

# Crowdsourcing in Public Management: Current Research and Future Directions

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## Abstract

The sweeping progress of Web 2.0 technologies and capabilities has been welcomed as a shortcut to the democratization of public management. Although there is a large amount of research investigating the power of crowdsourcing in dealing with challenging public problems, few studies have elaborated what have been achieved and what should be done. This paper seeks to present a critical examination of the substrate of crowdsourcing research in public management base on the Bibliometrics and Visualization Analysis of the selected literatures. Subsequently, we develop a comprehensive analytic framework of crowdsourcing in public management and identify several important research directions for scholars. In accordance with design focus, problem focus, process focus, actor focus and outcome focus, the existing literature has demonstrated five research domains. Nevertheless, this field is still in its infancy, the theoretical foundations are weak, and the practical effects are controversial. Future research should be done to explore this emerging field from a broader perspective, with deep analysis of the participants, public organization and system management in crowdsourcing in public management.

## Keywords

Crowdsourcing, Participation, Research Status, Future Directions

## 1. Introduction

Since the term crowdsourcing first coined by journalist (Howe, 2008), the commercial world has focused on how to best take charge of the creative, productive capabilities, wisdom and resources outside of the organization to deal with a specific problem or issue within an organization, and promote business model innovation. Crowdsourcing can be defined as a “type of participative online ac-

tivity in which an individual, an institution, a non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bring their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage that what the user has brought to the venture, whose form will depend on the type of activity undertaken (Estellés-Arolas, 2012: p. 198).”

As a distributed online problem-solving and product/service-producing model (Brabham, 2009; Clark & Logan, 2011), crowdsourcing is not exclusive for business application and private purpose. The sweeping progress of Web2.0 has reduced the transaction cost of interpersonal information change and collective action, and dramatically extended the government’s behavioral boundary of leveraging collective wisdom and intelligence of the public. From city planning to environmental conservation, crowdsourcing has been adopted by public organizations as an effective participatory tool for public management, which has attracted considerable attention from academic world.

As an emerging field, research on crowdsourcing is still in its infancy. Relevant analyses are mainly conducted by scholars from the disciplines of business management and information system, and most of them focus on private application of crowdsourcing. For anyone interested in pursuing further efforts in this field, a system assessment of current research would be beneficial for comprehensive understanding of what has been achieved and what are opportunities for future research. Although several studies have evaluated the status quo of crowdsourcing research (Zhao & Zhu, 2012; Ghezzi et al., 2017), given the exploded scholarly interest in crowdsourcing in public management practices, almost no attention has been devoted to provide a systematic review of crowdsourcing research in public management specifically.

To fill this gap, we depict the landscape of studies on crowdsourcing in public management and synthesize various streams of research to provide an overview of the current status, and also propose directions for future investigations that are valuable for both academics and practitioners. The theoretical analysis of crowdsourced public management is shown in Section 2. The methodology used in this research is introduced in Section 3. A critical examination of the visible and invisible aspects of literature on crowdsourcing in public management is shown in Section 4, followed by the direction for future research from three perspectives in Section 5. Section 6 concludes.

## **2. Theoretical Discussion**

The philosophy of “open source governance”, which seeks to the combination of open source movement and democratic principle so that the general public can

contribute to public affairs at lower transaction costs and marginal cost, is the driving force behind the application of crowdsourcing in public management (Brabham, 2013; Certomà et al., 2015).

Scholars often use different terms to describe the potential of crowdsourcing in public management such as citizen sourcing (Torres Clouston, 2015), collaborative government (Mcguire, 2006), Wiki government (Noveck, 2009), Do-It-Yourself government (Dunleavy & Margetts, 2010), open social-innovation (Raffl, 2014) and crowdsourced government (Clark & Logan, 2011). In existing literature, there are three types of understanding of crowdsourcing in public management:

1) An online public problem-solution model used by government in management process, which is featured by aggregative collection of creative solutions activities through online community (Clark & Logan, 2011; Brabham, 2012). Admitting that the government is not omniscient and omnipotent provides the basic reason for applying crowdsourcing to public management process. A number of “wicked problems” (Mcguire, 2006) that government faces today cannot be solved effectively by traditional bureaucratic progress, and crowdsourcing contributes to public management mainly in three ways (Bott et al., 2014): the first is the top-down approach, government disclose public issues and relevant information to online community through customized Web and mobile applications, and government and social organizations mainly rely on their official websites as platform for publishing tasks to the public (Noveck, 2009). The second is the bottom-up approach, people of similar purpose and interests in independent platform voluntarily cooperate with each other and join online forums, virtual community discussion to address problems, or organize the creation of social products, services or produce social effects by setting up blog, video and other media or the third-party platform (Torres Clouston, 2015). The third is the integration of top-down and bottom-up approach, participants in public crowdsourcing programs provide support for management and decision-making on public affairs through the establishing platform, integrate and compare data from official agencies with crowdsourcing activities (Raffl, 2014).

