Analyzing the scientific evolution and impact of e-Participation research in JCR journals using science mapping

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ABSTRACT

This study presents a science mapping approach to analysing the thematic evolution of e-Participation research. We combine different bibliometric tools to analyse the evolution of the cognitive structure of this research topic, allowing us to discover the most prominent, productive and highest-impact subfields. In addition, we are able to identify thematic areas and show their evolutionary behaviour, supported by different visualization tools to show a graphical and dynamic vision of the e-Participation field. Findings indicate an increase in e-Participation research in the last five years, and the evolution of this field of knowledge to a more techno-social system in order to engage the citizenry in public sector management.

1. Introduction

Now a common trend around the world, Web 2.0 technologies have allowed citizens greater involvement in public affairs (Sivarajah, Irani, & Weeerakkody, 2015) and their use by governments has created more affordable, participatory and transparent public sector management models (Kim & Lee, 2012). These technologies are forcing a re-consideration of the administrative structures of governments and the fostering of open, user-driven governance (Bertot, Jaeger, & Grimes, 2010) and have emphasized the idea of citizen engagement and participation in public affairs (Mintz, 2008).

Thus, in recent years, research in the e-Participation field has experienced continued growth, stimulated by increasing attention from both practitioners and academics/researchers (Medaglia, 2012; Susha & Grönlund, 2012). This growing body of literature has confirmed the interdisciplinary field of knowledge of e-Participation research (Medaglia, 2012; Freschi et al., 2009), comprising a large number of academic disciplines and existing in a complex social and political environment (Macintosh, Coleman, & Schneeberger, 2009). In other words, research in the field of e-Participation is fragmented, so it is impossible to obtain a single point from which to access this research topic, due to the large diversity of research disciplines involved.

This problem does not enable a broad view of the research area or the evolution of the topics in this field to be known, which makes it difficult to provide useful and non-biased insights for future research. Comprehensive reviews are therefore needed to integrate contributions and to provide a critical outlook in this field. Therefore, it is of utmost importance to explore its intellectual core in order to understand the construction of theoretical support underpinning the question of e-Participation, by analysing the cumulative body of knowledge (Holsapple, 2008; Medaglia, 2012).

In the academic literature we can find previous studies on e-Participation based on using different approaches, frameworks and techniques (Medaglia, 2012; Susha & Grönlund, 2012; or Molka-Danielsen, 2010a,b; for example). Although valuable, most bibliometric projects (Freschi et al., 2009; Macintosh et al., 2009; Rodríguez Bolívar, Alcaide Muñoz, & López Hernández, 2012; Susha & Grönlund, 2012;) show a limited view and could lose the interesting lens of e-Participation research in terms of citizen engagement and e-democracy, which have been studied from several approaches. They also do not provide the possibility of looking at the evolution of this research field.

In fact, although Medaglia (2012) has carried out a systematic effort to understand the directions that the field of e-Participation is taking in its development over time, this study has many limitations that need to be addressed. In addition, prior research has not carried out a performance analysis in order to measure, quantitatively and qualitatively, the contribution of the e-Participation field, which limits its significance for analysis and future research.

Thus, it is necessary to use performance analysis and science mapping in order to deal directly with sets of terms shared by documents, mapping the literature directly from the interaction of key terms, and showing the evolution of the field of e-Participation. In this context, the science mapping approach displays the structural and dynamic aspect of scientific research (Cobo, López-Herrera, Herrera-Viedma, &

Herrera,2011), and is a spatial representation of how disciplines, fields, specialities and individual papers or authors are related to one another (Small, 1999). It is focused on monitoring a scientific field and delimiting research areas to determine its cognitive structure and its evolution (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011b) through measuring continuance across consecutive sub-periods and to quantify the research field by means of performance analysis (Cobo et al., 2011a,2011b). This longitudinal study based on co-words allows us to analyse the evolution of research topics, and a longitudinal study based on co-citations allows us to analyse the continuity of the intellectual base. In addition, it detects the most prominent, productive and highest-impact subfields (Cobo et al., 2011a).

Therefore, this paper seeks to perform co-word and performance analyses with the aim of examining the concept's evolution and the impact of the research themes of the e-Participation field of knowledge. To achieve this aim, this article presents a general approach to analysing the thematic evolution of the e-Participation research field. This approach combines performance analysis of science mapping for detecting and visualizing conceptual subdomains with a methodological tool performed by Cobo et al. (2011a,b) to achieve this. It allows us to quantify and visualize the thematic evolution of this research topic, as well as to update the state of the art of scientific literature on e-Participation.

2. Towards e-Participation as a public management model

During the last decades, governments have made huge efforts to promote participation, offering platforms in order to improve the efficiency, acceptance and legitimacy of political processes (Susha & Grönlund, 2014), which could favour openness and connect the public with the elected representatives (Freschi et al., 2009).

Thus, the citizenship could access rich information and, with their feedback on public services, get involved in shaping these services' integrated systems (Hu, Pan, Lin, Kang, & Best, 2014), while interaction with public managers and politicians and their participation in the decision-making process is easier (Nielsen & Pedersen, 2014; Saebo et al., 2010a,b). These efforts have improved trust in government (Kim & Lee, 2012).

So, many governmental organizations around the world have adopted platforms, applications and tools to promote an informed citizenry vis-à-vis voting decisions and improved information transparency (Saebo et al., 2010a,b), trying to achieve an increase in public confidence in government (Kim & Lee, 2012), monitoring the behaviour of public managers and politicians (Hui & Hayllar, 2010) and promoting the democratic process by offering debate and discussion on important issues of public concern.

These debates and discussions have been more participative and flexible with the use of online tools such as social media, which enable and promote social interactions (Hansen, Shneiderman, & Smith, 2011). Social media allow citizens to present their ideas without being subject to the controlling and/or corrupting influence of money and politics (Benkler, 2006). In addition, elected politicians and candidates also see social media and Web 2.0 tools as an opportunity to communicate with the public, giving citizens a more active advisory role in public affairs (Hui & Hayllar, 2010; Vaccari, 2013).

On the other hand, e-Participation also favours interaction among the civil society, the public managers and the formal political spheres in order to create or promulgate laws and regulations (Epstein, Newhart, & Vernon, 2014). In this case, there are systems and applications that enable and enhance the formal procedure of voting (Peng, 2013). These sophisticated voting machines offer a lot of advantages (Crothers, 2015), although previous research has highlighted security problems, which reduce the trust in them and increase citizen apathy (Vassil & Weber, 2011). As a result, governments have made significant investment in developing robust and secure systems that reduce their vulnerability to unwavering attacks from hackers.

