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Cent. Eur. J. Public Policy 2022; 16(2): 46–63
DOI: 10.2478/cejpp-2022-0007

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Strategic Conceptual Theories and Sustainable Cooperation Among Stakeholders in E-government, E-participation, and Social Media

ABSTRACT: *The objective of this study is twofold: on one hand, to analyze the current conceptual theories about e-government, e-participation, and social media. On the other hand, to analyze the cooperation among the most influential authors and its organizations where they belong. We will use different bibliometric software such as CitNetExplorer and SciMAT. Conceptual theories and cooperation among the most influential authors and its organizations will help us understand how the last trends in e-government and social media and the dynamics of the academic community work in the area. As interesting results, we can highlight that the technology acceptance model and the unified model of electronic government adoption are motor themes. Additionally, the analysis of the most influential authors and organizations shows that researchers such as Dwivedi from the University of Maryland and Jaeger from the Arizona State University in social media and e-government are the most significant authors. Furthermore, countries such as USA and Spain are leading the research on three topics, where Spanish researchers are growing considerably especially in social media related to e-government.*

KEYWORDS: e-government, e-participation, social media, conceptual theories, performance analysis, bibliometric análisis, science mapping, cooperation, researchers.

JEL CODES: O3 Innovation • Research and Development • Technological Change • Intellectual Property Rights: O33 Technological Change: Choices and Consequences • Diffusion Processes
R5 Regional Government Analysis: R50 General

RECEIVED 13 July 2022; **ACCEPTED** 11 October 2022.

INTRODUCTION

The objective of this study is twofold: to analyze current conceptual theories and how the stakeholders collaborate on the research fields of social media use related to e-government. Specifically, we want to define the current research theories in the area together with the understanding of how the authors and their organizations perform and cooperate in these research fields.

Many studies have been published on how the public administration adapted to the technological development and challenges associated with this fact. First, the e-government theory was studied, when the public administration started to modernize and

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Cent. Eur. J. Public Policy 2022; 16(2): 46–63
DOI: 10.2478/cejpp-2022-0007

introduce new technologies into their workflow (Rodriguez-Bolivara, 2017). Later, e-participation initiatives started to bring attention to the researchers, as citizens became more interested in having a more active role in the public policy-making process (Lourenço, 2007). Public administrations understood that it was necessary to hear what the citizens had to say and how they wanted to participate in the policy-making process (Zubrzycka 2022), but as well the local and regional governments accentuated that citizen engagement with the apparition of social networks.

In the same way that companies analyze how they adapt to the digital world with online business models, and what actions they carry out to sell and advertise themselves through online marketing, municipalities also have their own particular way of adapting and advertising information, namely the e-government model and Open Data policies.

We can consider that there are three main aspects in the relationship between government and citizens:

- Offer of services from the government to the citizen (e.g., electronic transactions).
- Offer of information that the citizen requests from the government.
  - External management (e.g., how to carry out a procedure, where to go to obtain information, etc.).
  - Internal management: Everything related to management indicators and accountability.
- E-democracy or citizen participation: Refers to the participation of citizens in the development of public policies and more recently, to the management of social networks of public entities.

The citizen, as an external user of this accounting management information, must be able to evaluate public management with the information published (Moñibas, 2015). To make a comprehensive analysis of this information, it must be possible to observe the achievement of the strategy proposed by the organization with the indicators they use to measure their management. In addition, municipalities must adapt to the new communication channels that are social networks, through which the citizen requests this management information, and which make participatory democracy possible (Royo, 2018).

The reasons of the relevance of the topic of e-government are based on authors such as Meijer et al. (2015) who drew a metatheory of e-government and concluded that there is a need for research that explains how individuals transform government, how new technologies transform the social construction of government and the influence on government change of the dual relationship between the behavior of individual actor and systems. Abu-Shanab et al. (2019) wanted to find the prevailing direction of e-government research by analyzing e-government publications. Munoz et al. (2017) presented a performance analysis of e-government where they quantified and visualized the thematic evolution of the research topic by a co-word analysis with a longitudinal framework using SciMAT software.

Regarding e-participation, Saebo (2008) and Machintosh (2004, 2009) provided a definition of e-participation and studied the main research areas. These authors called for the need of a research framework, a combination of qualitative and quantitative studies, the focus on citizen-driven participation, the impact and challenges of e-participation in democracy, the need to know the right quantity, quality, form, and time to make information available, the potential of mobile technologies and social networks for e-participation, the problematic of finding a balance between problem-solving and power-sharing, along with assuring inclusion of minorities and equal opportunities of e-participation to all citizens (called digital divide). In summary, these papers helped to pave the way of e-participation as an autonomous research field apart from e-democracy and e-government studies and also envision the main problems that are still valid nowadays and need a more in-depth research effort, as we study in this article.

Finally, regarding social media related to e-government authors such as Zhang (2015) mapped the evolution of social media research. He examined the influential references, publications, authors, institutions, journals, and topics comparing the results obtained in the time span from 1990 to 2013 with the more recent period of 2009 to 2013. Alryalat et al. (2017) analyzed social media and citizen-centric e-government services. They summarized the most used theories, models, and frameworks in this field, denoting that the number of theories used is scarce. They also made a quantitative analysis of evolution in terms of the number of publications. One interesting outcome of this article is their study of limitations recognized by other authors, which gives researchers a picture of the research gaps in the literature. Fundamentally, according to the authors, the common limitations in this research field are nonrandom or nonrepresentative data sample, sample size, the difficulty of generalization, preliminary nature of findings, and disadvantages of cross-sectional studies instead of samples taken in a broader and longitudinal time span. They proposed a framework where e-government adoption is an effect of perceived trust, enhanced by engagement (related to transparency, communication, and awareness) and participation (related to crowdsourcing, collaboration, and security).

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In this article, we will reveal the theories that are at the core of each research are analyzed, which are e-government, e-participation, and social media related to e-government, and also identify which are the structure of cooperation between authors and organizations researching in these areas. We will demonstrate that most of the research is being led to putting the focus on social media research, as is becoming increasingly important for public administration to better manage their relationship with citizens and understand their needs and requests.

These analyses will help researchers to realize which theories are currently predominating in the area, make better decisions on where to apply in terms of research fellowships in organizations, and which journals are best to publish. Furthermore, this article will help identify who are the leading authors for collaboration purposes and know which authors on these topics would be imperative to reference in your paper. Ultimately, these decisions could lead to getting more attention in your paper.

Although there are many analyses about a literature review of specific terms associated with e-government and civic participation in public administration (Hermosa del Vasto et al. 2019 among others), we consider there is a need for a comparative analysis between the three core terms such as e-government, e-participation, and social media. As well, not many articles focus on a longitudinal performance analysis on these research topics (Rodriguez-Bolivar, 2018), especially in the social media research topic.

DATA COLLECTION AND RESEARCH METHOD

Selection of issues within the area

To achieve the aim of the article, we will make a performance analysis of articles related to the three research topics and make a comparison between them. We are going to analyze the evolution of the citation network with the software CitNetExplorer, which will allow us to understand who originated the discipline and who are the predecessors nowadays. Also, we are going to use SciMAT and VOSviewer, which will facilitate gaining insight on the most relevant authors according to the academic community. We are going to analyze the cooperation among authors and institutions with WoS data.

Abu-Shanab et al. (2019) analyzed articles published in 2018 by 11 selected journals in the e-government field. They concluded some of the topic clusters that recently appeared were e-democracy, voting and participation, e-governance, open government, and social media. Among those, some of the most frequently used terms associated with e-government in the last 5 years until 2017 were social media (72), e-participation (45), Open Government (44), and e-government (31).