2) An effective tool of online negotiation helping to overcome the limitations of traditional deliberative democracy and enable online public dialogue by empowering citizens (Brabham, 2009; Prest, 2012; Aitamurto, 2016; Messina, 2012). In the context of global democratic recession, crowdsourcing tools and processes have been used as a good medicine by developed countries to deal with the crisis of democracy and enhance political trust. The prospect of using the Internet in the democratic process is that it can not only promote communication and collaboration among citizens, but also design good online negotiation processes and use public collective intelligence to solve public problems (Noveck, 2009). Crowdsourcing is not a kind of representative democracy, and participants’ voices don’t represent the opinions of the majority. However, crowdsourcing can be used as a supplement of representative democracy, and the crowdsourcing model just does something in two ways (Brabham, 2013). Ideally, crowdsourcing can

be seen as a logical extension of the democratic process that enables local citizens to participate directly in public administration (Messina, 2012). At least, crowdsourcing helps to form programs and policies that are widely accepted by potential target groups (Burby, 2003).

3) An online community governance mechanism drawing inputs and insights from undefined crowds in order to take full advantage of public intelligence and genius to improve public governance (Lukensmeyer & Torres, 2008; Clark & Logan, 2011). Besides completing the traditional democratic participation, crowdsourcing also brings insights and new ideas to solve public problems. Using crowdsourcing in public sphere means that the public is coopted as a major partner in the management processes taking place within government organizations (Mergel, 2012). By empowering the people, crowdsourcing promotes public participation in the process of public service and policy innovation and helps the government to reduce the cost, promote innovation, and enhance the trust relationship between government and citizen (Brabham, 2012). For example, the United States Open Government Initiative and European Governments 2.0 Action regarded crowdsourcing as an indispensable policy tool to improve governments' administration (Mergel & Desouza, 2013; Raffl, 2014). Many developing countries also began to use crowdsourcing mechanism to enhance national governance capacity, such as the using of crowdsourcing in coordination of natural disaster relief and the reconstruction of the country by Libya crowdsourcing project after the civil war, and Kenya government's use of online crowdsourcing to defend human rights and combat violence (De Leeuw et al., 2011).

Based on the above discussion, from an integrated view, this research defines *the crowdsourcing in public management* as a collaborative online governance activity of taking that is traditionally performed by a designated public organization and outsourcing it to a large group of undefined people, in which, by empowering citizens in online community, the creative, productive capabilities, wisdom and resources outside of the organization are used to deal with a specific public problem.

Deliberative democracy theory is regarded as the theoretical basis for crowdsourcing in public management (Clark et al., 2016). This theory stresses the importance of "subjective legitimacy" and "normative legitimacy", which emphasizes the moral rationality of government behavior and public decision-making (Misak & Nino, 1998), and advocates the empowerment to marginalized groups and disadvantaged citizens (Brabham, 2009). Inclusiveness, accountability and transparency are guidelines of deliberative democracy (Aitamurto, 2012; Cupido & Ophoff, 2014), crowdsourcing in public management serve to the three guidelines in several ways: crowdsourcing can increase inclusiveness by opening public deliberation to all the potential citizens as possible, and making the unrepresented voices and knowledge of diverse individuals be heard by decision makers (Linders, 2012). Next, crowdsourcing can used to enhance accountability through ensuring the answerability and enforcement of decision makers' actions. A "participatory contract" and a feedback loop can be used to the decision makers ac-

countable to their promises and actions, and the participants are aware of the way their contributions are used and the reasons for public decisions (Aitamurto, 2012). What's more, crowdsourcing can not only improve horizontal transparency (refers to transparency between participants) by providing fair rules, encouraging interaction and deliberation between the participants (Bott et al., 2014), but also prompt vertical transparency by publish all information about policymaking process including the division of responsibilities, goals and potential impact should be publicized, so as to make participants to trace the crowdsourcing process (Brabham, 2008, 2009).

### 3. Data and Methodology

The methodology employed to depict the landscape of studies on crowdsourcing in public management and synthesize various streams of research to provide an overview of the current status follows three-stages: the search for research on crowdsourcing in public management, the creation of various streams of research based on the methods of bibliometrics and visualization supported by CiteSpace and VOSviewer, and the interpretation of the various stream of research based on a systematic analysis of the literature.