Together with the above-mentioned issues, over the years the new means of e-Participation have generated and reinforced new forms of inequality and exclusion. Significant barriers, such as access, design, personal capacity, trust, skills, willingness and awareness can create obstacles for the very people who could contribute input to public affairs (Parvez, 2006). Therefore, these impediments also play a part in limiting the role of e-Participation and in moderating its implication in the democratic process (Vassil & Weber, 2011).

3. Method and data collection

This paper uses SciMAT (http://sci2s.ugr.es/scimat), which is a powerful science mapping software tool that has been applied to other areas such as computer science, psychology, marketing and/or management, with the aim of analysing the progress of a specific research topic's evolution to help track the emergence of the knowledge field and predict its future trends (DeSmet et al., 2016; Zhang, Wang, Ordóñez, Tang, & Yan, 2015).

This tool incorporates methods, algorithms and measures for all the steps in the general science mapping workflow, from preprocessing to the visualization of the results (Cobo et al., 2011b, 2012). It was designed according to the science mapping analysis approach, which combines both performance analysis tools and science mapping tools to analyse a research field and to detect and visualize its conceptual subdomains (particular topics/themes or general thematic areas) and its thematic evolution in a longitudinal framework (Cobo et al., 2011a). It is based on a co-word analysis (Callon, Courtial, Turner, & Bauin, 1983) and the h-index (Hirsch, 2005).

To achieve this aim, this software tool performs a science mapping analysis approach that has differents steps: data retrieval, data preprocessing, network extraction, network normalization, mapping, analysis and visualization (Cobo et al., 2011b) (see Fig. 1).

In our study, we used the ISI Web of Science (ISIWoS) database (http://www.webofknowledge.com) to retrieve the data and we carried out an advanced search with keywords related to e-Participation (Saebo, Rose, & Flak, 2008; Sanford & Rose, 2007; Susha & Grönlund, 2012), taking into account the interdisciplinary character of this field of knowledge (Macintosh et al., 2009; Medaglia, 2012) (see Table 1). Then, we conducted a preprocessing process in order to detect duplicate and misspelled items, time slicing, data reduction and network reduction.

Once the data have been preprocessed, a network extraction phase was conducted where a network is built using descriptive keywords. In this phase, we established a direct linkage, which is a relationship between documents and references (citation relation). Next, these relationships are represented in strategic graphs and evolution graphs.

Later, we carried out a co-word analysis (Callon et al., 1983), which can be performed to show the conceptual structure and the main concepts dealt with by field. At this point, it is necessary to conduct a normalization process to build the network of relationships, which uses different mesasures, with the Salton's Cosine (Salton & McGill, 1983) and the Jaccard indexes (Peters & van Raan, 1983) being the most popular ones.

Once the normalization process was finished, we used the principal component analysis and clustering algorithms to build the science map (Chen & Redner, 2010; Coulter, Monarch, & Konda, 1998). Finally, we performed analysis methods that allowed us to discover useful knowledge from the data, networks and maps in a three-stage process to analyse the research field in a longitudinal framework (Cobo et al., 2011b):

1. *Detection of the research themes*. In each period studied, the corresponding research themes are detected by applying the simple centres algorithm (Coulter et al., 1998) to a normalized co-word network.
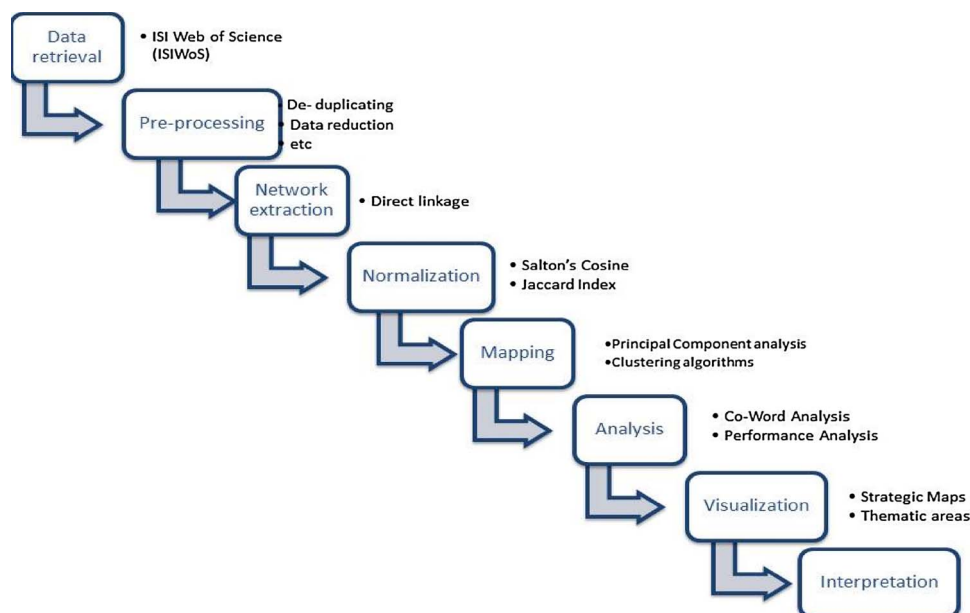2. *Visualizing research themes and thematic network*. The detected

Fig. 1. Workflow of science mapping.

themes are visualised by means of two different visualization instruments: strategic diagram (He, 1999) and thematic network. Each theme can be characterized by two measures (Callon, Courtial, & Laville, 1991): *centrality* and *density*– Table 2. These measures are useful to categorize the detected clusters of a given period in a strategic diagram (Cobo et al., 2011a). Given both measurements, a research field can be visualised as a set of research themes, mapped in a two-dimensional strategic diagram and classified into four groups:

a Themes in the upper-right quadrant are both well developed and important for the structuring of a research field. They are known as the *motor-themes* of the speciality, given that they present strong centrality and high density.
b Themes in the upper-left quadrant have well-developed internal ties but unimportant external ties and as such they are of only marginal importance to the field. These themes are very *specialized and peripheral*.
c Themes in the lower-left quadrant are both weakly developed and marginal. The themes in this quadrant have low density and low centrality and mainly represent either *emerging* or *disappearing* themes.
d Themes in the lower-right quadrant are important for a research field but are not developed. This quadrant contains *transversal and general*, basic themes.

3 Performance analysis

In this phase, the relative contribution of research themes and thematic areas to the whole research field is measured and used to establish the most prominent, most productive and highest-impact subfields, by means of bibliometric indicators, such as number of published documents, number of citations, or different types of h-index (Hirsch, 2005).

Following the science mapping workflow, the visualization techniques were used to create a science map and the results of the different analyses. This paper obtained the science map and the performance analysis of the e-Participation research, which are examined in the next section of this paper.

