Citizen Engagement With Open Government Data

A Systematic Literature Review of Drivers and Inhibitors

Purwanto, A.; Zuiderwijk-van Eijk, A.M.G.; Janssen, M.F.W.H.A.

**Important note**
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

# Citizen Engagement With Open Government Data:
## A Systematic Literature Review of Drivers and Inhibitors

Arie Purwanto, Delft University of Technology, The Netherlands

Anneke Zuiderwijk, Delft University of Technology, The Netherlands

Marijn Janssen, Delft University of Technology, The Netherlands

https://orcid.org/0000-0001-6211-8790

## ABSTRACT

Citizen engagement with open government data (OGD) can enhance the effectiveness of governments and improve not only the quality of public policy making but also public services provisioning and ability to address societal problems. Although previous research gives insight into citizen's drivers and inhibitors for engaging with OGD, they have not yet been integrated into a single conceptual model. The aims of this study are twofold: 1) to systematically review the literature on individual citizens' drivers and inhibitors for engaging with OGD and 2) to develop a conceptual model of citizen engagement with OGD based on the findings of the literature review. To attain this objective, the authors systematically analyzed 52 papers published in the period 2009-2019. Seven categories of drivers of citizen engagement are identified: citizen's profile, personal, performance-related, economic, social, technical, and political. Three groups of inhibitors are also identified: citizen's profile, technical, and political. This study helps in understanding how the engagement of citizens can be enhanced.

## KEYWORDS

Citizen Engagement, Conceptual Model, Factors, Literature Review, OGD, Open Government Data

## INTRODUCTION

Citizen engagement with OGD can enhance the effectiveness of governments and improve not only the quality of public policy-making but also public services provisioning and ability to address societal problems (Huijboom & Van den Broek, 2011). Citizen engagement with OGD refers to activities performed by citizens to produce artifacts such as applications, maps, visualizations, articles, or news based on the transformation of government data into fact, information, insight, interface, new data, or service (Davies, 2010; Susha, Grönlund, & Janssen, 2015). Society's collective expertise and knowledge that are harvested in an OGD engagement, such as hackathons, can produce artifacts

that create alternative solutions to solving societal issues (Kuk & Davies, 2011). For example, an election monitoring application built on top of open election data enables the provision of feedback to the election authorities regarding suspicious results that might lead to corruption (Graft, Verhulst, & Young, 2016).

Previous research in the discipline of social sciences shows that citizens are being driven to engage with OGD by factors like 'performance expectancy' and 'social influence' (Zuiderwijk, Janssen, & Dwivedi, 2015). A recent study in the United Kingdom (UK) shows that citizen engagement with OGD is driven by the relative advantage of open data, its compatibility, and the observability of its outcomes (Weerakkody, Irani, Kapoor, Sivarajah, & Dwivedi, 2017). In contrast, another study suggests that citizen engagement with OGD in public transportation hackathon is driven by intrinsic motivations such as having fun and enjoyable activities and intellectual challenge (Juell-Skielse, Hjalmarsson, Johannesson, & Rudmark, 2014). Furthermore, one study finds that citizen engagement with OGD in Swedish hackathons is mainly inhibited by resource-related issues, such as lack of time and money (Hjalmarsson, Johannesson, Juell-Skielse, & Rudmark, 2014). Yet, another study on open data barriers in the UK finds that not only resource problems inhibit citizen engagement with OGD, but also data quality and data portal quality issues (Martin, 2014). These findings suggest that the drivers and inhibitors that play a role in some instances of citizen engagement are different from those that play a role in other contexts. Various studies mention different drivers and inhibitors. Furthermore, studies on drivers and inhibitors of citizen engagement sometimes even draw contradictory conclusions.

Although previous research gives insight into citizen's drivers and inhibitors for engaging with OGD (e.g., Hossain, Dwivedi, and Rana (2016)), they have not yet been integrated into a single conceptual model. There is a lack of insight into the enabling and disabling conditions that moderate different types of OGD use (Safarov, Meijer, & Grimmelikhuijsen, 2017). Hence, there is a need for a comprehensive model of drivers and inhibitors that potentially provides a theoretical argument for citizen engagement with OGD.

A recent review conducted by Hossain et al. (2016) shows that most literature predominantly focuses on organizational and inter-organizational perspectives. Not surprisingly, the literature emphasizes organizational analysis on OGD provision since open government initiatives have hitherto been supply-driven (Evans & Campos, 2013). Despite citizen engagement is among the purposes of open government movement and engaged citizens are regarded as key to the success of OGD programs (Dietrich, 2015), most literature simply speculates about citizens (Safarov et al., 2017). Current research is lacking studies at the individual level of analysis (Hossain et al., 2016), particularly citizens who engage with OGD.

The aims of this study are twofold: 1) to systematically review the literature on individual citizens' drivers and inhibitors for engaging with OGD, and 2) to develop a conceptual model of citizen engagement with OGD based on the findings of the literature review. The scientific contribution of this paper is twofold. First, it provides a systematic review of drivers and inhibitors of citizen engagement with OGD at the level of individual citizens, which the current open data literature is lacking. Second, this study synthesizes the literature and proposes a conceptual model for investigating factors that influence citizen engagement with OGD based on empirical findings of current open data research. This study helps in understanding how the engagement of citizens can be enhanced.

This paper is structured as follows. We present the Systematic Literature Review (SLR) approach that guides this research in the next section, followed by the discussions of the main review findings and the descriptive analysis of the reviewed papers. Then, we discuss the synthesis of the results based on the proposed research questions, followed by the theoretical and practical implications of the research. Finally, we provide conclusions and delineates the limitations of this review and future research directions.

## RESEARCH APPROACH

In this study, we followed the guidelines for conducting SLR as proposed by Kitchenham and Charters (2007). We also apply backward and forward-searching to the included articles as recommended by Webster and Watson (2002).

A critical step required before the work of an SLR can start in confidence is the development of the review protocol, which functions as a plan for conducting the review (Okoli & Schabram, 2010). Essentially, a review protocol "specifies the research question being addressed and the methods that will be used to perform the review" (Kitchenham et al., 2009, p. 4). In the following sections, we present the different elements of our protocol, as depicted in Figure 1.