#### Selection and identification of the research publications

Scholars from various disciplines have produced publications on numerous topics related to outsourcing, but this paper focuses on crowdsourcing within the field of public management. We aim to analyze the literature in the Social Sciences Citation Index (SSCI) database covering research on public management. Given that academic research on crowdsourcing began in 2006, we set our search terms for "crowdsource\*" to cover the period from 2006 to 2020, with the retrieval date ending on May 16, 2020. This approach aligns with the principle that public management encompasses broad areas, including public administration, public policy, public economics, public affairs, public services, and more (Hughes, 2012). The search term "crowdsource\*" ensures comprehensive coverage of the relevant literature.

The initial search yielded 1955 papers. After removing duplicate documents and excluding conference papers, book reviews, reviews, editorial materials, conference abstracts, book chapters, corrections, news items, and covers, 1772 articles remained. Following an in-depth review, we excluded articles unrelated to public management, resulting in a final list of 421 papers for analysis. Although the SSCI database does not specifically categorize public administration, public policy, public economics, public affairs, and public services, we identified relevant papers by carefully examining each one.

Our in-depth reading reveals that these articles broadly focus on politics and administration, public administration, non-profit organizations (NPO) and non-governmental organizations (NGO), public policy, social security and welfare, social policy, urban community, land management, public health, and other areas, all of which fall under the umbrella of "public management" (Hughes, 2012). While "public management" is not a precisely defined field, scholars gen-

erally interpret it broadly (Pollitt & Bouckaert, 2017), and we adopt this broad perspective in our study.

### **Bibliometrics and visualization analysis supported by CiteSpace and VOSviewer**

In the analysis of bibliometrics and visualization, CiteSpace excels in analyzing co-cited documents and predicting future trends, while VOSviewer can produce intuitive visualizations and succinctly display current research fields (Yi et al., 2020). Therefore, we combine the advantages of these two tools for our analysis.

CiteSpace supports the visualization of a scientific field from bibliographic sources by creating networks of various entities, including cited references, co-authors, and co-occurring keywords. This paper focuses on document co-citation networks and networks of co-occurring keywords to provide more accurate and comprehensive insights into crowdsourcing in public management domains. Individual nodes in these networks can be aggregated into clusters based on their interconnectivity, with each cluster representing a distinct specialty or thematic concentration. Key points of interest include highly cited landmark articles, articles with strong citation bursts, and keywords with a significant surge in frequency.

Using VOSviewer 1.6.15's Concurrence Clustering Label View function, we conduct the bibliometric and visualization analysis of the literature. Concurrence clustering analysis calculates the degree of relation between subject words (based on their frequency of co-occurrence in the same literature) and groups subject words that are closely related into distinct clusters with independent concepts. The attribute similarity within a cluster is maximized, while the similarity between clusters is minimized. In Concurrence Clustering Label View, each circle and label represent an element (subject words), with the size of the circle indicating the importance of the element. Circles of the same color belong to the same cluster. To avoid overlapping labels, tag views generally display only a subset of labels.