4. Analysis of results

The use of new technologies to promote citizen participation in digital governance and the transformation of digital government information and services have attracted the attention of the academic community, as evidenced by the proliferation of an increasing number of research contributions (see Fig. 2) – 1026 articles published. In the past five years in particular, e-Participation initiatives at all levels of government have begun to consolidate, with 442 articles published, representing 43.08% of all articles published since 2000.

4.1. Visualizing the state of the art on e-Participation

In order to analyse the most highlighted themes of the e-Participation field for the 2000–2015 period, a strategic diagram – see Fig. 3 – offers information about the number of published documents (core documents + secondary documents) associated with each theme. This analysis is made for the whole research period to give a comprehensive view of the main and relevant themes on e-Participation research.

In Fig. 3, we can observe that the main contributions on e-Participation are focused on citizens (E-GOVERNMENT and WEB). They are motor themes, well developed and important for the structuring of the e-Participation field. These studies are focused on how the e-Participation platforms favour e-inclusion, e-services, and openness, providing rich information and facilitating the interaction between citizens and public managers that increases the transparency of decision-making (Gunawong, 2015).

In addition, we can observe that ACCOUNTABILITY and GROUP-DECISION-MAKING are marginal importance themes, with little impact and unimportant external ties. These contributions are focused on the direct link between participation and the political decision-making process (Nielsen & Pedersen, 2014), through the design of digital platforms to favour greater transparency of public information (Harrison & Sayogo, 2014), and to enable, enhance and guide decision-making. Nevertheless, they can be categorized as generic and broadly encompassing (Medaglia, 2012) or as being for specific decision-making purposes (Boukhris, Ayachi, Elouedi, Mellouli, & Amor, 2015), hence their reduced importance.

Other relevant research topics in e-Participation are PROTOCOL and SIGNATURES – see Fig. 3. These research themes are related to privacy

Table 1
Characteristics of advance research and query.

Keywords	Subjects
e-Participation – e-Part – Electronic Participation	Business – Communication – Economics
e-Democracy – Electronic Democracy	Computer Science Artificial Intelligence
e-Governance – Electronic Governance	Computer Science Cybernetics
e-Campaigning – Electronic Campaigning	Computer Science Hardware Architecture
e-Community – Electronic Community	Computer Science Information Systems
e-Consultation – Electronic Consultation	Computer Science Interdisciplinary Applications
e-Decision making – Electronic Decision Making	Computer Science Software Engineering
e-Polling – Electronic Polling	Computer Science Theory Methods
e-Rulemaking – Electronic Rulemaking	Engineering Electrical Electronic
e-Voting – Electronic Voting	Information Science and Library Science
	International Relations
	Law – Management
	Operations Research Management Science
	Planning Development
	Political Science – Public Administration
	Social Issues – Social Sciences
	Interdisciplinary
	Telecommunications

TS = ("e-participation" OR "e-democracy" OR "e-governance" OR "e-campaigning" OR "e-community" OR "e-consultation" OR "e-decision making" OR "e-polling" OR "e-rulemaking" OR "e-voting" OR "electronic-participation" OR "electronic-democracy" OR "electronic-governance" OR "electronic-campaigning" OR "electronic-community" OR "electronic-consultation" OR "electronic-Decision making" OR "electronic-polling" OR "electronic-rulemaking" OR "electronic-voting" OR "e-Part") AND WC = ("BUSINESS" OR "COMMUNICATION" OR "COMPUTER SCIENCE ARTIFICIAL INTELLIGENCE" OR "COMPUTER SCIENCE CYBERNETICS" OR "COMPUTER SCIENCE HARDWARE ARCHITECTURE" OR "COMPUTER SCIENCE INFORMATION SYSTEMS" OR "COMPUTER SCIENCE INTERDISCIPLINARY APPLICATIONS" OR "COMPUTER SCIENCE SOFTWARE ENGINEERING" OR "COMPUTER SCIENCE THEORY METHODS" OR "ECONOMICS" OR "ENGINEERING ELECTRICAL ELECTRONIC" OR "INFORMATION SCIENCE LIBRARY SCIENCE" OR "INTERNATIONAL RELATIONS" OR "LAW" OR "MANAGEMENT" OR "OPERATIONS RESEARCH MANAGEMENT SCIENCE" OR "PLANNING DEVELOPMENT" OR "POLITICAL SCIENCE" OR "PUBLIC ADMINISTRATION" OR "SOCIAL ISSUES" OR "SOCIAL SCIENCES INTERDISCIPLINARY" OR "SOCIOLOGY" OR "TELECOMMUNICATIONS") AND PY = 2000–2015
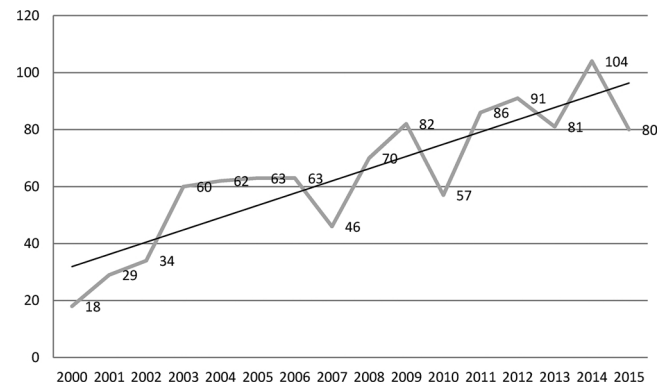
Source: Own elaboration.

Fig. 2. Time sequence for articles on e-Participation (2000–2015).

2013), the limitations of traditional systems (Crothers, 2015) and the need to increase security (Peng, 2013; Vassil & Weber, 2011). Furthermore, there exists a concern about the trust that citizens have in e-Voting machines (Carter & Campbell, 2012). Hence, TRUST and PARTICIPATION are research themes that are very important for the development of e-Participation, but they are not developed – see Fig. 3.

Closely related to the above topics, PRESIDENTIAL-ELECTION is a well-developed research theme but it is very specialized and peripheral. Studies on this topic analysed the growing use of the Internet to campaign and win elections (Vaccari, 2013). The use of the Internet and social media to obtain political news and share political information is widespread (Carter & Campbell, 2012). These tools are used by politicians to win the elections and to learn the citizens' opinions (Gil de Zúñiga, Jung, & Valenzuela, 2012), but they do not foster citizen involvement in decision-making (Andersen & Medaglia, 2009).

Together with the above research topic, there is another one (E-RULEMAKING) that is very specialized – see Fig. 3. Indeed, there are few studies about the participation of citizenry in the political process in order to create or promulgate laws and regulations. Nevertheless, the debate has been opening up, while the Internet may favour a new era of a more inclusive and deliberative democracy model, or conversely, it may be just as likely to reinforce existing inequalities (Epstein et al., 2014; Shulman, 2005).