**Figure 1. The SLR approach adapted from Kitchenham and Charters (2007)**
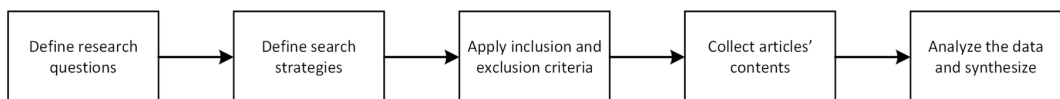


## Research Questions

In this study, we use the SLR approach for several purposes. First, to position this research relative to current knowledge, to suggest areas for further investigation and to build on this knowledge. For this purpose, the following research questions guide our SLR:

1.   In which contexts did previous research investigate citizen engagement with OGD?
2.   What are the capabilities and roles of citizens who engage with OGD according to previous research?
3.   What types of OGD citizen engagement are investigated by previous research?
4.   What are the theories and theoretical models that have been indicated (e.g., developed, used, tested, or applied) in previous research concerning citizen engagement with OGD?

We asked the first three questions to obtain insight into the actual settings of OGD that might drive or inhibit citizen engagement. Understanding context is essential since different countries have different purposes of publishing OGD (Schwegmann, 2012; Ubaldi, 2013). Insight into the capabilities and roles of citizens is also crucial to understand who the citizens are as direct users of OGD (Johnson & Robinson, 2014; Susha et al., 2015). Our current knowledge about the engagement is limited to hackathons or innovation contests (Safarov et al., 2017), while citizen or community-led OGD engagement also exists in practice (Young & Verhulst, 2016). The fourth question was asked to understand the role of the use of particular theories and theoretical models in evaluating factors that drive or inhibit citizen engagement.

The second purpose of our literature review was to summarize existing evidence concerning individual citizens' drivers and inhibitors for engaging with OGD. Consequently, the following research questions were formulated:

5.   What factors drive individual citizens to engage with OGD according to previous research?
6.   What factors inhibit individual citizens from engaging with OGD according to previous research?

## Search Strategies

A search strategy concerns the formulation of search terms which take into account all possible alternative words, the wording of search strings based on the search terms, and the selection of academic publication databases over which the search will be carried out (Kitchenham & Charters, 2007). Table 1 provides the search terms used in our SLR. We built a search string comprised of two sets of words representing both *engagement*, *open government data*, and alternative terms (see Appendix 1 for the complete search query). We added *participation* and *involvement* because, in the Information Systems domain, user engagement is regarded as a complete set of user participation and user involvement toward information systems (Hwang & Thorn, 1999; Kappelman & McLean, 1992). We also included *acceptance*, *adoption*, *use*, and related words in our search terms. We included these terms because engaging with OGD implies that citizens have to adopt OGD – a process that begins with accepting OGD and ends with making full use of it (Renaud & van Biljon, 2008).

Table 1. The search terms used in our systematic literature review

| Engagement | Open Government Data |
|---|---|
| Engag* (engage, engaging, engagement) | Open government data |
| Participat* (participate, participating, participation) | Public sector information |
| Involv* (involve, involves, involving, involvement) | Open data |
| Accept* (accept, accepting, acceptance) | Public data |
| Adopt* (adopt, adopting, adoption) | Public government data |
| Use, usage, using | Open public sector data |
| | Open public data |
| | Big open data |
| | Big open public sector data |
| | Open public sector information |
| | Open government information |

We sought for papers in the following databases: Scopus and Web of Science. Scopus also indexes well-known publishers of peer-reviewed literature such as ScienceDirect (Elsevier), Springer, Wiley-Blackwell, Taylor & Francis, Sage, Emerald, Oxford University Press, Cambridge University Press, ACM, and IEEE. Our search string is applied to the title, abstract, and keywords of publications.

## Inclusion and Exclusion Criteria

In this section, we discuss the inclusion and exclusion criteria that we applied to our SLR. In general, studies included in this review must be published as a journal paper or conference paper or in conference proceedings in the period 2009 to 2019 (10 years) and written in the English language. We start our review from the year 2009 since previous research found that the number of publications using the term *open data* sharply increased since that year. This increase is likely due to the beginning of the worldwide adoption of open data programs inspired by Obama's (2009) first executive order on *Transparency and Open Government*. Hence, we argue that choosing the year 2009 as a selection criterion is justifiable. Only studies following empirical research methods (e.g., case study, survey, experiment) were included. Document analyses, including literature reviews and conceptual papers, were excluded. We also excluded retracted papers and original papers which have been extended, for example, a conference paper which was extended to a journal article. We focused on studies investigating citizen engagement with OGD and excluded studies of OGD provision and usage by businesses and governmental and non-governmental organizations. Finally, we excluded publications from irrelevant fields such as medical ethics, physics, and astronomy.

## Data Extraction

Table 2 depicts the data that we extracted for each study included in our review.

By querying the search terms described in Table 1, we retrieved 8450 publications from Scopus (n=2589) and Web of Science (n=5861). Using guidelines from Kitchenham and Charters (2007), we performed seven steps of the inclusion/exclusion process (see Figure 2). In the first stage, the retrieved papers were filtered out based on the source of the conference or journal. Articles without source information were excluded. Furthermore, we determined the relevance of the sources based on their title and filtered out documents from irrelevant sources (e.g., Nucleic Acids Research or Astronomy). The first stage resulted in 1222 publications. In the second stage, we removed duplicates from the two databases, and 1038 papers remained. In the third stage, although non-conference and journal items have been filtered out using the search query, publications such as editorials, tutorials, ongoing research, posters, workshops, and panels were still collected in the search. Therefore, such publications were excluded, resulting in 970 papers. We scanned the abstracts of the publications and discarded abstracts containing irrelevant topics such as blockchain, machine learning, and virtual reality-based participation. Non-empirical papers such as literature reviews, conceptual articles, research notes, and technical reports of open data platforms were also dismissed. The fourth stage led to 108 included publications. In the fifth stage, we scanned the content of the publications and discarded irrelevant studies such as the use of open data by the private sector or non-governmental organizations, and 43 papers were included. In the sixth stage, we used the Scopus database to perform a backward search by examining the references of the included publications and forward search by exploring articles citing the publications. The backward and forward search aims to find more relevant papers since they might not be discovered in the primary search (Webster & Watson, 2002). We added six articles from the backward search and three more from the forward search (n=9). The additional papers collected through the backward and forward search were not found in the first instance of the search since they do not contain the specified keywords.