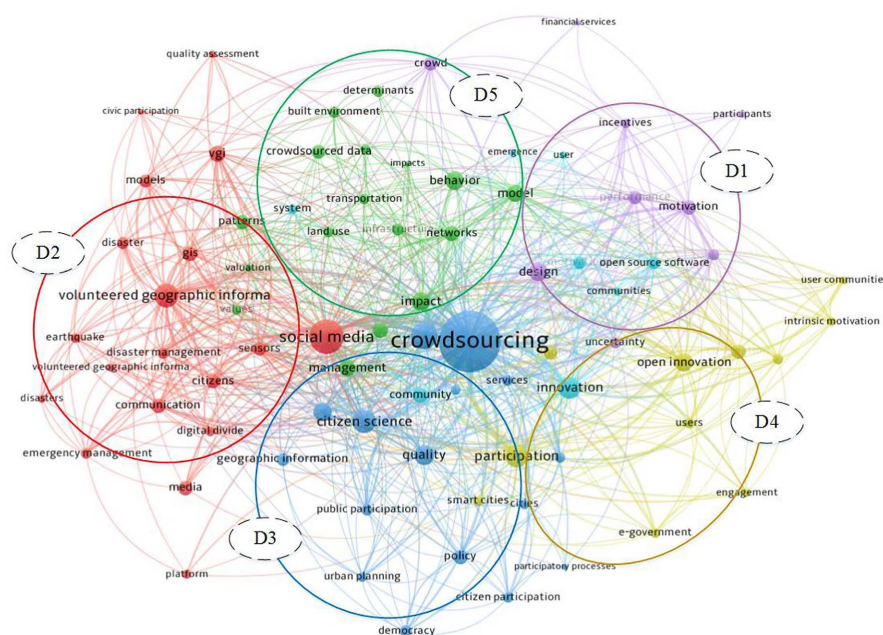
## **4. Results**

### **Identification and interpretation of clusters: main research domains exist in current literature**

We use VOSviewer 1.6.15 to explore the interpretation of the various streams of research based on a systematic analysis of the literature. **Figure 1** represents the terms that most frequently co-occurred (at least three times in the title, abstract, and keywords) in the subject words in 421 articles. Aiming to display the results of clustering more clearly, we use five large circles (D1-D5) to mark the clusters of five colors.

The five main clusters in the term map show that there are five research areas existing in current literature, including a crowdsourcing operating mechanism in public management (D1), crowdsourcing application in public governance, volunteered geographic information system and emergency disaster manage-

ment (D2), crowdsourced policymaking and public service providing (D3), participants' behaviors in crowdsourcing public management (D4) as well as effects and impacts of crowdsourcing in public management (D5).



**Figure 1.** Keyword clustering in public management crowdsourcing literature.

### D1: Elements and operation mechanism of public management crowdsourcing

Design, motivation, incentives, performance, participation, and other high-frequency co-occurrence words form the first field of public management crowdsourcing research (D1). D1 belongs to studies that consider crowdsourcing in public management as an online collective intelligent system and focus on the operational elements, type, programming design, and evaluation framework of public crowdsourcing projects.

Civic conception and innovation, incentives, cooperative administration, and cooperative democracy are often operated as the basic elements of civic crowdsourcing (Schmidhuber et al., 2019). Nam (2012) expanded this basis and constructed a public crowdsourcing element analysis framework that consists of transparency, participation, collaboration, consultation, and responsiveness. Theatrically, several scholars argue that consultation and collaboration have the most important significance to the success of crowdsourcing in the public sector (Brabham, 2008; Clark & Logan, 2011). However, empirical research shows that consultation and collaboration are seriously inadequate in practice (Prest, 2012). Another study implies that in the public sector, to ensure the smooth operation of crowdsourcing program and keep a high level of participation, governmental sponsors should be aware of the significance of appropriate incentives and pay attention to potential participants' needs and motivations (Sowmya & Pyarali,

2013). Moreover, political commitment is essential, the specific requirements of the problem and solution should be defined in advance, and the degree of adoption of the participants' ideas and contributions should be formally undertaken (Brabham, 2013). The government should learn to act as a planner rather than a manager as it used to be, and try to keep the crowdsourcing process honest, transparent, and responsive (Prpić et al., 2015).

Sophisticated and well-designed programming is the key to the success of crowdsourcing projects in public management. Like public package projects in the private sector, the crowdsourcing design in public management mainly involves three main actions, namely, incentive mechanism design, two-way communication, and information aggregation (Wijnhoven et al., 2015). A complete package project is supposed to include conceptual design, technical design, communication phases, ideas/tasks entry, evaluation, monitoring, incentives, process evaluation and documentation, implementation, etc. (Amrollahi, 2016). When it comes to the stage of implementation, the government should remember that educating citizens to understand public policies, enabling the public to have more access to the policymaking process, and making the government's future policy process more smoothly are the foremost goals for applying crowdsourcing in public management (Alizadeh et al., 2019). Hence, a successful government crowdsourcing project is supposed to guarantee a clear evaluation of the citizen's learning achievements (Brabham, 2013). The performance evaluation should focus not only on the quality and added value of crowdsourcing, but also on the analysis of the process rather than the outcomes. To address this issue, Prest (2012) put forward a multi-dimensional assessment framework which consists of three categories of components: design, process, and impact.

#### **D2: Crowdsourcing applications in public governance, volunteered geographic information system, emergency and disaster management**

Volunteered geographic information, emergency management, disaster management, disasters, quality assessment, civic participation, open street map, vgi and other high-frequency co-occurrence words constitute the second field of public management crowdsourcing research (D2).