On the other hand, there is a weakly developed and marginal theme, which is becoming of growing importance in the area of future research gaps, namely RIGHTS. In this regard, studies analyse how Web tools and social media are changing the way of democracy and favouring civic engagement. These technologies and platforms are getting the citizenry involved in public affairs in order to assert its rights (Karakaya Polat & Pratchett, 2014).

However, previous literature believes that technology is necessary, but not sufficient, for effective online civic engagement (Epstein et al., 2014). Moreover, it requires the reorganization of government with flatter and flexible hierarchies of more creative, cooperative and interactive officials (Dawes, 2008). Thus, many contributions have focused on the DIGITAL DIVIDE, and how it is useful to analyse disparities in online civic engagement. This is important for the e-Government field although it is not developed.

According to Medaglia (2012), little attention has been paid to

and security, assessing the security of e-Participation sites to identify opportunities for and threats to the sites and their users (Vassil & Weber, 2011). Similarly, we can find other words related to security, such as RANDOM-ORACLE and SECRET, but these research themes are weakly developed and marginal, considering and considered to be emerging or gaps in e-Participation themes.

In addition, we can observe that e-Voting activities (VOTER, NETWORK and MIX-NETWORK) are key research themes. In this case, academics analysed activities, platforms and tools to enable and enhance the formal procedure of voting (Peng, 2013). These contributions deal with the outcomes of these sophisticated voting systems (Peng,

Table 2
Centrality and Density Measures.

CALLON'S MEASURES	DEFINITION
Centrality c = 10 * Σe_{uv} with u an item belonging to the cluster and v an item belonging to the other clusters.	he degree of interaction of a network with other networks, and it can be understood as the external cohesion of the network.
Density d = $100\frac{\Sigma e_{ij}}{n}$ with i and j items belonging to the cluster and n the number of items in the theme.	The internal strength of the network, and it can be understood as the internal cohesion of the network.

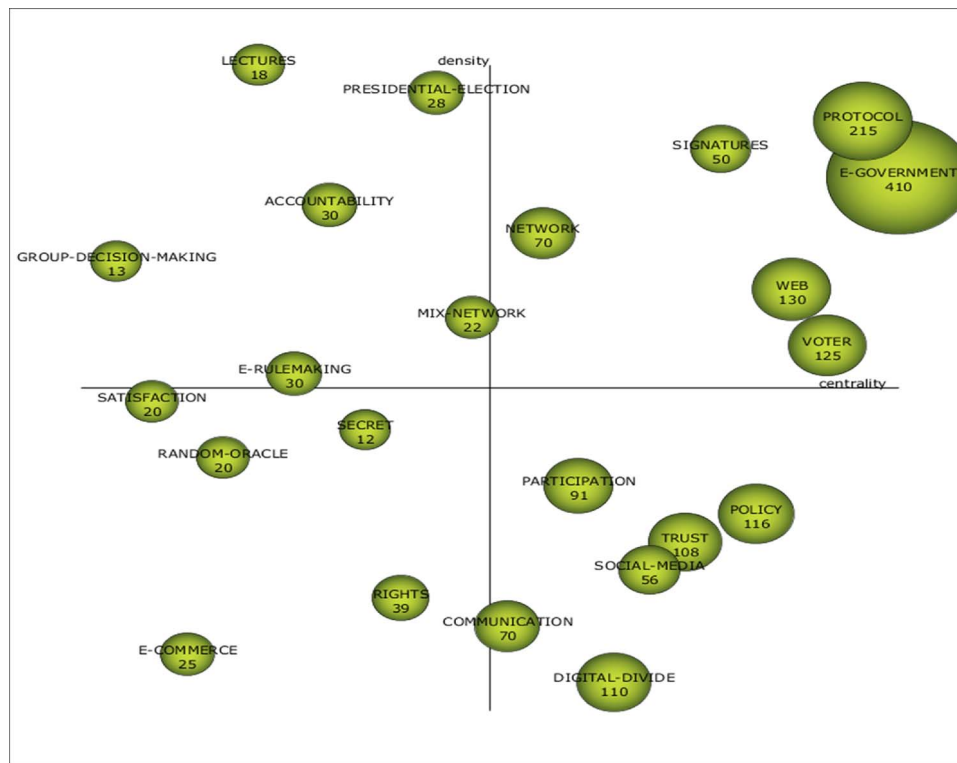Source: Own elaboration based on Callon et al. (1991).

Fig. 3. Strategic diagram from the period 2000–2015.

analysing Web 2.0 tools, despite their potential for enabling citizen participation in the policy-making process (Skoric, Zhu, Goh, & Pang, 2015). Hence, SOCIAL-MEDIA is an important theme for the e-Participation field and a research gap to be addressed in the future. However, research has provided pessimistic proof of social media's presumed revolutionary impact (Reddick & Norris, 2013). It is necessary, therefore, to analyse the usefulness of disclosing greater volumes of information to a wider range of citizens and facilitating the decision-making process, and how citizenry can influence and participate in the co-producing of initiatives on public online services.

4.2. Visualizing the dynamic view on e-Participation research

In this section, we examine the evolution of the most relevant themes on e-Participation research during two periods of time (2000–2008 and 2009–2015) – see Table 3 and Figs. 4 and 5. The reason for splitting the whole research period into these years is that the widespread use of the Internet for political communication and participation accelerated during the 2008 presidential campaign partly due to President Obama's tech-savvy campaign advisors (Hendricks & Denton, 2010).

According to Table 2, research studies can be identified into four groups according to their topics: citizen participation; electronic government; technical aspects of new technologies used; and general terms in the use of new technologies. The first group includes all research that deals with two different issues: political participation (COMMUNITIES, E-DEMOCRACY, ELECTIONS, POLICY, VOTING, RIGHTS, RULE-MAKING and E-DECISION-MAKING) and citizen engagement in public sector management (SOCIAL MEDIA and PUBLIC PARTICIPATION) (*techno-social focus*).

The second group is about electronic government and it is about the use of new technologies for improving transparency (ACCOUNTABIL-ITY/TRANSPARENCY) and to produce public sector services (E-GOVERNMENT) (*instrumental focus*). The third group is about the technical aspects of new technologies with the aim of understanding the evolution of new technologies, which reflects the worries of the

citizenry in terms having trust in using e-services (*technological focus*). Finally, the fourth group of research is about 'general terms', which includes ways of interacting with citizens (ONLINE and NETWORK) and subjective issues regarding new technologies (ATTITUDES and DIGITAL-DIVIDE) (*contextual focus*).