According to Abu-Shanab et al. (2019), social media topic was the most used term by far, with a frequency of 72 in a 5-year time span. In addition, Rodriguez-Bolivar 2018 remarked that social media is an important topic to be addressed in the future, especially how the citizens can influence and participate in the coproducing of initiatives on public online services.

However, there is a problem with data retrieval because this is a topic researched in many research fields, hence it is difficult to focus the search on the database. Nevertheless, we tried a WoS search for "social media" and "e-government," which yielded a reasonable amount of results, so we considered adding them to the analysis. As well, we considered Open Government to be a too broad topic that collides with the e-government keyword, so we chose not to use it. The search in WoS yielded more than 13,000; this number makes it nearly impossible for any drill-down analysis of the data.

Based on the findings of Abu-Shanab et al. (2019) and stated concerns, we chose the following issues to analyze: e-government, e-participation, and social media related to e-government. Finally, we chose only "articles" and "reviews" as document types, excluding early access documents. This selection was made for consistency of the database that is used in different software that has different data characteristics requirements. Also, SciMAT doesn't take into account these documents as they don't include the date of publication and the analysis made is timeframe based.

Research Methodology

This article is going to analyze issues associated with e-government, e-participation, and social media based on previous works of researchers in this field. The data was gathered in the Web of Science (WoS) core collection in 2020. The outcome will be analyzed with different bibliometric software, depending on the functionality required. The main steps will be the following (Table 1):

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Tab. 1: Steps of bibliometric analysis.

1.	Gather information from the Web of Science database.
2.	Pre-processing. Unify elements and clean the database. Part of the process consists of unifying duplicates, authority control, set periods of analysis. Not all software allows you to do this pre-processing of the data. It would need several iterations of searches in WoS with Boolean operators to reduce the search to specific articles on the topic.
3.	Choose normalization and visualization measure: In Scimat the Equivalence index is used by the software's author recommendation. In Citespace, we used Cosine as link strength as a default setting. In VOSViewer we used total link strength because it depicts better the relevancy of the units studied for our research purposes.
4.	Extraction of the specific network (co-occurrence of words, authors, countries, organizations; bibliographic coupling of authors references; co-citation of authors and reviews)
5.	Analysis and interpretation of data: discover thematic network and evolution of term over the time.

Tab. 2: Data collection method.

Retrieval database:	Web of Science Core Collection
Retrieval mode:	Advanced search
Boolean Logic model:	TS= e-government TS= e-participation TS= ("social media" AND e-government)
Retrieval time span:	1900-2020
Citation index:	SSCI; A&HCI; CPCI-SSH; BKCI-SSH; ESCI
Languages:	All
Type of document:	Article and review Exclude: Early access
Data updated to	February 2020

(Based on methodology proposal of Guo 2019)

This article aims to answer the following research questions.

RQ1: What are the strategic conceptual theories in e-government, e-participation, and social media?

RQ2: What is the evolution of most influential authors on e-government, e-participation, and social media?

RQ3: Which are the most influential journals and organization to cooperate with on government, e-participation, and social media?

Following the first step mentioned in Table 1, we performed a search in the WoS database with the following methodology, stated in Table 2.

We started applying the filters cited in Table 1 and excluding early access articles. We end up with 4,283 articles in e-government, 453 articles in e-participation, and 274 articles in social media and e-government. As we wanted to have as many references as possible to analyze in-depth the network of top articles, we decided not to exclude any article from the list. The article is based on most cited papers within the discipline, so these nonrelated articles have a low impact on our results.

Once we got our database after the selection process, we performed analysis in SciMAT and VOSviewer, in order to make a co-occurrence analysis and get a graphic strategic visualization of how different theories relates to one another depending on how much attention they are getting from researchers.

Co-occurrence analysis measures the relationship between words that appear together repetitively in a set of articles. For example, papers about bibliometric analysis with the software SciMAT would indicate a co-occurrence relationship between the word "bibliometric" and "SciMAT." While SciMAT allows doing a preprocess of the data (which allows output to be more accurate), VOSviewer allows visualizing the networks as a graphic setting. In SciMAT, we automatically process the words by plurals and then manually search for other words that we consider should be together for the analysis. After this preprocessing of the database, we performed the analysis with the specifications indicated below (Table 3):

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Tab. 3: Theories' Analysis in SciMAT.

	e-government	e-participation	Social media
Periods Name	Nº of Documents		
Before 2009	1321	47	0
2009-2014	2116	176	67
2015-2020	1764	230	212
TOTAL*	5201	453	279
Unit of analysis:	Words (Author's words, source's words, and added words)		
Data reduction (frequency):	4	2	2
Kind of matrix:	co-occurrence		
Network reduction:	3	1	1
Normalization method:	Equivalence index		
Clustering algorithm:	Simple centers algorithm (Max network size: 12 Min 3)		
Document mapper:	Union mapper		
Quality measures:	H-index and Sum citation		
Longitudinal map-evolution map:	Inclusion index		
Longitudinal map- Overlapping map:	Jaccard's index:		

** The number of documents used in SciMAT analysis doesn't match with the WoS search because for the analysis in this software tool, we used all types of documents as a type of document in the search query.*

SciMAT software tool's output shows a strategic diagram, which shows the nodes' size for the database analyzed, related to its density and centrality. Density is a measure to express internal cohesion, and centrality is the intensity of its internal relations). When a node has a high density (indicates it is a well-developed theme) and centrality (indicates the importance of the topic) it represents a motor theme. This means the issue is a key and mature topic within the field (it appears in the right upper quadrant of the diagram). If the node has low density but high centrality, it is a basic and transversal theme (right lower quadrant). When a node has a low density and low centrality, it means whether the topic is emergent or is disappearing (left lower quadrant). Finally, if the topic has high density but low centrality, it is a well-developed and isolated topic in the field (left upper quadrant) (Cobo, 2011).

After analyzing the strategic diagram in SciMAT and VOSviewer, we wanted to study the cooperation between authors and organizations along the years in the selected research areas. To do so, we used ancestors and predecessors' analysis in CitNetExplorer software and bibliographic coupling in the software VOSviewer.

CitNetExplorer software is used to show publications along with time axes, cluster publications, and drill down in a citation network and identify core publications (Van Eck, 2014). This software allows making a more detailed analysis of an author´s network (by default only shows a network of 40 authors, to better display the links among them). The color of the tags shows to which family an author belongs, in terms of citation relationship. (Table 4).

Regarding the citation network analysis in VOSviewer, three analyses can be made when analyzing the reference's relationship of a group of units (authors, journals, and documents), bibliographic coupling, co-citation analysis, and citation link. VOSviewer is a software that allows to make these analyses and present a visualization of the networks analyzed. VOSviewer uses by default the association strength normalization method to normalize the differences between nodes caused by highly cited and prolific scholars (Van Eck 2014, Van Eck 2010). For clustering, we selected the default values of the software.

The first analysis, bibliographic coupling (useful to understand the most relevant authors currently that are citing a common reference), shows the link that two units have because they cite the same document (A and B cite C) (Van Eck, 2014). The most common types of bibliographic coupling analysis are author and document coupling, depending on the researcher's objective. Bibliographic coupling is more problematic when we analyze its impact. Once the documents that cite the same reference are published, they cannot change; hence the data related to its bibliographic relationship becomes static. It is like a photograph in a given moment of the overlap in the reference list of publications within a specific research field.