Crowdsourcing has gradually developed into a distributed online innovation process in public governance (Certomà et al., 2015). Participation, multi-dimensionality, objectivity, fairness, transparency, collaboration, and adaptability are the core elements of public governance (Kumar et al., 2018), and the mechanism of crowdsourcing can discover the potential value of each element effectively (Prpić et al., 2015). The democratization of scientific research and innovation can promote citizens' direct participation in political life and encourage the public to give advice and suggestions to important public issues (Van Schepen, 2019). It requires the government to input all kinds of resources, use technology tools and community-based diversified knowledge to promote knowledge sharing and citizen participation, which are the value of crowdsourcing in public management (Haltofova, 2018).

Crowdsourcing application has played a major role in disaster warning, geo-



graphic information collection, and other public governance areas (Chaves et al., 2019). Supported by social media, the public's direct discovery has become an important information source of disastrous weather detection and prevention (Brabham, 2008, 2009). Social media users can spread meteorological disaster information to others timely, which improves the government's ability of information management in detecting and preventing disasters (Chatfield & Braja-widag, 2014). Mechanism of crowdsourcing based on social media can promote a multidirectional and interactive weather dialogue between government, ordinary citizens, and citizen "scientists" who are willing to submit disastrous weather reports to the authorities (Panagiotopoulos & Bowen, 2015). This decentralized information network has changed the traditional one-way meteorological information flow to interactive information sharing and multidirectional dialogue (Van Schepen, 2019).

By contrast, although citizen crowdsourcing has shown great potential in changing the ways of collecting, storing, spreading, analyzing, visualizing, and using geographic information, it only has limited effects on official geospatial data which are manipulated by geographic information organization (Oloo, 2018). Governments often controls the data process strictly due to the consideration of data quality and safety, which leads to slow adoption of crowdsourcing mechanism by geographic information authorities (Clouston, 2015).

It is worthwhile to point out that scholars have tried to use citizen crowdsourcing to solve global important governance problems that are highly complex, such as conflict, climate change, poverty and other problem areas where traditional democratic institutions and international foreign policy often fail (Van Schepen, 2019). For example, Mulder et al. (2016) analyzed the information transfer process of crowdsourcing generated big data of Nepal earthquake in 2015 and the Haiti earthquake in 2010 and found that residents suffering from disaster are neither excluded from the information flow, nor excluded from the explanation of crisis information. Because information is used by the official disaster response entity, the residents are just in a marginalized position in the process of using these big data to support their own interests.

### **D3: crowdsourced policy making and public service providing**

Policy, services, public, participation, governance, and other high-frequency co-occurrence words form the third field of public management crowdsourcing research (D3).

The widespread use of various web 2.0-supported applications in policy making process has attracted scholars' attention, and they often use "policy crowdsourcing" or "crowdsourced policy making" to describe the new style of policy-making (Lodge & Wegrich, 2014; Haltofova, 2018). Prpić et al. (2015) developed a systematic framework suitable to analyze all applications of crowdsourced policymaking, in which policy crowdsourcing practices are classified based on the policy cycle and IT-mediated technique. Their review of 83 works on policy crowdsourcing suggests that crowdsourcing has been already used in different stages of the policy cycle.

Lots of researches have verified the theoretical and practical value of the crowdsourcing policy (Moon, 2017). Crowdsourcing improves the legitimacy of the government behaviors by empowering the people and enabling consultations between multiple-stakeholders in the policy discussion process at a lower cost (Lenart-Gansiniec & Sulkowski, 2018; English et al., 2018). More importantly, using a crowdsourcing mechanism in policy making is also conducive to engage the public in correcting the mistakes of the policy from the government to improve the rationality of the policy (Radu et al., 2015). Moreover, crowdsourced policy-making can make the process of the government action be inclusive and open to all the citizens and win the public support for public policies in a participatory way (Zinnbauer, 2015; Van Schepen, 2019).

As for the implementation process of policy crowdsourcing, Aitamurto and Landemore (2015) introduced a designed framework of crowdsourcing policy, which included five fragments: inclusion, accountability, transparency, modularization, and comprehensive support. Specifically, two kinds of technologies are required in policy crowdsourcing: one is the idea crowdsourcing on a large scale which makes it possible to conduct effective knowledge research; the other is on-line discussion and negotiation platform that encourages more users to provide more proofs for the ideas they support.

Except for the influence on public policymaking, crowdsourcing has cast its shade on public services. In crowdsourced public service providing, the government holds primary responsibility, but citizens influence direction and outcomes, which helps the government be more responsive and effective (Linders, 2012). This will shift the role of citizens from “the users and selectors” to “producers and designers” of public service. The government regards the public as cooperative partners rather than customers of public service (Alizadeh et al., 2019).