**Table 2. The data extracted from each of the included papers**

| | |
|---|---|
| **Publication-related data** | Title, name of authors, abstract, keywords, type of publication (journal or conference paper), name of publication outlet, publication year, research approach, data collection and analysis method |
| **Context of the study (RQ1)** | Country, city, data collection period, the domain of OGD |
| **Citizen's capabilities and roles (RQ2)** | Number and type of respondents, respondent demographics |
| **Types of engagement (RQ3)** | The setting of the OGD usage, respondent activities, output(s) of OGD usage |
| **Theories and theoretical models (RQ4)** | Theoretical framework, hypotheses development, theoretical implication(s) |
| **Drivers (RQ5)** | Findings concerning demand, needs, interest(s), purpose, motivation(s), influencing factor(s) |
| **Inhibitors (RQ6)** | Findings concerning challenges, difficulties, problems, impediments, barriers |

In total, 52 publications were selected for our SLR (see Appendix 2 for a complete overview). The search results show that the conference outlets of the reviewed papers are predominantly from the fields of Information Systems and Public Administration. At the same time, the journal outlets include more diverse areas such as political science, theoretical computer science, information science, geo-information, and public policy.

**Figure 2. The execution stages of the systematic literature review**
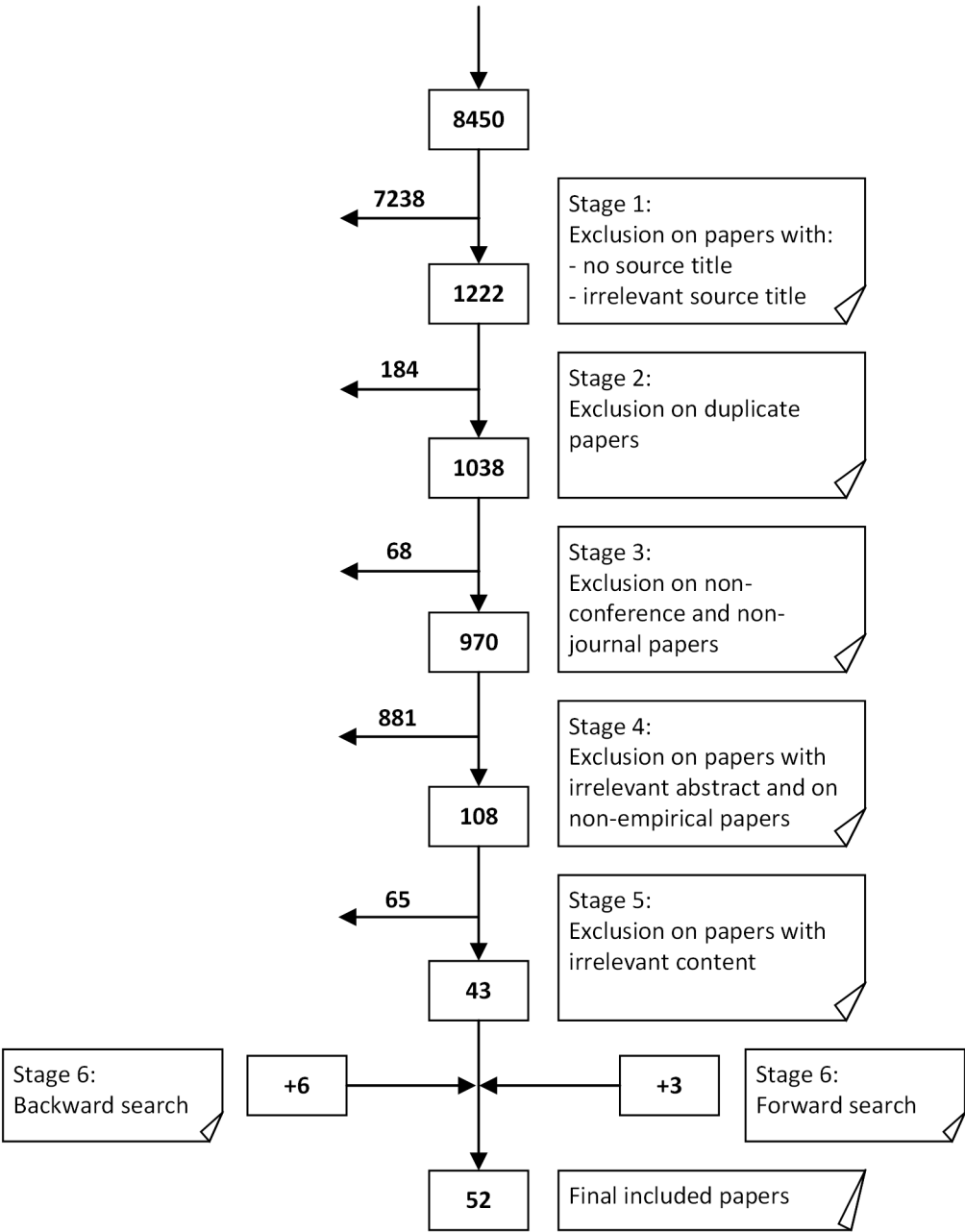


Figure 3 depicts the distribution of the reviewed papers per year. The execution of our selection criteria did not result in papers published in 2009 and 2010; papers published from 2011 onwards are included. Kuk and Davies (2011) are among the firsts to study citizen engagement with the UK government's OGD, launched in 2010, from the perspectives of participants in hackathons. This result may be due to research produced from 2009 to 2010, were mainly focused on the *supply side* of OGD, which includes technical studies on the standardization of metadata or the provision of linked