Opposite to co-citation (that shows the group of authors most relevant over the time to the discipline cited conjointly), the bibliographic coupling is beneficial to understand the most relevant authors nowadays who are citing a common reference. When we find a robust bibliographic coupling relationship, it would mean that two units share a fair amount of references. This fact could

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Tab. 4: Clusters for citation network in CitNetExplorer Software.

		E-government	E-participation	Social Media
Group 1	Blue	Top 10 publication by citation score and intermediate publications	Top 10 publication by citation score and intermediate publications	Top 10 publication by citation score and intermediate publications
Group 2	Green	Social Media	Citizen Participation	Data
Group 3	Purple	E-Participation	Social Media	Twitter
Group 4	Orange	Adoption	E-Democracy	Facebook
Group 5	Yellow	Validation	Local	Local
Group 6	Brown	Satisfaction	Trust	Transparency

Tab. 5. Bibliographic coupling of authors parameters in VOSviewer.

	E-government	E-participation	Social Media
Counting method	Fractional counting		
Reduction method	Ignore documents with more than 25 authors		
Threshold Min doc. per author	10	3	2:
Threshold Min cit. per author	10	3	2
Selected units	39	36	58
Network visualization weight method	Total link strength		

indicate that each cluster is related to a specific domain inside the research field. Another explanation is that the research field is significantly narrowed, and there is a limited number of scholars publishing in the field; hence, they end up citing the same articles. Usually, we would find the cluster dominated by the successor authors in a longitudinal citation network on the discipline (the most recent authors connected to previous authors reference-wise). For example, in the e-government research field, we find that Dwivedi and Rana appear in the same group of authors. These authors are usually publishing together on the same topics, so they likely share a reference list.

When performing the analyses, the researcher can set the resolution parameters concerning the number of citations that an author needs to have to be considered in the analyses. Only the authors with the most significant link strength will be shown in the final visualization. When selecting a more exigent threshold, visualization prioritizes more relevant recent authors. Hence, we selected the parameter of 10 documents and citation per author, as it showcases better the groups of authors that we want to analyze (the research front). We used the same parameters, except the threshold, for the three research fields studied. The parameters selected for this analysis are shown in Table 5.

The second analysis is co-citation analysis. It means that two units (author, document) are both cited by a third unit (A and B are cited by C) (Van Eck, 2014). When there is a co-citation relationship, whenever a third party cites an author, there is a higher probability that the second author is cited. The most common types of co-citation analysis are references and authors. This measure can evolve as cited references change over time. If several newly published documents cite the same previous documents or authors altogether, then the co-citation relationship between the previous documents or authors will increase. It's like a movie that shows the accumulation of two units' relatedness in terms of co-citation. Chen (2006) defined co-citation as the footprint of a research front. The strength of the link shows how many times this co-citation had occurred. When this happens, the authors belong to the same research group, because they are more likely to be cited by the other members of the research group conjointly. We can also encounter strong co-citation when an author publishes an update of a previous paper or bases its methodology or theory proposal on the one presented in a former paper. In this case, later scholars are more likely to cite both papers to show the evolution of the original paper's results to the updated one, usually when the first paper is well cited. Usually, we can use this type of analysis to determine the intellectual base of a research discipline. Chen (2005) defines the research front as a time-variant mapping domain, while the intellectual base is the citation trail of the research front in the literature (Table 6).

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Tab. 6. Co-citation of authors parameters in VOSviewer.

	E-government	E-participation	Social Media
Counting method	Fractional counting		
Threshold Min nº citation per author	138	30	20
Selected units	100	33	76
Network visualization weight method	Total link strength		

RESULTS AND DISCUSSION

Strategic diagrams of conceptual theories

Regarding research question 1, we have performed an exhaustive search in WoS database on the three research areas mentioned earlier, as it has been explained in Table 2. Then, we have used two different software to visualize and identify the theories in a strategic diagram to a better understanding of the evolution of these research fields over the years. We have used SciMAT and VOSviewer software for the co-occurrence of words, following the methodology previously described. Figure 1 shown below is related to the period 2015 to 2020.

The e-government nodes (in red) show that the technology acceptance model, known as TAM (a subtheory of this model is the unified theory of acceptance and use of technology, UTAUT and the unified model of electronic government adoption, UMEGA), and Delone and McLean model appear as motor themes. In contrast, emerging topics are related to Twitter and smart cities. As to e-participation nodes (in blue), we see that the most significant node is technology, followed by social capital (related to UTAUT and trust), design (connected with participatory governance, online deliberation, and text mining), and user experience are the motor themes. Simultaneously, policy analysis (gamification, motivation), and tools (framework, communities) are the emergent themes. Also, we found well-developed and isolated themes such as GIS (geographic information system) and future research (related to co-creation, Delphi method, and real-time analysis). Concerning social media (in green), the motor themes are adoption model, transformation, and crowdsourcing. Also, we see as core themes Twitter and information technology. Political trust appears as a topic widely developed within this topic. In the emergent themes' quadrant, we found nodes related to performance and empirical research linked with literature review and meta-analysis.

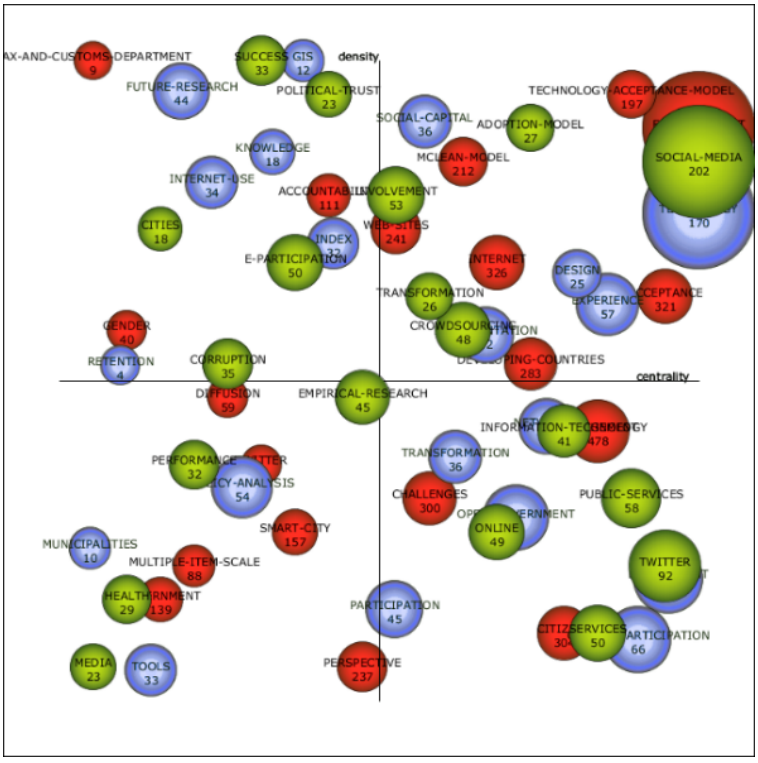
To ratify the results obtained before and view topic clusters associated with each core term, we used the software VOSviewer. This software tool allows us to show a network of terms visualized in a term density map by core term. In this case, the database is not preprocessed and does not consider different periods. We performed a co-occurrence analysis with the full counting method. As we can see, the main clusters that appear associated with e-government are: Social media, engagement, and political participation; adoption and perceived usefulness of e-government; knowledge sharing, web services, and e-administration (see Figure 2.. Clusters associated with e-participation are not so clear, as this term is a more recent term used by different disciplines. We can detect these groups: Trust, user acceptance, and e-government services; social media, citizen participation, co-production, Twitter, and crowdsourcing; online participation, e-democracy, and framework; Internet use, political participation, democracy, and e-consultation (Figure 3). Social media is the topic with more clusters, given that it is recently studied associated with e-government. The main clusters are Web 2.0, Facebook, Internet, and political communication; media, innovation, and open data; Accountability, open government, and local government; information technology, trust, performance, digital divide; social media use, e-participation, co-production, ICTS, and crowdsourcing.