Regarding citizen participation (*techno-social focus*), in the bulk of the literature e-Participation research shows a clear trend of political participation in the first sub-period analysed (2000–2008) (404 documents) and a large decrease in this research in the second sub-period analysed (2009–2015) (247 documents) – see Table 3. This represents the clear evolution of the introduction of new technologies into the public sector area (we can observe this evolution in Fig. 6), which has great relevance to the political use of new technologies, hence, ELEC-TIONS, E-VOTING and DEMOCRACY are important themes for the e-Participation research field but are not developed, being emerging research gaps – see Fig. 5.

In addition, this relevance has moved towards social and citizen participation in public sector management in the more recent years (2009–2015). Citizens are increasingly demanding participation in public sector management and policies (there is a strong connexion with POLICY and PUBLIC PARTICIPATION in Fig. 6), pressuring public administrations to make available technological tools for improving access to information and participation in public sector management (there are links between ATTITUDES, E-DEMOCRACY and ONLINE with SOCIAL MEDIA in Fig. 6).

On the other hand, results indicate that citizens are requiring public administrations to introduce electronic means aimed at improving government transparency and services delivery – *instrumental focus* – (there is a strong connexion between E-GOVERNMENT and ACCOUN-TABILITY in Fig. 6). This way, nowadays, E-GOVERNMENT (16 h-Index) has become a main issue in the political area, and is important for the structuring of the e-Participation field – see Table 3 and Fig. 5.

The third group of research (*technological focus*) shows the evolution in technical issues regarding the use of technologies by citizens. As shown in Table 3 in the Annex and Fig. 4, public administrations focused their efforts on the privacy and security items (SIGNATURES – 11

Table 3
Performance measures for the themes in each subperiod.

Research Topics		Subperiod 2000–2008				Subperiod 2009–2015			
		Number of documents	Number of citations	Average of citations	h-Index	Number of documents	Number of citations	Average of citations	h-Index
CITIZEN PARTICIPATION	POLITICAL PARTICIPATION								
	COMMUNITIES	46	90	1.96	5	–	–	–	–
	E-DEMOCRACY	64	628	9.81	14	108	545	5.05	14
	ELECTIONS	14	67	4.79	6	44	183	4.16	8
	POLICY	116	480	4.13	13	–	–	–	–
	VOTING	146	320	2.19	11	76	287	3.78	7
	RIGHTS	–	–	–	–	9	53	5.89	3
	RULEMAKING	12	17	1.42	2	10	17	1.7	3
	E-DECISION-MAKING	6	59	9.83	4	–	–	–	–
	CITIZEN ENGAGEMENT IN PUBLIC SECTOR MANAGEMENT								
	SOCIAL MEDIA	–	–	–	–	59	437	7.41	11
	PUBLIC-PARTICIPATION	–	–	–	–	26	97	3.73	7
ELECTRONIC GOVERNMENT	ACCOUNTABILITY/ TRANSPARENCY	–	–	–	–	19	129	6.79	6
	E-GOVERNMENT	126	803	6.37	16	187	854	4.56	16
TECHNICAL ASPECTS	BATCH-VERIFICATION	–	–	–	–	3	4	1.33	1
	CONFIDENCE	13	22	1.69	3	–	–	–	–
	SIGNATURES	61	190	3.11	11				
	ENCRYPTION	26	42	1.62	3	–	–	–	–
	PRIVACY	82	276	3.36	11	–	–	–	
	PROTOCOL	–	–	–	–	29	54	1.86	5
	TRUST	–	–	–	–	30	190	6.33	7
GENERAL TERMS	ATTITUDES	4	7	1.75	1	–	–	–	–
	DIGITAL-DIVIDE	–	–	–	–	31	171	5.52	7
	NETWORK	–	–	–	–	16	39	2.44	4
	ONLINE	132	576	4.36	15	–	–	–	–

Source: SciMAT.

h-Index and PRIVACY – 11 h-Index).

Studies focused their goals on analysing the different problems of hacking identities, the vulnerability of electronic signatures, showing the technological advantages that try to ensure privacy (Shao, 2005), as well as on the development of robust and secure systems against attacks (this behaviour can be observed in the link between BLIND-SIGNATURE and E-VOTING in Fig. 6). Later, in the second sub-period, it was time to improve interoperability with protocols and batch-verification, which

can have a great effect on trust in electronic government (TRUST – 7 h-Index and PROTOCOL – 5 h-Index) (there is a strong connexion between CONFIDENCE and TRUST, and also between PRIVACY and PROTOCOL in Fig. 6), which are very important motor themes for the structuring of this field of knowledge – see Fig. 5.

Finally, regarding the general terms (contextual focus), results show two main findings. On the one hand, the attitude of citizens towards using new technologies to be in contact with the government has been
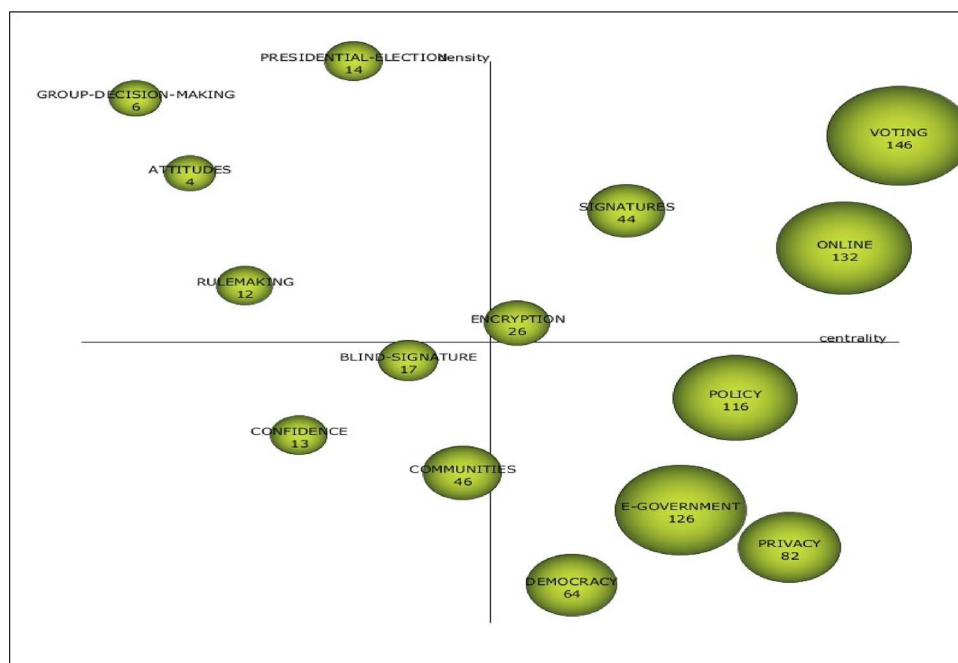