**Figure 3. The distribution of the reviewed papers per year**
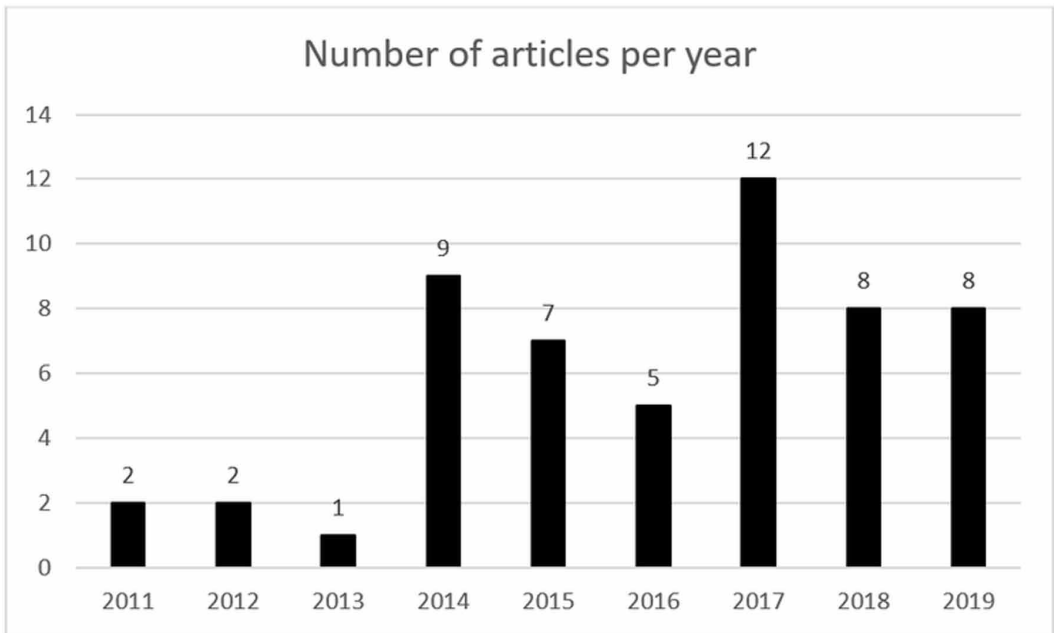


data, but its focus did exclude citizen engagement. As OGD is gradually adopted widely, the focus of research slowly shifted to OGD use.

## Data Analysis and Synthesis

We use qualitative data analysis to analyze and synthesize the reviewed studies. All of the information extracted from each reviewed paper in the previous stage was recorded in Excel worksheets. The data underlying our SLR and our protocol are available online at the 4TU Research Data portal http:// doi.org/10.4121/13095809). The findings from our data analysis and synthesis can be found in the following sections.

## FINDINGS

Based on Kitchenham and Charters (2007) recommendation, we carried out the descriptive analysis and content analysis to qualitatively summarize the results of the reviewed papers. The results of our analyses are presented in each of the following subsections to answer the corresponding research questions.

## Descriptive Analysis: The Context of OGD Citizen Engagement

In this subsection, we answer our first research question, namely: "in which contexts did previous research investigate citizen engagement with OGD?" Half of the reviewed papers (n=26) use a case study research method utilizing interviews, workshops, brainstorming, and focus group discussions on collecting qualitative data (see Figure 5). At the same time, slightly more than two-fifths of the studies (42.31%, n=22) concerns quantitative survey-based studies. Six quantitative studies are regarded as exploratory since they aimed at exploring or describing a phenomenon instead of predicting or explaining causation. Three other papers are mixed methods studies, applying a combination of quantitative and qualitative approaches. The use of mixed methods indicates that merely an individual

Figure 4. The distribution of the research methods used in the reviewed papers
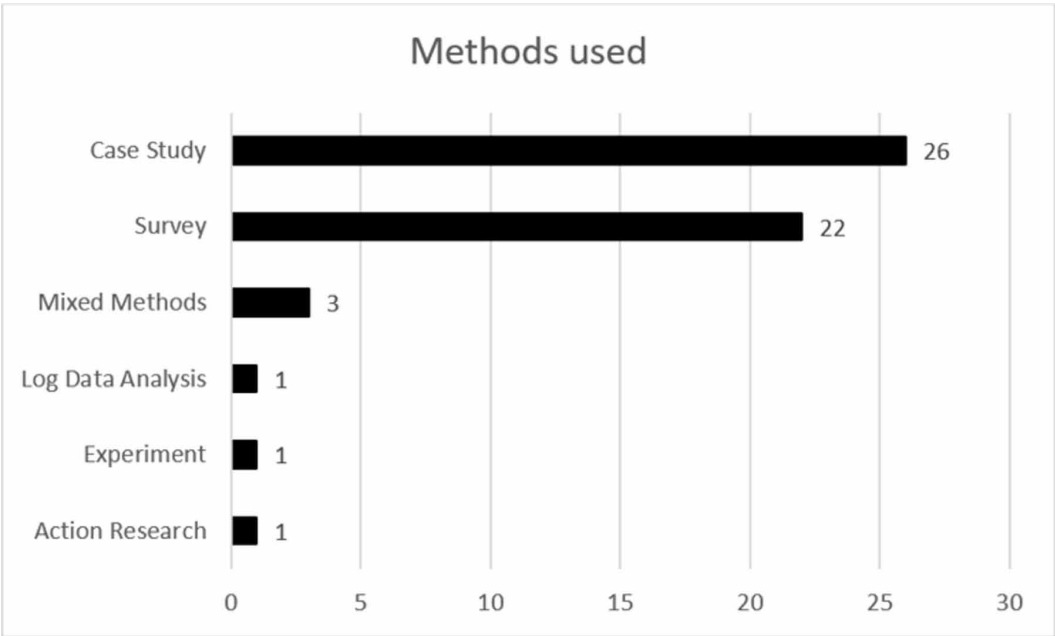


type of inquiry, quantitative or qualitative, is not sufficient to explain the phenomenon under study (Creswell & Plano Clark, 2018). The remaining papers (n=3) use different methods: action research (Jarke, 2019), experiment (Zuiderwijk, Janssen, & Susha, 2016), and log data analysis (Dittus, Quattrone, & Capra, 2016). Despite the indication that as a research theme, citizen engagement with OGD is still in its infancy phase and exploratory, the diversity of approaches used to study the phenomenon is gradually increasing. Yet, studies using critical approaches are still lacking.