Comparing results from SciMAT and VOSviewer, we can conclude that we found the same main topics. Although VOSviewer software gives a more detailed and visual analysis of the clusters, SciMAT allows consulting the articles associated with each cluster.

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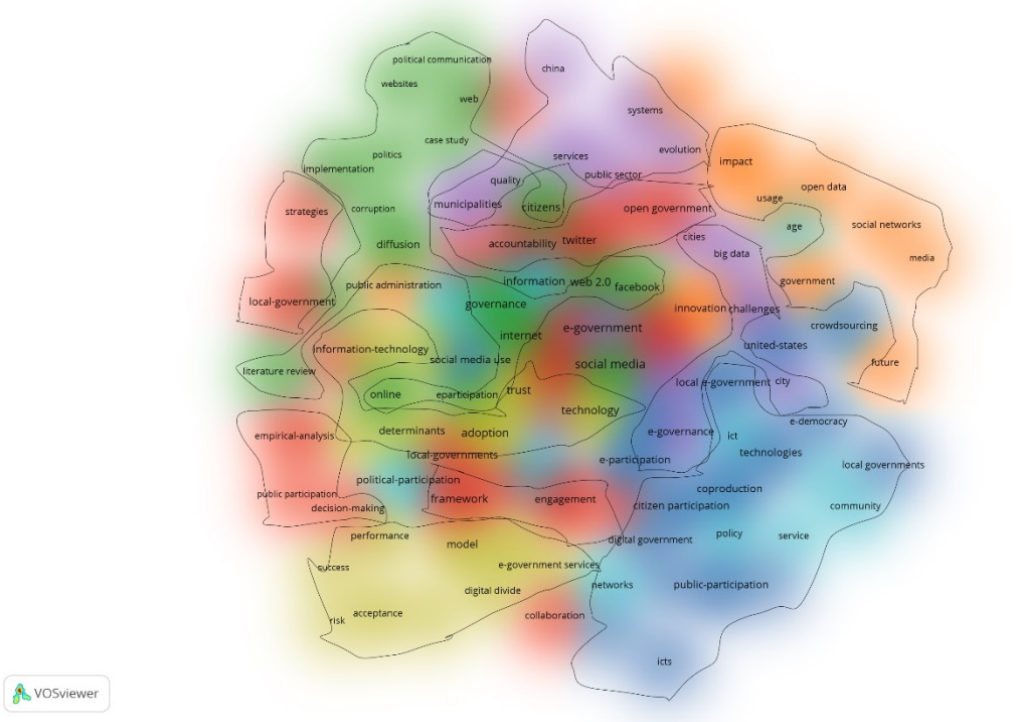
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Fig. 1: Strategic Diagram 2015-2020 period in SciMAT software.



Red: e-government Blue: e-participation Green: Social Media & e-government

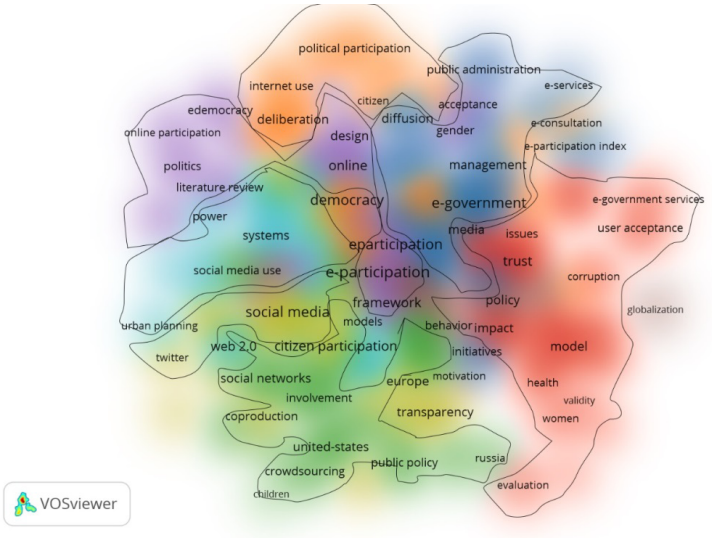
Fig. 2 : Density visualization map on the three main topics in VosViewer in E-government and social media. Weight: Link.



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Fig. 3: Density visualization map on the three main topics in VosViewer in E-participation. Weight: Link.

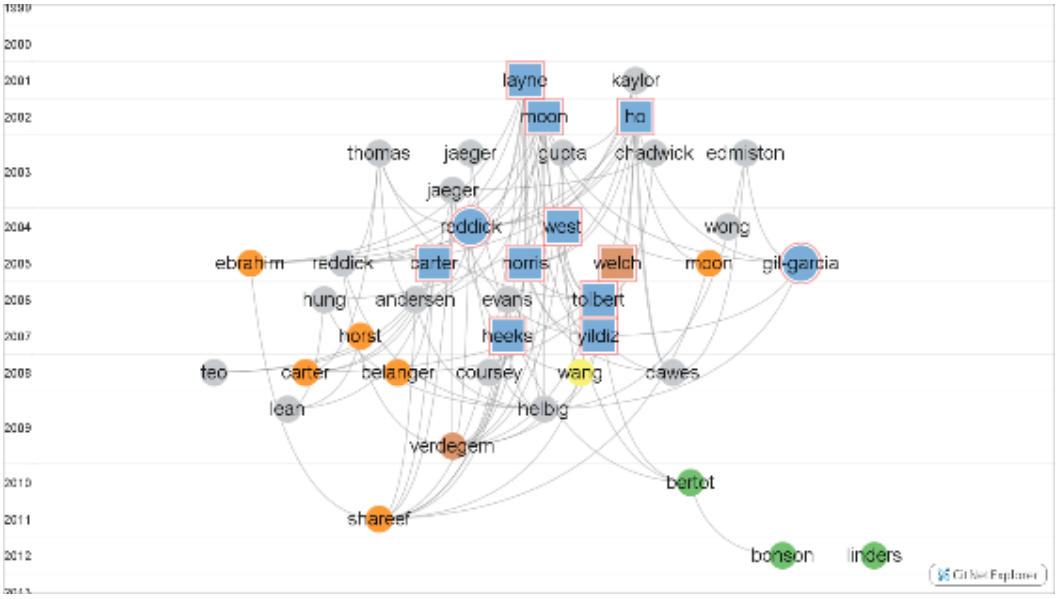


Evolution of Author's Citation Network

Regarding research question 2, we identify which are the ancestors and predecessors of authors publishing in each research area, and which are the links between the different research groups and schools that are created within the organizations. The timeline of authors based on citations is analyzed in CitNetExplorer software. The data shown is consistent with previously analyzed data (see Table 4).

In Figure 4, 5 and 6, we can see the full network with the top 10 publications surrounded by a square. The ones surrounded by a circle are intermediate publications, those are publications that are located on a citation path from one publication to another. Colors refer to different clusters created manually by filtering issues found in the publication title.

Fig. 4: Citation network with CitNetExplorer software in e-government.



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Fig. 5: Citation network with CitNetExplorer software in e-participation.