In the stage of service design, extensive consultation and discussion help the government select the alternatives and make better decisions (Tshimula et al., 2019). Crowdsourcing can also efficiently correct the information asymmetry between citizens and public service organization (Chen & Aitamurto, 2018). Under this condition, the long-term responsibility of “the public-policymakers-service providers” will be changed, and the crowdsourced information exchanging and sharing mechanism makes the public closer to the problem (Spyratos, & Stathakis, 2017). Then the short-term responsibility between the citizens and the government can be implemented through enhancing citizen’s direct power to a government agency (Harrison & Johnson, 2019). However, the crowdsourced public service providing is still at its early stage. The fundamental reason why governments in most western countries accept and choose the crowdsourced service delivery is to relieve finance pressure rather than improve their performance or empower the public (Osborne et al., 2012; Zinnbauer, 2015).

#### **D4: Participants’ behaviors in crowdsourced public management**

Participation, users, engagement, user, communities, e-government, open

innovation and other high-frequency co-occurrence words form the fourth field of public management crowdsourcing research (D4). The documents of the actor perspective focus on explaining and predicting organization or people's behavior in the process of public crowdsourcing, with specific emphasis placed on exploring the motivation mechanism of citizens' participation in public management.

It's obvious that the motivation mechanism is a combination of internal intrinsic factors and external incentive factors (Juell-Skielse et al., 2014). Citizens are more likely to participate in public crowdsourcing programs when they perceive the program can bring them with money, interesting and enjoyable experience, career development, peer recognition, meeting new people and social contact, contributing to a collaborative effort, learning new skills and knowledge, and self-expression (Panagiotopoulos & Bowen, 2015; Wijnhoven et al., 2015). Furthermore, Greenhill et al. (2016) and Zou et al. (2019) showed that system administration and support, rule, and feedback, effort expectation, and performance expectation are important predictive variables of participatory behavior in government crowdsourcing program.

Voluntary is the basic principle of citizen participation in public management crowdsourcing project (Gómez-Barrón et al., 2019; Yan et al., 2020); thus, the literature on the motivation of volunteer behavior is of important reference value to explore the incentive of citizens' participation. Existing empirical evidence has implied that altruism, feedback, and encouragement to participants have the most important positive effects on citizens' participation behavior (Juell-Skielse et al., 2014; Chaves et al., 2019). Most participants are altruistic, or at least mutually beneficial, and are actively involved when they feel they can make their own contributions to valuable public service. Specifically, the formal commitment of the government and its timely feedback to participants are critical in promoting a successful crowdsourcing program (Coleman et al., 2017). Only when the participants feel the crowdsourcing initiative is not a "political show", can they effectively participate in public affairs and influence the government behaviors (Brabham, 2009, 2013; Evseeva, 2018).

#### **D5: Crowdsourcing effect and challenge**

Impact, valuation, impacts, model, value, determinants, behavior and other high-frequency co-occurrence words form the fifth field of public management crowdsourcing mechanism research (D5).

Only when the crowdsourcing works, can it be meaningful in public management. Several scholars have investigated the effect (outcome, impact, value, etc.) of crowdsourcing in public management. The effect of crowdsourcing programs varies according to the nature of the issues crowdsourced. For example, Glaeser et al. (2016) analyzed a supervision crowdsourcing program in Boston and found that crowdsourcing reward system significantly improved the impact of food safety supervision. However, the internal conflicts between the crowdsourcing policy logic and the traditional decision-making process bring The Cross Country Race Traffic Law to a standstill in Holland (Aitamurto, 2016). Lodge and

Wegrich’s (2014) research on British government crowdsourcing regulatory reform action “red tape challenges” in 2015 also showed that crowdsourcing action has no prominent impact on traditional policymaking pattern, and there need new crowdsourcing ways to improve the value in policymaking.

The uncertainty of the effect reflects the challenges of implementing crowdsourcing in public management, which has been discussed from the perspective of technology, organization and governance. The technological challenges including (Mazumdar et al., 2017; Rice & Martin, 2018): 1) Digital gap: the availability of the internet and social media technology determines the level of public involvement. 2) Information overloading: the mass data from crowdsourcing initiative has potential risks of distracting the limited cognitive skills of the decision-makers and the participants, which will make the crowdsourcing invalid. 3) The conflicts in data management: official data, donated data, and crowdsourced data aren’t organized and evaluated in accordance with standard criteria of data management, and each of them may conflict with others. 4) Malicious use of data: especially when the crowdsourced behaviors involve human rights violations and conflicts.

