was ranked third by the number of citations in the [Kitchin \(2014\)](#) article, the number of its documents remains small. Yet, we suppose that Anglo-Saxon countries engage the most in the SPG research context. As for source journals in the SPG field, the *Public. Adm. Inf. Technol.*, *Sustainability*, *Sustainable Cities Soc.*, *Cities*, and *Gov. Inf. Q.* were the five leading journals in terms of number of citations and publications in the SPG research. We also observe that *Public Adm. Inf. Technol.* and *Sustainability* are the most relevant publications to choose from while writing about smart city, while *Gov. Inf. Q.* is the most appropriate for topics concerning smart government. The analysis of the most influential documents in SPG research revealed that [Kitchin's \(2014\)](#) article is the most cited in the smart city research area. In the field of smart government research, the article

by [Savoldelli et al. \(2014\)](#) is the most frequently cited one. More significant numbers of documents in SPG research were associated with Rodríguez Bolívar M. P. (based on the highest number of records), Gil-García J.R. (based on the h-index), and Kitchin R. (based on the highest number of citations).

Moreover, through the keywords co-occurrence document network analysis of document analysis, we identified areas of greatest activity in the smart city and smart government research fields based on SPG publications. The co-occurrence network of authors revealed that the SPG research area chiefly concerned the following topics: participation/collaboration themes (i.e., citizen engagement), sustainability, public value (i.e., citizen centrality), and emerging technologies (i.e., technology savviness). Further, the four main research subtopics of smart city include: smart city and smart city governance, urbanisation, sustainability, and ICT and urban governance. The leading five subtopics of smart government are: smart government, public administration and public service, e-government, ICT and open government, and smart governance. An in-depth analysis of the intensity of the association between smart words identified in SPG research found that most of the terms (that is, for instance, smart transportation, smart living, smart energy, etc.) are more associated with smart city publications. However, it was noticed that smart technology and smart government words are narrowly independent, meaning they are nearly equal in smart city and government publications.

If we concentrate on the findings of our analysis, we can highlight the following conclusions: (1) the research on SPG has mainly grown since 2013; (2) SPG is the subject of constant changes and rapid development, which is still largely connected with ICT (recently, however, the authors of the articles connect SPG more often with the concept of participation and collaboration); (3) countries that invested the most in SPG research till now are the United Kingdom, the USA, and Ireland; (4) the top publications in SPG research include *Public. Adm. Inf. Technol.*, *Sustainability*, and *Sustainable Cities Soc.*; (5) the primary study areas of SPG are participation/collaboration topics (i.e., citizen engagement), sustainability, public value (i.e., citizen centrality), and emerging technologies (i.e., technological savvy).

In conclusion, this bibliometric study advances knowledge of the SPG concept by emphasising the research areas of smart cities and smart governments, which are frequently discussed in the literature but have never been thoroughly explored, at least in relation to the evolution of the SPG concept. Therefore, our research provides bibliometric support for the smart city and smart government research domains in SPG. In particular, this study helps to understand the evolution of the SPG research area based on smart city and smart governments over the past two decades. Our findings support and complement the results of previous studies like [Chugunov et al. \(2018\)](#) and [Fernandes et al. \(2019\)](#). We confirm the lack of smart government research areas in previous similar studies using the bibliometric analysis. This study clearly has certain limitations. Yet, since our research contributes to understanding the evolution of SPG, the objectives proposed in the study could be applied and tested using data from other data sources. Although Scopus is considered a world-leading database of peer-reviewed literature, it might not cover the entire collection of SPG research. The inclusion of different databases, such as Google Scholar or WoS, may have provided additional insights not arising from this study. Second, only titles, abstracts, and keywords in the English language were included in the study, which might cause some publication bias. Still, one could also argue that English is common and in wide use while publishing research internationally, implying that all-important scientific contributions should be visible in databases like the one used. An opportunity nevertheless remains for future studies to address this issue.

Irrespective of the above limitations, the findings reported here may benefit the scientific community and allow evidence-based policymaking to fully address the issues connected to SPG. At the same time, the results could also serve as an essential source for detecting associated research gaps and contribute to a better understanding of SPG research in the future. This bibliometric study provides a broad overview of the research

field, its evolution, and linkages between studies, which can serve as a further springboard for investigation.

Author Contributions: Conceptualisation, A.A.; methodology, L.U.; software, L.U.; validation, L.U.; formal analysis, L.U.; investigation, P.V., D.R., L.U. and A.A.; resources, L.U.; data curation, L.U. and P.V.; writing—original draft, P.V. and D.R.; writing—review and editing, P.V., D.R., L.U. and A.A.; visualization, L.U.; supervision, A.A.; project administration, A.A. and D.R.; funding acquisition, A.A. All authors have read and agreed to the published version of the manuscript.