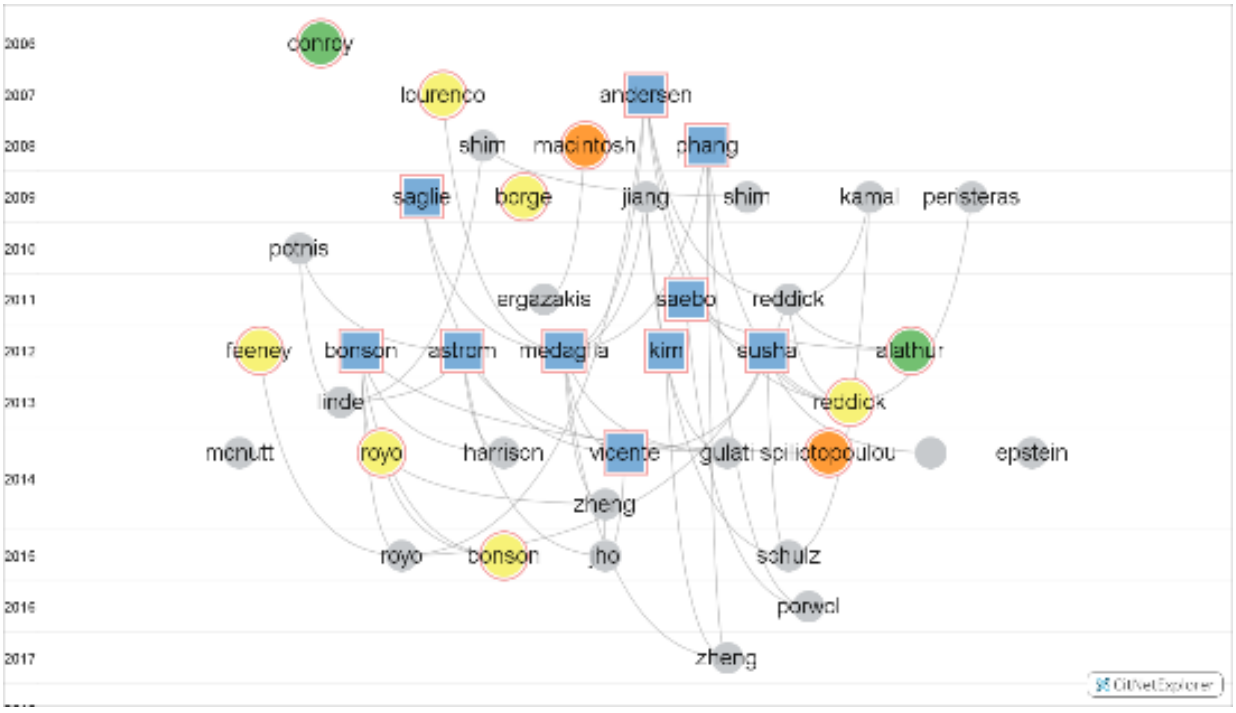
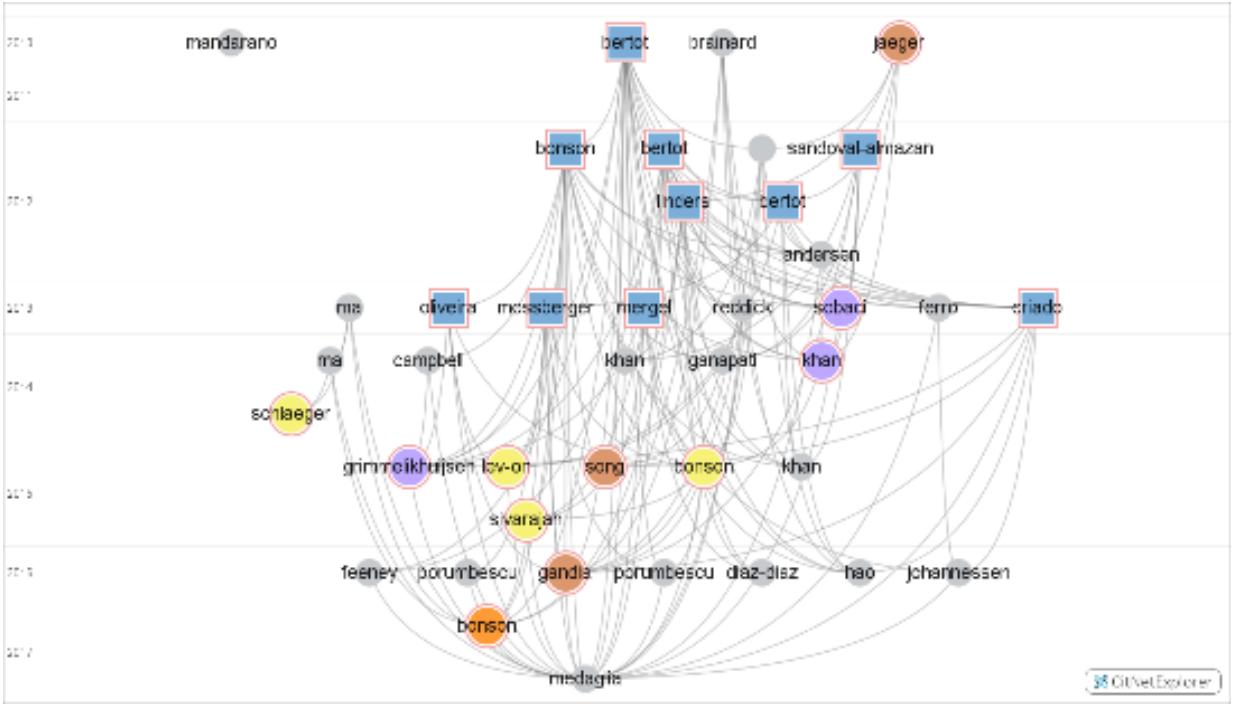


Fig. 6: Citation network with CitNetExplorer software in Social media related to e-government.



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Tab. 7: Top 10 authors by nº of articles.

E-government			E-participation			Social media and e-government		
Author	**Nº art***	**H-Index****	**Author**	**Nº art**	**H-Index**	**Author**	**Nº art**	**H-Index**
Weerakkody, Vishanth.	37	25	Royo, Sonia	7	12	Jaeger, Paul T.	7	29
Janssen, Marijn.	35	29	Aichholzer, Georg	6	5	Royo, Sonia	6	12
Dwivedi, Yogesh K.	32	52	Zheng, Yueping	5	7	Reddick, Christopher G.	6	20
Irani, Zahir.	25	42	Rodriguez Bolivar, Manuel Pedro	5	18	Bonson, Enrique	5	10
Reddick, Christopher G.	25	20	Oliveira, Tiago	4	23	Bertot, John Carlo	5	23
Jaeger, Paul T.	24	29	Sampaio, RC	4	3	Feeney, Mary K.	5	19
Bannister, Frank.	19	11	Yetano, Ana	4	9	Rodriguez Bolivar, Manuel Pedro	5	18
Bertot, John Carlo.	18	23	Lee, Jooho	4	7	Sandoval-Almazan, Rodrigo	4	7
Rodriguez Bolivar, Manuel Pedro.	18	18	Alcaide Munoz, Laura	4	0***	Ramon Gil-Garcia, J.	4	3
Rana, Nripendra P.	17	28	Vogt, S	4	22	Ingrams, A	4	5

**Nº of articles of the author in the database downloaded from WOS in each related topic. Consulted on February 2020*
***H. Index: of author according to author´s page in WOS consulted on July 2020*
****Author´s record on WOS shows 0 citations. In Google Scholar H-index is 17.*

We could expect that a group of authors who have strong citation relations over time are related because they confront a common topic. For example, in the e-government output, we find that the seminal reference is Layne, Moon, and Ho, while the most recent references are Bertot, Linders, and Bonson, being related and segregated from the central cluster. Those authors are clustered in the same group that deals with social media. According to e-participation, we found a concentration of authors around 2012, which is consistent with the analysis made previously about the evolution of publications in e-participation. Also, we detect a cluster of authors who published about e-democracy, composed of Bonson, Royo, Reddick, Feeney, Borge, and Lourenço. Related to social media, the first references appeared in 2010 that are similar to the cluster found in the e-government database, such as Bertot, Bonson, and Linders. We also observe that the latest author shown in this visualization is Medaglia in 2017, which is connected to most of the nodes of this network, as the document that is referred to is a bibliometric analysis of social media research. Also, there is a prominent group of authors publishing about local government and social media use concerning Facebook and microblogging.