Concerning the spatial dimension, we found that more than half of the reviewed papers investigate citizen engagement with OGD in European countries (n=30), predominantly from the UK, Sweden, the Netherlands, and Germany. Nearly one-fifth of the reviewed studies focus on OGD engagement in Asian countries (n=10), over which eight of the studies investigate the engagement in individual Asian countries. Nine other papers have individual (n=5) or multiple (n=4) American countries as the primary context under investigation. Almost a handful of papers examine citizen engagement with OGD in Australian (n=2) and African (n=2) context. Moreover, thirteen out of the remaining reviewed papers study citizen engagement in state or city context, predominantly European cities.

More than two-thirds of the reviewed studies carried out data collection from 2010 until 2019 (n=36). Sixteen studies did not specify the period of their research. More than half of the reviewed papers (n=31), predominantly using the quantitative survey approach (n=21), did not specify the domains of OGD understudy, while the remaining studies explicitly investigate particular areas. Public transportation (n=7), government spending (n=4), public services (n=3), and education (n=3) are predominant topics among the investigated domains.

Rather than specifying their profiles based on capabilities that they possess and roles that they play during an engagement, ten of the reviewed papers, mostly employing a quantitative approach (n=9), study "citizens" in general. Interestingly, a handful of the reviewed studies indicated that the citizens' knowledge regarding OGD and their experience in engaging with OGD might be limited or non-existent (n=5). For example, Weerakkody, Irani, et al. (2017) found that only 30% of the sampled citizens participating in their survey have used open data, while Osagie et al. (2017) identified 27.8% of the sampled citizen-respondents had no significant experience with OGD use. Another example

concerning sampled parents of primary school pupils in the Netherlands showed that only 36% of the sampled parents had visited the website providing education performance data (de Kool & Bekkers, 2015, 2016). Lastly, Afful-Dadzie and Afful-Dadzie (2017) discovered that 61.1% of the sampled media practitioners understudy had not heard of OGD.

## Content Analysis

### *Capabilities and Roles of Citizens who Engage with OGD*

In this subsection, we answer the question: 'what are the capabilities and roles of citizens who engage with OGD according to previous research?' Capabilities concern the ability of citizens that may be unobservable, whereas roles are related to what citizens do, which are relatively observable during an engagement. The capabilities and roles of citizens vary, and a citizen having particular capabilities may have one or more roles. For example, a citizen working as an application developer can contribute to writing programming codes and, at the same time, analyzing datasets. The profiles of citizens, indicated by their capabilities, are assumed to influence the way they engage with OGD or their roles in the engagement. Hence, it is considered that different drivers and barriers affect citizens' potential roles when engaging with OGD.

In the examined papers, 21 (40.4%) mention citizens' capabilities. These studies assumed that citizens under investigation had engaged with OGD. Yet, the context concerning the OGD with which citizens engage and activities carried out in the engagement was either unknown or simulated. Citizens' capabilities identified in these studies include academia (e.g., researchers, faculty members, students, and teachers, professionals or experts, journalists (e.g., bloggers, content writers, photojournalists), activists from civil society organizations, and company employees (see Table 3).

Eight studies (15.4%) investigated citizens' roles in different context-bound OGD engagement (see Table 4), such as participation in open government projects (Hutter, Füller, & Koch, 2011; Schmidthuber, Piller, Bogers, & Hilgers, 2019), public service hackathons (Gama, 2017; Hjalmarsson et al., 2014; Kuk & Davies, 2011), humanitarian mapping (Dittus et al., 2016), electoral initiative (Purwanto, Zuiderwijk, & Janssen, 2018), and marketplace innovation (Smith, Ofe, & Sandberg, 2016). Prominent roles that are identified in these studies include app developers in open data hackathons and citizen-led initiatives and contributors of ideas, feedback, and idea evaluation (Hutter et al., 2011), new data to maps (Dittus et al., 2016), and scrutinization of election data (Purwanto et al., 2018).

Thirteen studies (25%) specified both citizens' capabilities and their roles in OGD engagement, and these results enable us to analyze the relationship between capabilities and roles to understand whether particular capability can be linked to a specific role in the engagement (see Table 5). In a fully connected relationship, the capabilities mentioned by the researchers can be directly associated with particular roles. For example, Rudmark, Arnestrand, and Avital (2012) identify a student and a freelancer who engage with public transportation data to develop Android and iOS apps correspondingly. In a partially linked relationship, particular capabilities can be assumed to be directly associated with a similar role (e.g., developers, data analysts, designers). At the same time, other capabilities cannot be linked to particular roles since the authors did not mention such relation explicitly. For instance, Choi and Tausczik (2017) identify students, researchers, journalists, and data scientists as the capabilities of participants of an open data hackathon. They suggest that these citizens play roles as civic hackers and data analysts. A data scientist in the hackathon might be a data analyst as well, but associating students' roles with developers or data analysts are conjectural since no supporting evidence is available. Our findings suggest that the way citizens engage with OGD is not contingent upon solely citizens' capabilities but also their roles in the engagement.

### *The Type of OGD Citizen Engagement*

In this subsection, we answer our third research question, namely: 'what types of OGD citizen engagement are investigated by previous research?' Purwanto, Zuiderwijk, and Janssen (2020) suggest four types of OGD engagement based on the initiatory level of citizens and the level of government

Table 3. The overview of reviewed studies that identify citizens' capabilities (n=21)