**References with strong citation bursts and future directions**

Significant increases in research interests within the public management crowdsourcing are characterized by publications that experience citation bursts. The bursts are based on a total of 421 bibliographic records which were selected from 1772 valid references. Figure 2 shows the top 30 references with the strongest citation bursts during the period between 2006 and 2020.

**Top 25 References with the Strongest Citation Bursts**

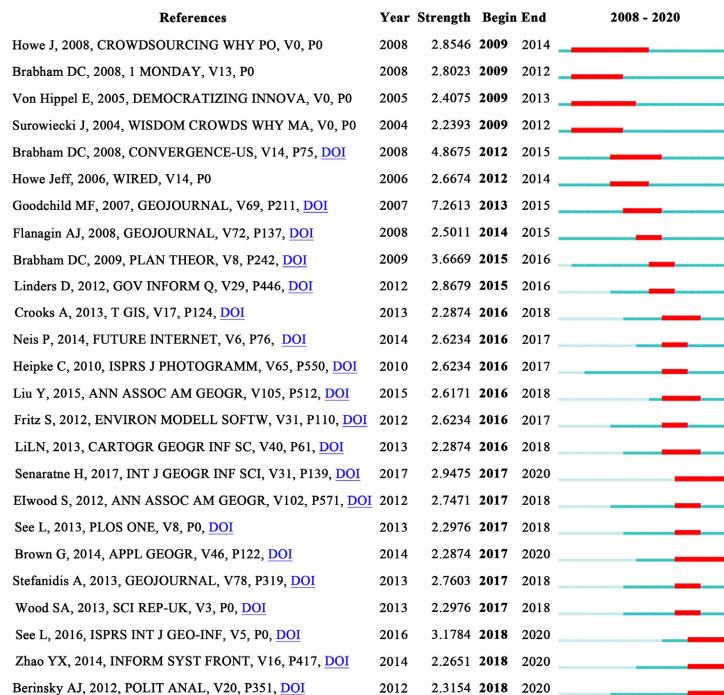


Figure 2. Top 30 references with strong citation bursts.

As shown in **Figure 2**, most references started their bursts in the year 2009, 2016, 2017, and 2018. There are three references that began to burst earlier than these references, with the bursting in the year 2012, 2014, 2014, and 2015. **Table 1** shows the representative references for eight groups since they began to burst.

**Table 1.** Representative reference with the strongest citation burst.

References	Year	Citation Burst		
		Strength	Begin	End
Howe, 2008	2008	2.85	2009	2014
Brabham, 2008	2008	4.86	2012	2015
Goodchild, 2007	2007	7.26	2013	2015
Flanagin & Metzger, 2008	2008	2.50	2014	2015
Brabham, 2009	2009	3.66	2015	2016
Crooks et al., 2012	2013	2.28	2016	2018
Senaratne et al., 2016	2017	2.94	2017	2020
See et al., 2016	2016	3.17	2018	2020

In the group of the year 2009, the top one reference with the strongest citation bursts is **Howe's (2008)** paper. **Howe (2008)** elaborated on the invention of crowdsourcing, the current utilization of the crowd, and how the power of the crowd could be used to shape the future. Howe's burst never came to its end until 2014. In the group of the year 2012, **Brabham's (2008)** article indicated that crowdsourcing can provide a new model to solve public problems. The burst had lasted for five years from 2012 till 2015. In the group of the year 2013, **Goodchild (2018)** reviewed the phenomenon that virtual globes encourage volunteers to develop interesting applications using their own data and examined the reason why crowdsourcing had been carried out by volunteers in solving public problems. Goodchild's burst provided proof that crowdsourcing began to apply in practice in 2013. The burst had lasted for five years from 2013 till 2015. In the group of the year 2014, **Flanagin and Metzger (2008)** further studied the quality, reliability and overall value of voluntary geographic information (VGI). Flanagin's burst went on from 2014 to 2015. In the group of the year 2015, **Brabham (2009)** explored the challenges of public participation in urban planning projects, particularly in the harnessing of creative solutions. This burst indicated that the focus of crowdsourcing research had shifted to prompt participation since 2015. In the group of the year 2016, the top one reference with the strongest citation bursts is **Crooks et al. (2012)** study. His article assessed the potential of the use of harvested social media content for event monitoring and analyzed the crowdsourcing benefit that could offer the citizens favorable results in a timely manner to enhance their situational awareness and improve their responses to disasters. Crook's burst continued from 2016 to 2018. In the group of the year 2017, **Sena-**

ratne et al. (2016) presented a classification of VGI to assess the quality of selected types of VGI. The burst lasted from 2017 to 2020. In the group of the year 2018, See et al. (2016) demonstrated the role of citizens in crowdsourcing geographic information and provided a guide to the status of this rapidly emerging and evolving subject. The burst lasted from 2018 till 2020.

