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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, &

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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