| Capabilities | Source(s) |
|---|---|
| *Academia*, including faculty members, students, researcher, teacher | Benitez-Paez, Degbelo, Trilles, and Huerta (2018), Beno, Figl, Umbrich, and Polleres (2017), Canares (2014), Charalabidis, Loukis, and Alexopoulos (2014), Fitriani, Hidayanto, Sandhyaduhita, Purwandari, and Kosandi (2019), Hellberg and Hedström (2015), Khurshid, Zakaria, Rashid, and Shafique (2018), Martin (2014), Osagie et al. (2017), Ruijer et al. (2017), Saxena and Janssen (2017), Talukder, Shen, Talukder, and Bao (2019), Toots, McBride, Kalvet, and Krimmer (2017), Zuiderwijk, Janssen, Choenni, Meijer, and Alibaks (2012), Zuiderwijk, Janssen, et al. (2015), Zuiderwijk, Susha, Charalabidis, Parycek, and Janssen (2015), Zuiderwijk et al. (2016), Wang, Richards, and Chen (2018, 2019) |
| *Activists* who work for Civil Society Organization (CSO) or Non-profit / Non-Governmental Organization (NGO) | Beno et al. (2017), Canares (2014), Martin (2014), Ruijer et al. (2017) |
| *Company employees*, working for the private sector (no particular responsibilities specified) | Beno et al. (2017), Fitriani et al. (2019), Martin (2014), Ruijer et al. (2017) |
| *Information Technology (IT) Consultants* to government | Hellberg and Hedström (2015) |
| *Data analysts* | Benitez-Paez et al. (2018) |
| *Application developers* | Benitez-Paez et al. (2018), Ojo et al. (2016), Osagie et al. (2017) |
| *Entrepreneurs*, looking for a business opportunity from open data | Benitez-Paez et al. (2018), Talukder et al. (2019) |
| *Journalists*, creating professional news or citizen journalism articles | Afful-Dadzie and Afful-Dadzie (2017), Benitez-Paez et al. (2018), Canares (2014), Ruijer et al. (2017) |
| *Politicians* | Benitez-Paez et al. (2018) |
| *Professionals*, e.g., managers, experts, project leaders, data intermediaries | Benitez-Paez et al. (2018), Ojo et al. (2016), Talukder et al. (2019), Zuiderwijk, Susha, et al. (2015), Zuiderwijk et al. (2016), Wang et al. (2018, 2019) |

Table 4. The overview of reviewed studies that identify citizens' roles (n=8)

| Roles | Source(s) |
|---|---|
| *Analysts* who download, cleanse, and analyze data using particular statistical methods | Kuk and Davies (2011) |
| *Contributors* who contribute to share ideas, provide feedback, evaluate ideas of others, verify and enrich datasets | Dittus et al. (2016), Hutter et al. (2011), Purwanto et al. (2018), Schmidthuber et al. (2019) |
| *Developers* who design and develop mock-ups, prototypes, interfaces, or applications | Gama (2017), Kuk and Davies (2011), Purwanto et al. (2018), Smith et al. (2016) |
| *Leaders* who manage and lead a team of other roles | Gama (2017), Hjalmarsson et al. (2014), Purwanto et al. (2018) |

involvement with the end-users of open data: 1) no engagement, 2) government-led engagement, 3) citizen-led engagement, and 4) co-produced engagement. We examined how many of the studies in our sample relate to the four types of OGD engagement, as mentioned above (see Table 6). Our analysis

Table 5. The overview of reviewed studies that identify citizens' capabilities and roles (n=13)

| Capabilities and roles are specified and can be fully linked (n=7) | | |
|---|---|---|
| **Capabilities** | **Roles** | **Source(s)** |
| Academia (e.g., students, researchers) | Developers | Crusoe, Simonofski, Clarinval, and Gebka (2019), dos Santos Brito, dos Santos Neto, da Silva Costa, Garcia, and de Lemos Meira (2014), Rudmark et al. (2012), Juell-Skielse et al. (2014) |
| | Data analysts | Crusoe et al. (2019), Whitmore (2014) |
| Professionals | Developers | Rudmark et al. (2012) |
| Developers | | Juell-Skielse et al. (2014) |
| Domain experts | | Juell-Skielse et al. (2014) |
| Company employees | | Smith and Sandberg (2018) |
| Entrepreneurs | | Smith and Sandberg (2018) |
| Hobbyists | | Smith and Sandberg (2018) |
| Non-experts | Contributor | Jarke (2019) |
| *Capabilities and roles are specified and can only be partially linked (n=5)* | | |
| **Capabilities** | **Roles** | **Source(s)** |
| Professional, designer, developer | Designer, developer | Maruyama, Douglas, and Robertson (2013) |
| Academia, journalist, data analyst | Developer, data analyst | Choi and Tauszik (2017) |
| Developer, domain expert, academia | Developer, data promotor | Hivon and Titah (2017) |
| Non-expert, developer, academia | Developer | Khayyat and Bannister (2017) |
| Company employee, data analyst, developer, analyst, professional, domain expert, academia, designer | Developer, designer, data analyst, domain analyst | Purwanto, Zuiderwijk, and Janssen (2019) |
| *Capabilities and roles are specified yet cannot be linked (n=1)* | | |
| **Capabilities** | **Roles** | **Source(s)** |
| Academia, professional | Data analyst, developer, promotor | Cranefield, Robertson, and Oliver (2014) |

shows that more than half of the reviewed papers did not indicate any type of OGD engagement (55.77%, n=29). At the same time, one study reported the absence of citizen engagement in the cases studied (Canares, 2014). A quarter of the reviewed papers (25%, n=13) investigated government-led engagement which typically takes form in online participation (Hutter et al., 2011), open data hackathons (Juell-Skielse et al., 2014), or fellowship (Maruyama et al., 2013) sponsored by the government. Eight other studies examined citizen-led OGD engagement in different domains such as election (dos Santos Brito et al., 2014), defense (Whitmore, 2014), and humanitarian mapping (Dittus et al., 2016). Lastly, only one remaining paper studied co-produced OGD engagement in a smart city living laboratory aiming to create application mockups (Veeckman & van der Graaf, 2015).

### Theories and Theoretical Models in OGD Citizen Engagement Studies

In this subsection, we answer our fourth research question: 'what are the theories and theoretical models that have been indicated (e.g., developed, used, tested, or applied) in previous research concerning citizen engagement with OGD?' Our analysis of previous research shows that slightly more than

Table 6. The overview of the OGD engagement type and outcomes of the reviewed papers

| Engagement Type (derived from Purwanto et al. (2020)) | Outcomes | Source(s) |
|---|---|---|
| **No engagement (n=1)** | NA | Canares (2014) |
| **Government-led (n=13)** | Application (e.g., tools, service prototype), ideas (e.g., concepts, best practices), analysis report | Choi and Tausczik (2017), de Deus Ferreira and Farias (2018), Gama (2017), Hellberg and Hedström (2015), Hivon and Titah (2017), Hjalmarsson et al. (2014), Hutter et al. (2011), Juell-Skielse et al. (2014), Kuk and Davies (2011), Maruyama et al. (2013), Purwanto et al. (2019), Schmidthuber et al. (2019), Wijnhoven, Ehrenhard, and Kuhn (2015) |
| **Citizen-led (n=8)** | Application (e.g., service), analysis report, maps | dos Santos Brito et al. (2014), Dittus et al. (2016), Jarke (2019), Purwanto et al. (2018), Smith et al. (2016), Smith and Sandberg (2018), Whitmore (2014), Rudmark et al. (2012) |
| **Co-produced (n=1)** | Application (mockup) | Veeckman and van der Graaf (2015) |

two-fifth of the reviewed papers (n=21) did not indicate any theory, while 31 studies mentioned one or more theories. The theories mentioned in the reviewed studies are incredibly diverse. Only a few theories are applied in more than one study, including the Technology Acceptance Model (n=7), Unified Theory of Acceptance and Use of Technology (n=5), Diffusion of Innovations (n=3), Information System Success Model (n=3), and Self-Determination Theory (n=3). Several other theories are mentioned only in one study (see Table 7).