Concerning the authors, researchers aimed to understand who the top 10 authors in this research field are, based on the number of articles published, instead of citations, within the database downloaded from WoS with the specification set previously. We made this analysis with the software SciMAT, by ordering the database by the number of articles (Table 7).

The analysis of the h-index parameter shows that e-government is the field where the authors held a higher level according to citation and publications, but between e-participation and social media, we found that the latter has a higher h-index on average (14.6) than a more established field such as e-participation (10.6). This demonstrates that social media is a topic that is relevant to researchers and that the researchers who publish in this field are more prolific and more cited. Also, the list demonstrates that there is a positive correlation between the number of papers published by an author in the research field and a higher h-index; and it also shows that the most prominent authors in the research field according to other software, such as Layne, Moon, Carter, Bertot, West, Ho, Moon, among others, are not the ones with more published articles (see Table 7 above).

Sustainable cooperation among actors and institutions in e-government, e-participation, and social media

In order to analyze the cooperation sustained among authors and institutions along the years, we used CitNetExplorer software. This tool is used to show the units analyzed, which is articles in our study, in a timeframe specified, and cluster the articles in different groups. The output is a citation network where we can pinpoint the core publications in the research field.

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Concerning e-government, there are three main clusters of authors who cite the same reference inside each group. We detect a strong relationship between Dwivedi, Rana, Shareef, and a related cluster between Weerakodi and Irani. Another cluster was formed by Reddick, Janssen, and Gupta (Figure 7). In the e-participation topic, there are two detectable clusters: one formed by Irani and Oliveira; another formed by Pirannejad and Chiabai, among others (Figure 8). In social media, there is a big citation cluster formed by Medaglia, Welch, Porumbescu, and Ingrams. Other related authors in terms of citations are Royo and Bonsón and in another cluster, Reddick, Anthopoulos, and Chatfield (Figure 9). Those actors tend to publish together, and in doing so, they share a common list of references. We could say that the mentioned authors are the research front of each research field analyzed.

Fig. 7: Bibliographic coupling author's visualization map on e-government (Weight: Total Link strength).

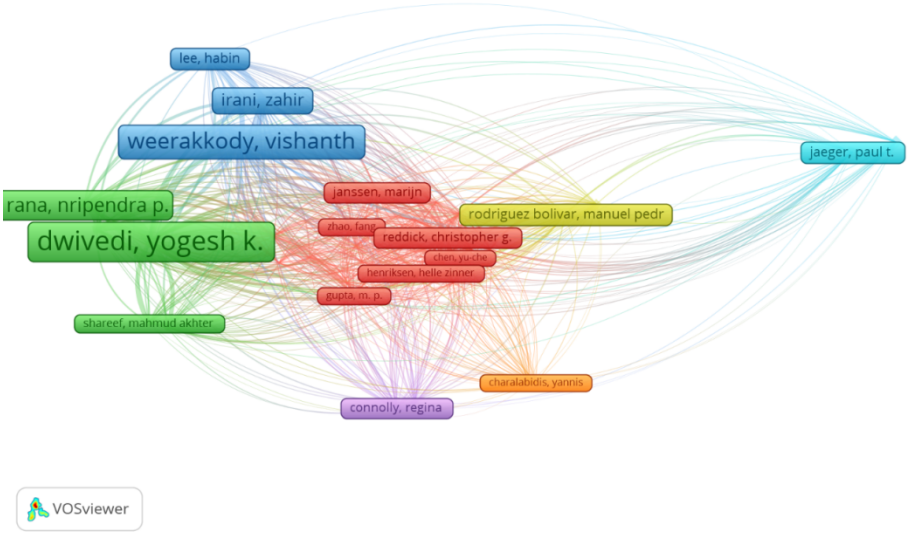
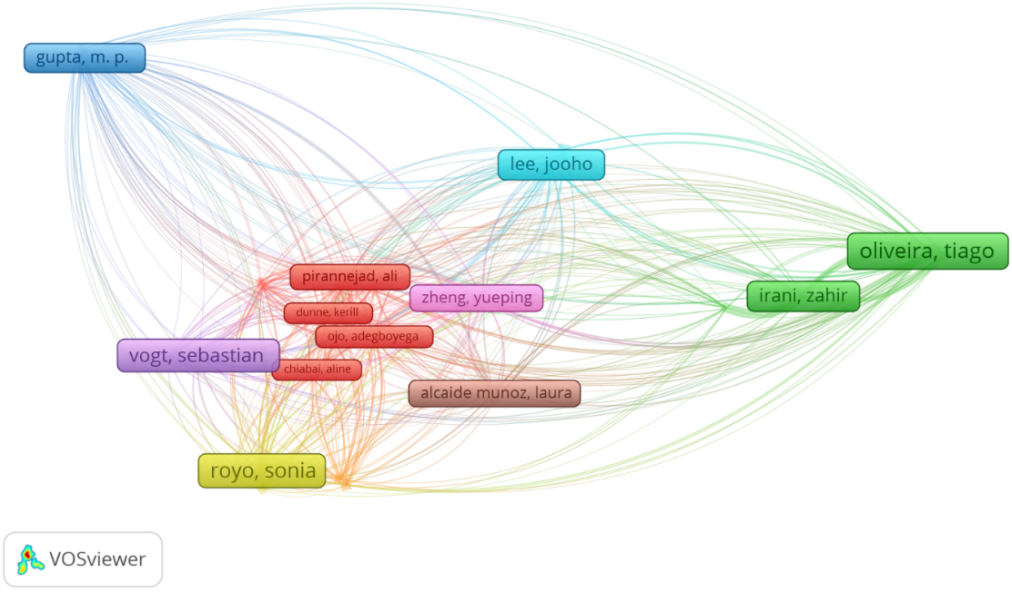


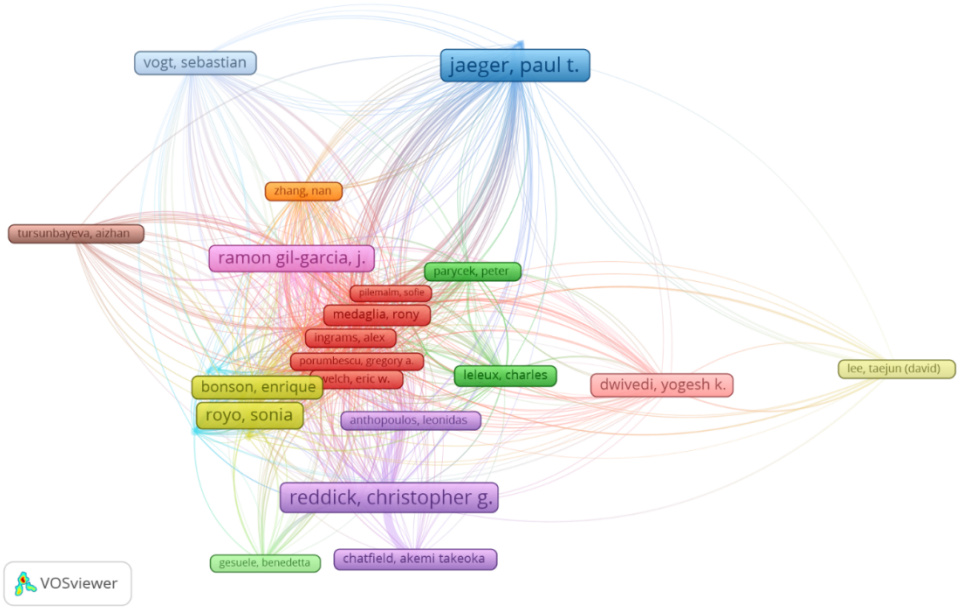
Fig. 8: Bibliographic coupling author's visualization map on e-participation (Weight: Total Link strength).