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Appendix A

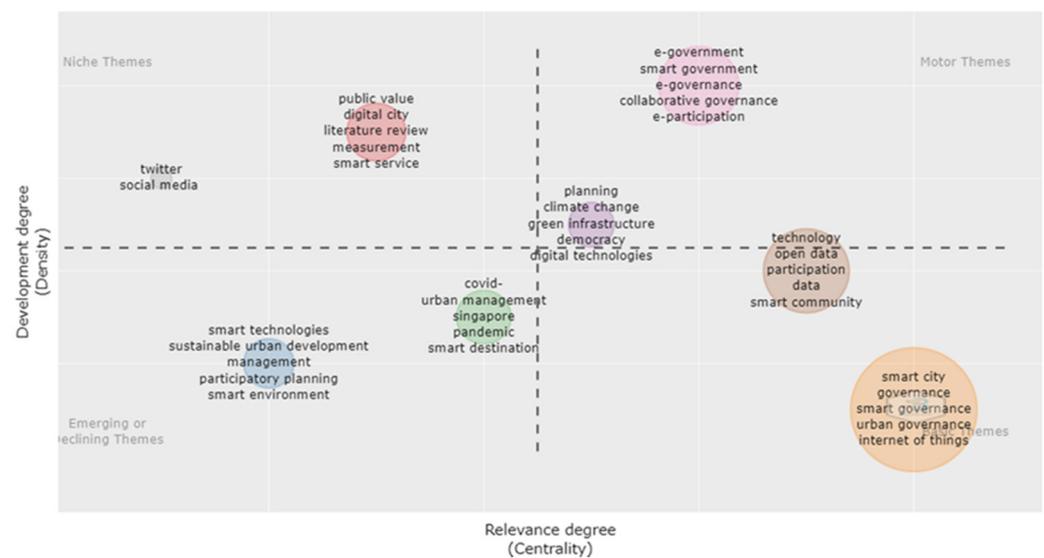


Figure A1. Thematic map of SPG smart city research.

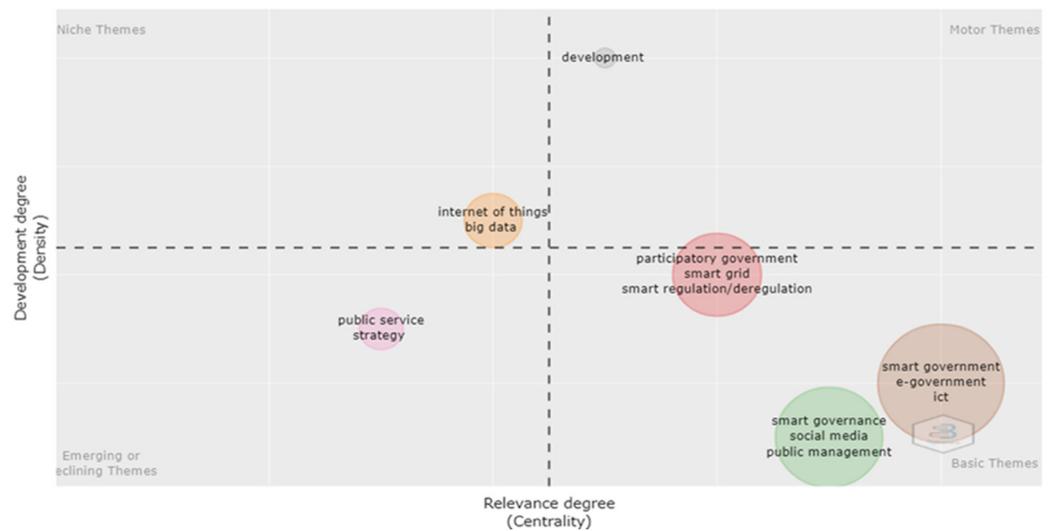


Figure A2. Thematic map of SPG smart government research.

Table A1. Research subfields based on authors’ keyword co-occurrence network in SPG smart city research.

Research Hotspots	Keywords
Smart city and smart city governance	smart city, smart governance, Internet of Things, decision making, big data, e-government, smart government, governance approach, governance, urban planning, urban development, urbanisation, India, technological development, technology, urban politics, China
Urbanisation	urban area, urban growth, USA, UK, economic development, policymaking, urban economy
Sustainability	sustainable development, sustainability, innovation, stakeholders, conceptual framework, climate change, strategic approach, quality of life
ICT and urban governance	ICT, urban governance, urban policy, local government, citizen participation, participatory approach, local participation, technology adoption

Table A2. Research subfields based on authors’ keyword co-occurrence network in SPG smart government research.

Research Hotspots	Keywords
Smart government	smart government, Internet of Things
Public administration and public service	public administration, public service, public management, adoption, bureaucracy, government data processing, state role, strategy
E-government	e-government, participatory government, smart (de)regulation, smart grid, sustainable spending level, third industrial revolution
ICT and open government	ICT, blockchain, digital government, open government
Smart governance	governance approach, smart governance, social media, government, COVID-19, design, development, e-governance, ecotourism, Korea

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