Furthermore, theory and theoretical models were used in different phases of research. Slightly more than two-fifth of these papers (n=23) used theory to develop the research framework or model and to test hypotheses. Seven other studies mentioned the theory to analyze or discuss the findings and implications of the study on existing theories. Several studies combined more than one theory when developing the research model and testing hypotheses (n=8). Our findings suggest that, on the one hand, theory development is not yet the focus of studies on citizen engagement with OGD and that the field is somewhat exploratory. On the other side, although different theories were used by most of the sampled studies, a converging pattern emerges as these theories are rooted in behavioral research. Furthermore, the findings show that understanding citizen engagement can be approached using an individual behavior perspective. Yet, the integration of different theories or consistent application of particular behavioral theories is lacking.

*Factors Driving Individual Citizens To Engage with OGD*

In this subsection, we answer our fifth research question: "what factors drive individual citizens to engage with OGD according to previous research?" Most of the reviewed papers did not exclusively focus on analyzing and reporting drivers of citizen engagement with OGD. Therefore, we excerpted empirical data that indicates the *demand*, *needs*, and *interests* of citizens, *purpose* of using OGD, *motivations* for participating in OGD engagement such as hackathon or open government projects, or *factors* influencing citizens' intention to use OGD. We found that a sample of more than two-thirds of the reviewed papers (n=36, 69.2%) provides evidence concerning factors that drive individual citizens to engage with OGD. More than a quarter of the sample (n=11, 30.6%) focuses exclusively on reporting factors that influence citizens' intention to accept and use different elements of open data (e.g., technologies, websites, data). In contrast, nearly a quarter of the sample (n=7, 19.4%) focuses on motivations for participating in open data-based initiatives, such as hackathons, digital innovation contests, and open government projects.

**Table 7. The overview of theories or theoretical models mentioned in the reviewed papers**

| Usage of Theory | Name of Theory | Source(s) |
|---|---|---|
| **Application (e.g., for developing a research framework/model, testing hypotheses, reflecting upon)** | Computer-mediated Transparency | Ojo et al. (2016) |
| | Diffusion of Innovations | Weerakkody, Irani, et al. (2017), Khurshid et al. (2018), Jurisch, Kautz, Wolf, and Krcmar (2015) |
| | Expectation Confirmation Theory | Zuiderwijk et al. (2016) |
| | Free/Libre Open Source Software Motivation Theory | Wijnhoven et al. (2015) |
| | Information System Success Model | Charalabidis et al. (2014), Talukder et al. (2019), Fitriani et al. (2019) |
| | Model of Coordinated Action | Choi and Tausczik (2017) |
| | Motivation Theory | Wirtz, Weyerer, and Rösch (2018) |
| | Multi-Level Perspective | Martin (2014) |
| | Open Innovation Theory | Hjalmarsson et al. (2014) |
| | Self-Determination Theory | Hutter et al. (2011), de Deus Ferreira and Farias (2018), Schmidthuber et al. (2019) |
| | Technology Acceptance Model | Charalabidis et al. (2014), Jurisch et al. (2015), Weerakkody, Kapoor, Balta, Irani, and Dwivedi (2017), Fitriani et al. (2019), Wang et al. (2018), Wirtz et al. (2018), Wirtz, Weyerer, and Rösch (2019) |
| | Theory of Planned Behavior | de Deus Ferreira and Farias (2018), Fitriani et al. (2019) |
| | Unified Theory of Acceptance and Use of Technology | Jurisch et al. (2015), Zuiderwijk, Janssen, et al. (2015), Zuiderwijk et al. (2016), Saxena and Janssen (2017), Talukder et al. (2019) |
| | User Participation | Hivon and Titah (2017) |
| | Utility Theory | Afful-Dadzie and Afful-Dadzie (2017) |
| **Analytical, i.e., for discussing the findings of the research concerning the study** | Activity Theory | Khayyat and Bannister (2017) |
| | Collective Action | Juell-Skielse et al. (2014) |
| | Collective Intelligence | Ruijer et al. (2017) |
| | Complementarity Theory | Kuk and Davies (2011) |
| | Information Technology Infrastructure Library Lifecycle Service Model | Smith and Sandberg (2018) |
| | Punctuated Change | Rudmark et al. (2012) |
| | Self-efficacy Theory | Dittus et al. (2016) |

We found not only different constructs such as the user-friendliness of the OGD portal and relevance of OGD but also similar ones such as the perception of relative advantage and the perception of usefulness. We classified the constructs in the following seven categories: 1) citizen's profile, 2) personal factors, 3) performance-related factors, 4) economic factors, 5) social factors, 6) technical factors, and 7) political factors. *Citizen's profile* concerns factors related to a citizen's characteristics

that may influence one's behavior to engage with OGD. *Personal* factors refer to the citizen's intrinsic motivations to engage with OGD. *Performance-related* factors concern the citizen's motivations to engage with OGD to fulfill the projected or required tasks. *Economic* factors refer to the citizen's motivations to create economic value out of OGD engagement. *Social* factors relate to the societal and community values and beliefs that may influence the citizen's behavior to engage with OGD. *Technical* factors refer to the citizen's perception towards the technological artifacts and their non-technological supports provided in facilitating OGD engagement. *Political* factors relate to the citizen's expectancy of realizing the benefits of OGD engagement in influencing public policy and governance. Table 8 provides the detailed results of this analysis.