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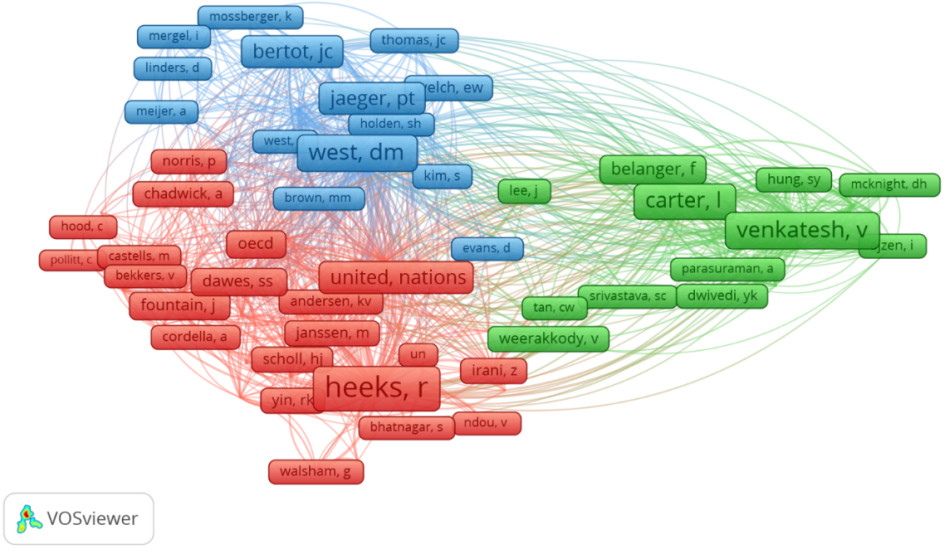
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Fig. 9: Bibliographic coupling author's visualization map on E-government and social media (Weight: Total Link strength).



In e-government, we see three main clusters that form the intellectual base of the discipline. Heeks chair the cluster in red. The cluster in blue by West and the cluster in green by Venkatesh (Figure 10). In e-participation, we observe four clusters without an apparent spearhead other than Macintosh in the green cluster, along with Medaglia and Phang. The yellow cluster is formed by United Nations, Norris and Moon, primarily. The blue cluster is formed by Bertot, Bonsón, and the European Commission, among others. The red cluster is formed by authors such as Chadwick and Astrom (Figure 11). Additionally, there are four defined clusters in social media, being the most detectable reference Bertot in the yellow cluster, along with Linders and Jaeger. In the blue cluster, we find Reddick, Janssen, and Belanger. Mergel, Criado, and Meijer form the green cluster. Last, in the red cluster, there are authors such as Mossberger, Tolbert, and Bannister (Figure 12).

Fig. 10: Co-citation authors visualization map on e-government. (Weight: Total Link strength).



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Fig. 11: Co-citation authors visualization map on e-participation. (Weight: Total Link strength).

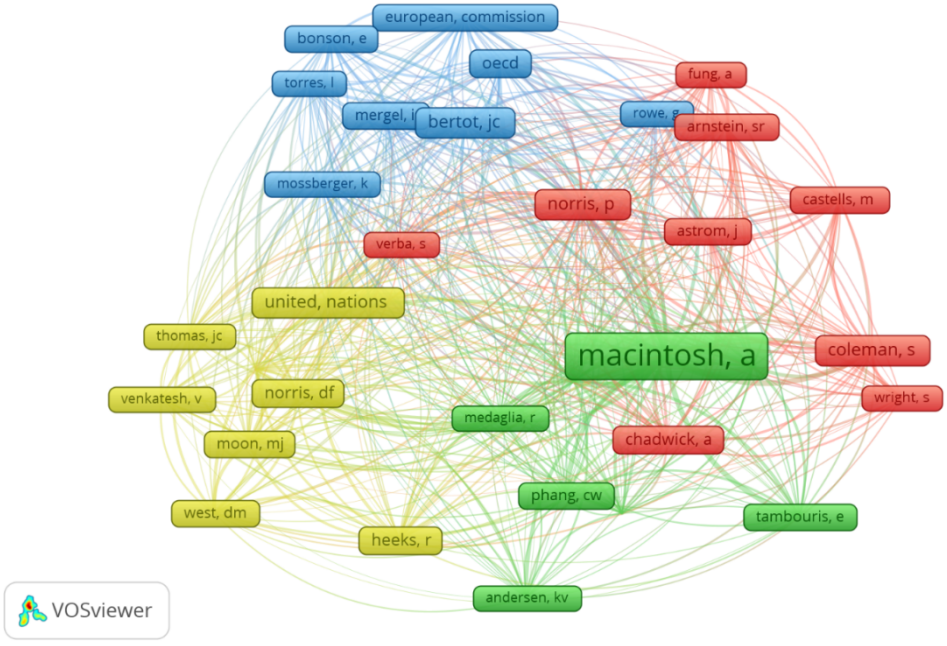
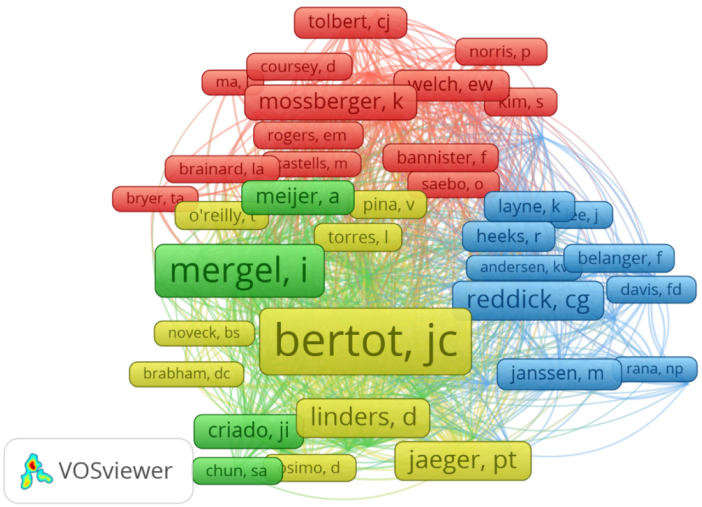


Fig. 12: Co-citation author's visualization map on e-government and social media. (Weight: Total Link strength).



As we saw, with this software tool, we can identify the groups of authors and the relevant ones within each group, according to the citation that other scholars in the discipline made. However, we have to remark that this software tool doesn't allow a longitudinal analysis of the author's citation relationships. While they inform about a cluster of authors who either cite a common reference or are cited together often, they do not allow us to see which is the source of that link and the citation path.