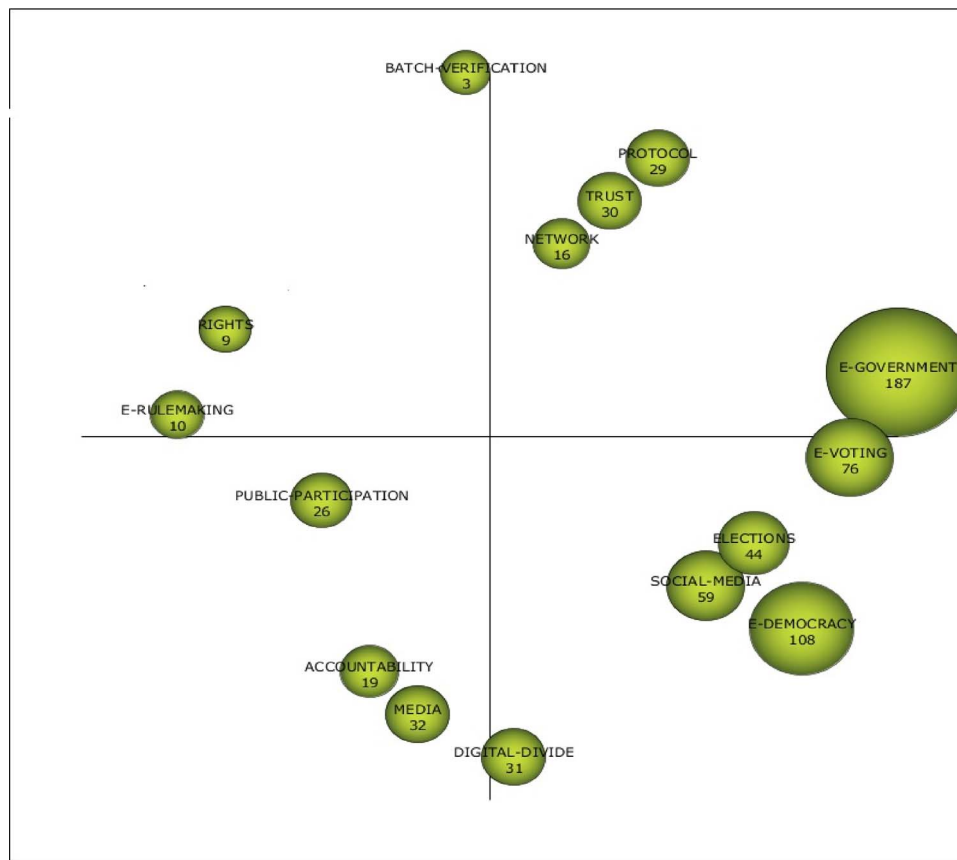**Fig. 4.** Strategic diagram from the subperiod 2000–2008.

Fig. 5. Strategic diagram from the subperiod 2009–2015.

solved in the second sub-period of time. Now there is no problem with citizens' attitude of towards using the technologies. By contrast, the problem remaining to be solved is focused on citizens' facility to access transparency and e-services on the Web, which could limit the possibility of using new technologies to receive these services (there are links between E-DEMOCRACY, PRIVACY, and E-GOVERNMENT with DIGITAL-DIVIDE in Fig. 6). These are not well-developed themes and are gaps to be addressed by future research – see Fig. 5.

5. Conclusions

This performance analysis has highlighted the growing body of knowledge on e-Participation, reflecting a gradual increase in the number of studies published in international journals since 2000, especially in the last five years. In addition, these articles deal mainly with e-Participation and the political sphere, accountability and transparency information, and technical aspects related to security and privacy. Likewise, our findings have confirmed the interdisciplinarity of the field.

Regarding political participation, the studies are focused on how the e-Participation platforms facilitate interaction between citizens and public managers, which increases the transparency of decision-making, and how there exist tools, means and systems to enable and enhance the formal procedure of voting (Peng, 2013). Likewise, politicians are using the Internet and social media tools to campaign and win elections (Vaccari, 2013). These sophisticated forms of new media have attracted the interest of the academic community, which has focused on the use of such technology to re-engage people with the democratic process.

On the other hand, the results indicate that citizens demand new tools and means with the aim of improving government transparency and accountability. Hence, the researchers have tried to analyse the direct link between participation and the political decision-making

process. However, there is still an apparent lack of adequate tools in which public deliberation and decision-making can take place. Nowadays there are still only good intentions about putting this into practice (Hansson, Belkacem, & Ekenberg, 2015).

In any case, the widespread availability of new means and channels to favour e-Participation, require security and privacy guarantees in their use. These topics were dealt with in the past and seem to be solved. Currently, the academic researchers are mainly focused on improving interoperability with protocols and batch-verification that can have a great effect on trust in electronic government.

On the other hand, previous literature believes that technology is necessary, but not sufficient, for effective online civic engagement (Epstein et al., 2014). Thus, many contributions focused on the DIGITAL DIVIDE, exploring the relationship between e-inclusion research and e-Participation and how they can benefit each other. In other words, the problem that remains to be solved is focused on the possibility of citizens being able to access transparency and e-services on the Web, which could limit the possibility of using new technologies to receive these services.

In fact, e-Participation research shows a clear transformation in the methods of interaction with citizens – see Table 2. E-government initiatives over the past decade have been based mainly on first-generation Web-based resources (including websites, pages and services), which were based on HTML, a relatively primitive, static page mark-up technology that simply outlines what a page should look like onscreen (first sub-period of research). Nonetheless, a recent demand-side survey performed by the EC-European Commission (2012) has put emphasis on the need to change the way in which public services are provided (Chan, Lau, & Pan, 2008) in order to offer a new generation of e-government services revolving around user needs (EC-European Commission, 2012). The advent of social media using Web 2.0 technologies has opened up unprecedented new possibilities for engaging
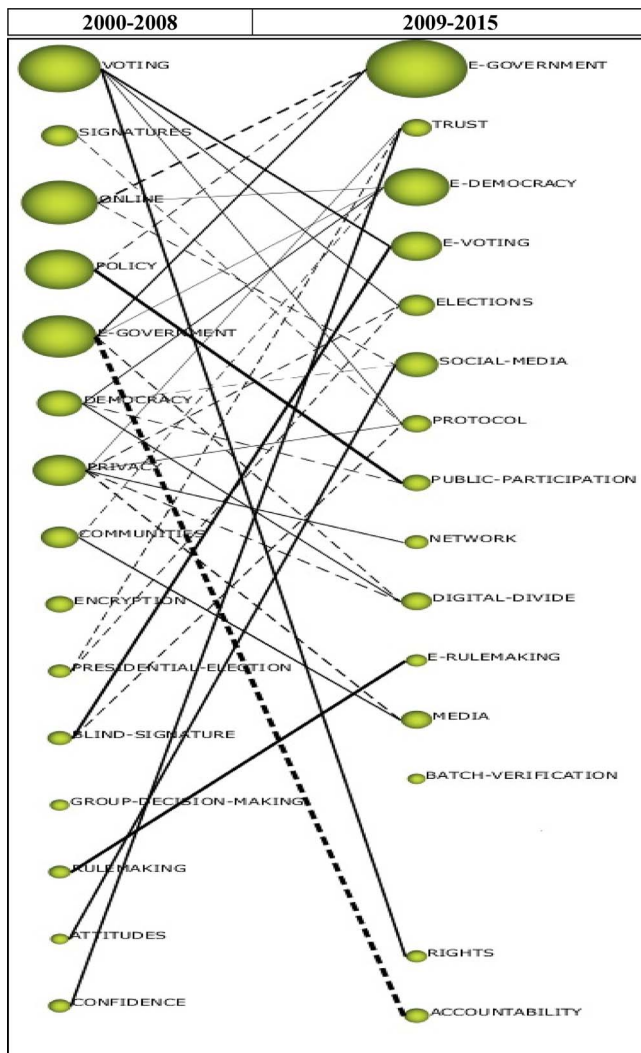
Fig. 6. Thematic evolution of the e-Participation research field (2000–2015).