As mentioned above, the most cited references cover a variety of scopes for more than public management, which reminds us that research on crowdsourcing in public management is still in its infancy and advances at a slow speed. The theoretical foundation is weak, and there are a series of unsettled important issues. For example, in the case of insufficient consultations, can deliberative democracy theory provide a strong theoretical basis for the application of crowdsourcing mechanisms in public management? What kind of theoretical support do we need more? Under what circumstances should the government choose to utilize crowdsourcing as a public problem-solving model? How to deal with the conflicts between the logic of traditional bureaucratic politics and the logic of crowdsourcing mechanism? How should the system be designed to encourage citizens to participate and contribute more to crowdsourcing programs? What measures should be taken to evaluate the success of crowdsourcing? Should the criteria be the number of participants, diversity or quality, or the quality of the outcome?

These unanswered questions point out the future directions in which the researchers could widen the scope and increase the depth of crowdsourcing studies in public management. If scholars want to go in the future directions to fill the research gap of crowdsourcing in public management, they could find their way in these unsettled problems.

## 5. Conclusion

Besides completing the traditional democratic participation, crowdsourcing brings insights and new ideas to solve public problems. Using crowdsourcing in the public sphere means that the public is coopted as a major partner in the management processes taking place within governments (Mergel, 2012). By empowering the people, crowdsourcing promotes public participation in the process of public service and policy innovation and helps the government to cut the cost, promote innovation, and enhance the trust relationship between government and citizen (Brabham, 2013). For example, the United States Open Government Initiative and European Governments 2.0 Action regard crowdsourcing as an indispensable policy tool to improve governments' administration (Raffl, 2014). Many developing countries also began to use crowdsourcing to enhance public management capacities, such as the using of crowdsourcing in the coordination of natural disaster relief and the reconstruction of the country by Libya, and Kenya government's use of online crowdsourcing to defend human rights and combat violence (De Leeuw et al., 2011).

From an integrated view, we can jump to a conclusion that crowdsourcing in public management is a collaborative online governance activity that is traditionally performed by a designated public organization and outsourced to a large

group of undefined people. In the activity, by empowering citizens in the online community, the creative, productive capabilities, wisdom and resources outside of the organization are used to deal with a specific public problem. The philosophy of the crowdsourcing in public management, working as the driving force behind the application of crowdsourcing in public management, seeks to combine the open-source movement and democratic principle so that the public can contribute to public affairs at lower transaction costs (Certomà et al., 2015).

As an emerging branch of e-public-participation in public administration and public policy (Prest, 2012), crowdsourcing in public management could be improved in three ways of participants, public bodies, and systems. Firstly, as the initiator and organizer, it is critical for the government to regard the participants of crowdsourcing as partners, with their needs, ideas, and incentives taken into consideration when the government implements crowdsourcing in the public management process. Secondly, crowdsourcing provides public authorities with better solutions at a lower cost in a creative way, and it requires the public bodies to open its decision-making process to acquire more external knowledge and intelligence actively. Thirdly, the crowdsourcing system is a social-technical system that can be used to support interaction and connectivity between people in public management (Hashimoto & Kano, 2018), therefore, it is required to focus on how to create and apply new technologies and tools to expand social actors or social organization behavior boundary. When researchers go into the future directions to fill the research gap, they must keep these ways in mind so as to enhance the effectiveness of crowdsourcing in public management.

What needs to be emphasized is being a form of e-public-participation in public administration and public policy (Kube et al., 2014), the virtue of crowdsourcing is engaging large, diverse participation rather than representative sampling, most contributions in crowdsourced policymaking come from self-selected participants in technical and social marginality, which means that the best contributions always come from the most unrepresentative people (Schmidhuber et al., 2019). This biased-sampling feature of crowdsourcing collides with the notion of equal participation and equal contribution rooted in the promise of democracy (Mergel, 2017). Besides, crowdsourcing is essentially an outcome-oriented action that aims to find solutions for intractable public problems through exploiting collective wisdom and diverse cognition outside of the government. In the existing literature, more attention has been paid to the positive contributions of crowdsourcing in public management, but the negative influences have been neglected intentionally or unintentionally. These efforts may lead to systematic bias in the studies of crowdsourcing in public management. To avoid such a dilemma, it is necessary to conduct a series of studies to discover the crowdsourcing paradox when a government wants both participation and control, efficiency and repetitiveness, process and outcome, and so on.

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## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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