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Sustainable cooperation among organizations

Regarding research question 3, to analyze the top 10 organizations to which the authors of the papers in the discipline are affiliated, we used the information shown in the WoS database (Table 8).

Tab. 8: Top 10 organization affiliation of authors by nº of articles.

E-government		E-participation		Social media and e-government	
Organization	**Nº art**	**Organization**	**Nº art**	**Organization**	**Nº art**
Brunel University	87	University of Zaragoza	10	Arizona State University	9
Delft University of Technology	68	Brunel University	8	University System of Maryland	9
University of Maryland	52	University of Ljubljana	8	University of Maryland College Park	8
State University Of New York (Suny) Albany	50	State University Of New York (Suny) Albany	7	University of Texas At San Antonio Utsa	7
University Electronics Sci Technology China	48	University of Granada	7	University of Texas System	7
National University Singapore	46	Austrian Academy of Science	6	Centro De Investigación Y Docencia Económicas A C CIDE	6
University Twente	42	Orebro University	6	University of Zaragoza	6
Swansea University	43	University of California System	6	State University System of Florida	6
Universidad De Granada	42	Copenhagen Business School	5	University of Granada	6
Universidad Texas San Antonio	39	Fraunhofer Gesellschaft	5	State University Of New York (Suny) Albany	5

The organization, situated in number one of the top 10 in the three topics are Brunel University, University of Zaragoza, and Arizona State University, located in England, Spain, and USA, respectively. This is consistent with the analysis made about top authors, as Brunel University is the organization of Weerakkody and Sivarajah. The University of Zaragoza is the organizational affiliation of Torres, Royo, and Bonson. Arizona State University is the organization of authors such as Welch, Mossberger, and Wells. Brunel University ranked first and second positions respectively in e-government and e-participation. We also observe that the University of Granada (Rodriguez Bolivar, Alcaide Munoz) and State University of New York Suny Albany (Gil-Garcia; Sayogo) appear in the top 10 in the three topics, followed by the University of Zaragoza and University of Maryland (Norris, Bertot, Jaeger), which appears in the top 10 of e-participation and social media.

For journals, we dismissed proceeding papers and books for this list. We made this analysis with the software SciMAT (Table 9).

Given this data, articles on the topics of e-participation or social media are more likely to be published in Q1 or Q2 scientific reviews. Eighty percent of the top 10 reviews in these topics are from these categories, and specifically social media has four Q1 reviews in the top 10 shown above. Although, e-government held the reviews with the highest h-index (average of 47.4, 40.9, and 42.3 respectively), probably due to being researched for a longer period than the other two topics.

CONCLUSIONS

The objective of this article was twofold: on one hand, we discovered that the technology acceptance model (TAM) and the unified model of electronic government adoption (UMEGA) are motor conceptual themes within the area of e-government and these are strategic as publishing in these issues means a sure success. On the other hand, this research aimed to identify how authors, countries, journals, and organizations cooperate when publishing on e-government, e-participation, and social media. A review of previous literature through bibliometric analysis has shown that e-government is the core of the three disciplines and is the research topic that originates from the others. Over the years, new trends became more attractive for researchers, given citation and relevancy of sources and authors, such as e-participation, and more recently, social media related to e-government initiatives.

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Cent. Eur. J. Public Policy 2022; 16(2): 46–63
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Tab. 9: Top 10 journals by nº of articles.

E-government				E-participation				Social media and e-government			
Journal	**Nº art***	**H-index ****	**Q *****	**Journal**	**Nº art**	**H-index**	**Q**	**Journal**	**Nº art**	**H-index**	**Q**
Government Information Quarterly	290	94	Q1	Government Information Quarterly	28	94	Q1	Government Information Quarterly	45	94	Q1
International Journal of Electronic Government Research	164	28	Q2	Transforming Government-People Process and Policy	18	35	Q2	International Journal of Public Administration in The Digital Age	16	1	--
Transforming Government-People Process and Policy	126	35	Q2	International Journal of E Planning Research	17	4	Q2	Transforming Government-People Process and Policy	16	35	Q2
International Journal of Public Administration in The Digital Age	63	1	--	International Journal of Electronic Government Research	12	28	Q2	Public Management Review	9	60	Q1
International Journal of Public Administration	48	41	Q2	Journal of Information Technology Politics	9	37	Q2	Policy and Internet	6	20	Q1
Electronic Journal of Information Systems in Developing Countries	44	15	Q3	International Journal of Public Administration	8	41	Q2	International Journal of Electronic Government Research	6	28	Q2
International Journal of Information Management	34	99	Q1	International Journal of E Politics	8	-	--	International Journal of Public Sector Management	5	53	Q1
Public Administration Review	30	130	Q1	Policy and Internet	6	20	Q1	International Journal of Public Administration	4	41	Q2
Information Development	24	22	Q3	Public Management Review	5	60	Q1	Information Polity	4	34	Q2
International Journal of Advanced Computer Science and Applications	23	9	Q4	International Review of Administrative Sciences	4	49	Q4	Administration and Society	3	57	Q3

**The data has been obtained from the database downloaded in February 2020 in the Web of Science webpage and analysed with SciMAT Software.*
***The data about the journal´s H-index has been obtained in July 2020 from https://www.scimagojr.com/*
****The data about quartiles have been obtained in July 2020 from https://www.scimagojr.com/*

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To analyze the citation network, we used CitNetExplorer software. Bibliographic coupling (useful to understand the most relevant authors nowadays who are citing a common reference) showed that there is a central cluster of authors in each research field. In the e-government topic, it is formed by Reddick, Janssen, and Gupta. The e-participation topic is formed by Pirannejad and Chiabai. The social media cluster is formed by Medaglia, Welch, Porumbescu, and Ingrams. Co-citation analysis shows the footprint or intellectual base of a research front. Based on this issue, we determine the intellectual base of the three research fields, Heeks, Macintosh, and Bertot. To understand the evolution of the citation network, we used CitNetExplorer. We detect that in the e-participation topic, the latest authors cited are Fornell, Sandoval-Almaraz, Khan, Anderson, Teorel, and Asatryan, among others. In social media, the latest authors cited are Bagozzi, Weerakkody, Sivarajah, Shareef, Dwivedi, Bryson, Abu-Shanab, et al., and Al-Sharafi. Those would be the latest trending authors according to citations.

Regarding the leading authors, countries, organizations, and journals by the number of articles on e-government, e-participation, and social media, we used the data gathered in WoS database, and the results show that authors who publish on social media topics have higher levels of h-index. Countries and authors' organizations affiliations are mainly from USA and Spain. Finally, Government Information Quarterly is the first review in the three topics and e-participation or social media research topics are more likely to be published in Q1 or Q2 scientific reviews.

This research is limited by its quantitative approach to the analysis of the literature review. The authors not only admit such limitations but also believe that this approach is complementary and necessary to understand the future upfront of these research disciplines. Another limitation of CitNetExplorer is that it does not show which topics the authors are related to, so it is not easy to understand the citation relation among and within the clusters.

In future research opportunities, we would like to put the focus on the relevance of the structure, organization, and dynamics of research groups within academic organizations. It would be interesting to analyze the development of these three research topics related to the different research groups in each country, starting with e-government theories and ending with the more growing attention on the social media research related to public administration and citizens. Also, we believe the local government, as the closest public organization to the citizens, is a subject of research interest nowadays, as there is an area massively studied in business and private entities but not in the public administration studies.

FUNDING DETAILS

This work was supported by the [University Rey Juan Carlos] under Grant PREDOC20-015-1591

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