the public in government work, which have been seen as effective tools to promote public goals.

In brief, the e-Participation field of knowledge has received great attention in the last few years and has evolved to a more techno-social system, allowing a greater citizen engagement in public sector management, not only in the political area. To achieve this aim, it has been relevant to focus the efforts of public administrations on improving government transparency (access to information) and access to e-services. Also, interoperability issues and new technological tools have become relevant to perform efficient delivery of public sector services and to improve the social perspective of citizen participation in municipal life and in decisions regarding public affairs.

At this point, it seems that the debate is open. Findings indicate that the Internet favours the creation of a democratic model and the inclusion of the citizens. However, it is evident that there are inequalities and differences between citizens. Therefore, it might be adequate to carry out studies about the context, skills and attitudes that are necessary in order to ease the integration of citizens into public affairs. Likewise, researchers must analyse the technical aspects and context to guarantee privacy and security, which increases the trust of citizens, and therefore, enhances their participation in public affairs.

Finally, there are many e-Participation tools, applications and platforms, and the politicians use these apps in order to favour transparency, participation and accountability (Harrison & Sayogo, 2014; Nielsen & Pedersen, 2014), but are the inclusion and participation

effective?; are citizens really taken into account in public decisions?; do the policy-makers and public managers really want to hear the views of citizens and take them into account? These questions have not been answered by previous research and they stimulate a lively debate about the scientific evidence needed to justify participation claims. In this regard, future research could undertake an empirical research to establish whether citizens are using e-Participation tools to get in touch with the governments and it could also analyse whether e-Participation tools are promoting the inclusion of citizens' suggestions or preferences in public decision-making processes. In addition, an analysis could be made of the power that citizens have and the role they play in these decision-making processes.

If citizens' suggestions or preferences are not taken into account in public decision-making processes, what is the strategy followed by policy-makers and public managers to enhance citizen participation? Is the purpose more propagandistic, and are there only good intentions? These questions still remain without answer. In this context, future research could analyse the strategy and the tactics that governments are employing with the use of e-Participation tools. That is to say, how the use of various platforms is in alignment with the organization's mission (strategy) and how the new online practices can support the organizational mission (tactic) (Mergel, 2012). Therefore, it could be interesting to identify whether a 'push', 'pull' or 'networking/mingling' tactic – in terms of Mergel (2013) for social media use – is used by governments and the reasons and factors why they have selected this tactic in their jurisdiction.

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References

Andersen, K. N., & Medaglia, R. (2009). The use of facebook in national election campaigns: Politics as usual? *Lectures Notes in Computer Science, 5694*, 101–111.

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom.* New Haven and London: Yale University Press.

Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government Information Quarterly, 27*(3), 264–271.

Boukhris, I., Ayachi, R., Elouedi, Z., Mellouli, S., & Amor, N. B. (2015). Decision model for policy makers in the context of citizens engagement. *Application on Participatory Budgeting. Social Science Computer Review.* http://dx.doi.org/10.1177/0894439315618882.

Callon, M., Courtial, J. P., Turner, W. A., & Bauin, S. (1983). From translations to problematic networks: An introduction to co-word analysis. *Social Science Information, 22*(2), 191–235.

Callon, M., Courtial, J. P., & Laville, F. (1991). Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemsitry. *Scientometrics, 22*(1), 155–205.

Carter, L., & Campbell, R. L. (2012). Internet voting usefulness: An empirical analysis of trust, convenience and accessibility. *Journal of Organizational and End User Computing, 24*(3), 1–17.

Chan, C. M., Lau, Y., & Pan, S. L. (2008). E-government implementation: A macro analysis of Singapore's e-government initiatives. *Government Information Quarterly, 25*(2), 239–255.

Chen, P., & Redner, S. (2010). Community structure of the physical review citation network. *Journal of Informetrics, 4*(3), 278–290.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011a). An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the Fuzzy Sets Theory field. *Journal of Informetrics, 5*(1), 146–166.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2011b). Science mapping software tools: Review, analysis, and cooperative study among tools. *Journal of the American Society for Information Science and Technology, 62*(7), 1382–1402.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E., & Herrera, F. (2012). SciMAT: A new science mapping analysis software tool. *Journal of the American Society for Information Science and Technology, 63*(8), 1609–1630.

Coulter, N., Monarch, I., & Konda, S. (1998). Software engineering as seen through its research literature: A study in co-word analysis. *Journal of the American Society for Information Science, 49*(13), 1206–1223.

Crothers, C. (2015). Using the internet in New Zealand elections and support for E-voting. *Political Science, 67*(2), 125–142.

Dawes, S. S. (2008). The evolution and continuing challenges of e-Governance. *Public Administration Review, 68*(1), S86–S102.

DeSmet, A., Cleemput, K., Bastiaensens, S., Poels, K., Vandebosch, H., Malliet, S., et al. (2016). Bridging bechavior science and gaming theory: Using the Intervention Mapping Protocol to design a serious game against cyberbullying. *Computers in Human Behavior, 56*, 337–351.

EC-European Commission. (2012). Public Services OnlineDigital by Default or by Detour? Assessing User Centric eGovenrment performance in Europe–eGovernment Benchmark 2012. Retrieved April 10, 2013 from http://ec.europa.eu/digital-agenda/sites/digital-agenda/files/eGov%20Benchmark%202012%20insight%20report%20published%20version%200.1%20_0.pdf.

Epstein, D., Newhart, M., & Vernon, R. (2014). Not by technology alone: The analog aspects of online public engagement in policymaking. *Government Information Quarterly, 31*(2), 337–344.

Freschi, A.C., Medaglia, R., Norbjerg, J. (2009). A tale of sic countries: eParticipation research from an Administration and Political Perspective, in Macintosh, A. and Tambouris, E. (Eds.), e.Part 2009, Lectures Note in Computer Science 5694, 36–45.

Gil de Zúñiga, H., Jung, N., & Valenzuela, S. (2012). Social median use for news and individuals' social capital, civic engagement, and political participation. *Journal of Computer-Mediated Communication, 7*(3), 319–336.

Gunawong, P. (2015). Open government and social media: A focus on transparency. *Social Science Computer Review, 33*(5), 587–598.

Hansen, D. I., Shneiderman, B., & Smith, M. A. (2011). *Analyzing social media networks with node XL insight from a connected world.* Burlintong, MA: Morgan Kaufmann.

Hansson, K., Belkacem, K., & Ekenberg, L. (2015). Open government and democracy. A research review. *Social Science Computer Review, 33*(5), 540–555.

Harrison, T. M., & Sayogo, D. S. (2014). Transparency, participation, and accountability practices in open government: A comparative study. *Government Information Quarterly, 31*(4), 513–525.

He, Q. (1999). Knowledge discovery through Co-word analysis. *Library Trends, 48*(1), 133–159.

Hendricks, J., & Denton, R. (2010). *Communicator-in-chief: How barack obama used new media technology to win the white house.* New York: Lexington Books.

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences of the United States of America, 102*(46), 16569–16572.

Holsapple, C. W. (2008). The pulse of multiparticipant systems. *Journal of Organizational Computing and Electronic Commerce, 18*(4), 333–343.

Hu, G., Pan, W., Lin, H., Kang, K., & Best, M. L. (2014). Study on the framework of e-Government services capability: An empirical investigation. *Social Science Computer Review, 32*(1), 56–73.

Hui, G., & Hayllar, M. R. (2010). Creating public value in e-government: a public-private-citizen collaboration framework in web 2.0. *Australian Journal of Public Administration, 69*(S1), S120–S131.

Karakaya Polat, R. K., & Pratchett, L. (2014). Citizenship in the age of the internet: A comparative analysis of britain and Turkey. *Citizenship Studies, 18*(1), 63–80.

Kim, S., & Lee, J. (2012). E-Participation, transparency, and trust in local government. *Public Administration Review, 72*(6), 819–828.

Macintosh, A., Coleman, S., & Schneeberger, A. (2009). EParticipation: The research gaps. *Lecture Notes in Computer Science, 5694*, 1–11.

Medaglia, R. (2012). eParticipation research: Moving characterization forward (2006–2011). *Government Information Quarterly, 29*(3), 346–360.

Mergel, I. (2012). *A manager's guide to designing a social media strategy. Special Report Series* Washington, DC: IBM Center for The Bussiness of Government.

Mergel, I. (2013). Social media adoption and resulting tactics in the US federal government. *Government Information Quarterly, 30*(2), 123–130.

Mintz, D. (2008). Government 2.0–fact or fiction? *The Public Manager, 36*(4), 21–24.

Nielsen, J. A., & Pedersen, K. (2014). IT portfolio decision-making in local governments: Rationality, politics, intuition and coincidences. *Government Information Quarterly, 31*(3), 411–420.

Parvez, Z. (2006). Informatization of local democracy: A structuration perspective. *Information Polity, 11*, 67–83.

Peng, K. A. (2013). A shuffle to achieve high efficiency through pre-computation and batch verification. *International Journal of Information Security, 12*(4), 337–345.

Reddick, C. G., & Norris, D. F. (2013). Social media adoption at the american grass roots: Web 2.0 or 1.5? *Government Information Quarterly, 30*(4), 498–507.

Rodríguez Bolívar, M. P., Alcaide Muñoz, L., & López Hernández, A. M. (2012). Profiling E-participation research in Europea and North America: A bibliometric analysis about articles published. In V. Weerakkody, & C. G. Reddick (Eds.). *Public sector transformation through E-government. experiences from Europe and North America* (pp. 120–139). Taylor & Francis.

Saebo, O., Rose, J., & Flak, L. S. (2008). The shape of eparticipation: Characterizing emerging research area. *Government Information Quarterly, 25*(3), 400–428.

Saebo, O., Rose, J., & Molka-Danielsen, J. (2010a). E-participation: Designing and managing political discussion forums. *Social Science Computer Review, 28*(4), 403–426.

Saebo, O., Rose, J., & Molka-Danielsen, J. (2010b). E-participation: Designing and managing political discussion forums. *Social Science Computer Review, 28*(4), 403–426.

Salton, G., & McGill, M. J. (1983). *Introduction to modern information retrieval.* New York: McGraw-Hill.

Sanford, C., & Rose, J. (2007). Characterizing eParticipation. *International Journal of Information Management, 27*(6), 406–421.

Shao, Z. (2005). Cryptanalysis of Xia-You group signature scheme. *Journal of Systems and Software, 75*(1–2), 89–94.

Shulman, S. W. (2005). E-rulemaking: Issues in current research and practice. *International Journal of Public Administration, 28*(7–8), 621–641.

Sivarajah, U., Irani, Z., & Weeerakkody, V. (2015). Evaluating the use and impact of Web 2.0 technologies in local government. *Government Information Quarterly, 32*(4), 473–487.

Skoric, M. M., Zhu, Q., Goh, D., & Pang, N. (2015). *Social media and citizen engagement: A meta-analytic review. New media and society.*

Small, H. (1999). Visualizing science by citation mapping. *Journal of the American Society for Information Science, 50*(9), 799–813.

Susha, I., & Grönlund, A. (2012). eParticipation research: Systematizing the field. *Government Information Quarterly, 29*(3), 373–382.

Susha, I., & Grönlund, A. (2014). Context clues for the stall of the Citizens' Initiative: Lessons for opening up e-participation development practice. *Government Information Quarterly, 31*, 454–465.

Vaccari, C. (2013). From Echo Chamber to persuasive device? Rethinking the role of the Internet in Campaigns. *New Media and Society, 15*(1), 109–127.

Vassil, K., & Weber, T. A. (2011). A bottleneck model of e-Voting: Why technology fails to boost turnout. *New Media and Society, 13*(8), 1336–1354.

Zhang, X., Wang, W., Ordóñez, P., Tang, J., & Yan, X. (2015). Mapping development of social media research through different disciplines: Collaborative learning in management and computer science. *Computers in Human Behavior, 51*, 1142–1153.