The three most frequently mentioned factors that drive citizens to engage with OGD are related to performance-related motivation, intrinsic motivation, and political interest. The expectation for gaining advantage from OGD engagement, such as monetary rewards and performing work tasks, is found to be the most influential extrinsic motivation. The feeling of fun and joy of exploring OGD, rooted in intrinsic motivation, is also mentioned as an influential factor. Interests and expectancy in politics to create a public good, transparency, and anti-corruption are influential political factors that drive citizen engagement. We also found that these three drivers are rarely integrated into a theoretical framework for analyzing and evaluating factors that influence citizen engagement with OGD; they are typically investigated separately.

### Factors Inhibiting Individual Citizens From Engaging with OGD

In this subsection, we answer the question: 'what factors inhibit individual citizens from engaging with OGD according to previous research?' We found that similar to the previous section, most of the reviewed papers did not exclusively focus on analyzing and reporting inhibitors of citizen engagement with OGD. Therefore, we obtained evidence concerning the inhibitors from excerpted empirical data that indicate the challenges, difficulties, problems, impediments, and barriers felt and experienced by citizens before engaging with OGD or during the OGD engagement. We found a sample of 26 articles (50%) among the population of the reviewed papers that provide such evidence of inhibiting factors. Nearly two-fifths of the sample (n=10, 38.46%) focus exclusively on reporting barriers of both simulated and actual open data use for innovation. In contrast, slightly more than a quarter of the sample (n=7, 26.92%) evaluate the challenges of the usability of open data platforms and barriers faced during the requirement and design phase of new open data programs.

We categorized various constructs found in the excerpted evidence in the following three categories of inhibitors: 1) citizen's profile, 2) technical factors, and 3) political factors (see Table 9). Factors that are most frequently found by researchers inhibiting citizens from engaging with OGD are as follows. Firstly, the perceptions of the complexity in handling datasets, secondly, particular data quality issues such as timeliness, interoperability, completeness, and format, and thirdly, lack of resources (e.g., time, money, knowledge, skill). We found that the latter inhibitors associated with data quality issues have already been identified in OGD research carried out many years ago (Zuiderwijk et al., 2012). Yet, the problems do not seem to cease to exist soon, and data quality is a recurring issue of OGD provision. Moreover, we found that inhibitors derived from personal factors, performance-related factors, economic factors, and social factors are nonexistent. This finding suggests that currently, it is generally accepted that engaging with OGD adds value to citizens' working performance and economy and society, yet it does not intrinsically demotivate citizens.

## CONCEPTUAL MODEL OF OGD CITIZEN ENGAGEMENT

The second objective of this study is to develop a conceptual model of OGD citizen engagement using the findings presented in the previous section. We synthesize a conceptual model that describes factors that drive an individual citizen to engage with or inhibit a citizen from engaging with OGD (see Figure 5). Different factors can positively or negatively influence citizen engagement with OGD. We

**Table 8. The overview of factors driving individual citizens to engage with OGD**

| Category | Drivers |
|---|---|
| *Citizen's profile* | Gender: male citizens are more likely to engage with OGD (Saxena & Janssen, 2017)<br>Education: citizens with higher educational qualification are more likely to engage with OGD (Wang et al., 2019)<br>Capability: citizens with different capabilities are more likely to be driven by different motivations (Purwanto et al., 2019; Smith & Sandberg, 2018), students, specialists, and human resource workers are more likely to engage with OGD (Wang et al., 2019)<br>Competency: citizens with Internet competence are more likely to engage with OGD (Wirtz et al., 2018)<br>Experience: citizens who have previous engagement experience will likely to engage with OGD again (Hutter et al., 2011; Purwanto et al., 2019) |
| *Personal factors* | Intrinsic motivation:<br>● Fun and enjoyment (de Deus Ferreira & Farias, 2018; Fitriani et al., 2019; Juell-Skielse et al., 2014; Khayyat & Bannister, 2017; Purwanto et al., 2018, 2019; Rudmark et al., 2012; Schmidthuber et al., 2019; Smith & Sandberg, 2018; Wijnhoven et al., 2015; Wirtz et al., 2018) such as exploring/playing with data (Smith & Sandberg, 2018)<br>● Altruism, i.e., attitude toward others (Khayyat & Bannister, 2017; Purwanto et al., 2017) such as civic duties (Wijnhoven et al., 2015), giving back to the country, searching for a higher purpose (Maruyama et al., 2013), doing something more meaningful (Jarke, 2019; Maruyama et al., 2013), and wanting to make a difference (Hellberg & Hedström, 2015)<br>● Intellectual challenge (Juell-Skielse et al., 2014; Khayyat & Bannister, 2017; Wirtz et al., 2018), e.g., solving problems (everyday personal issues or purely technical challenges) (Kuk & Davies, 2011; Rudmark et al., 2012; Smith & Sandberg, 2018)<br>● Compatibility, i.e., relevance to citizen's beliefs (Jurisch et al., 2015; Khurshid et al., 2018; Kuk & Davies, 2011; Weerakkody, Irani, et al., 2017; Wirtz et al., 2018)<br>● Learning new things (de Deus Ferreira & Farias, 2018; Gama, 2017; Jarke, 2019; Kuk & Davies, 2011) |
| *Performance-related factors (extrinsic motivation)* | Perceived relative advantage/usefulness (Jurisch et al., 2015; Toots et al., 2017; Weerakkody, Irani, et al., 2017; Weerakkody, Kapoor, et al., 2017; Wirtz et al., 2018, 2019) including performance expectancy (Purwanto et al., 2019; Smith & Sandberg, 2018; Talukder et al., 2019; Zuiderwijk, Janssen, et al., 2015), developing services and businesses (Smith & Sandberg, 2018)<br>Future career concerns (Kuk & Davies, 2011)<br>Recognition (de Deus Ferreira & Farias, 2018)<br>Observability (Weerakkody, Irani, et al., 2017) |
| *Economic factors* | Monetary/financial rewards (de Deus Ferreira & Farias, 2018; Kuk & Davies, 2011), economic motives (Khayyat & Bannister, 2017; Kuk & Davies, 2011), and potential gains (Smith & Sandberg, 2018) |
| *Social factors* | Social influence/approval (Choi & Tausczik, 2017; Fitriani et al., 2019; Purwanto et al., 2018; Saxena & Janssen, 2017; Talukder et al., 2019; Weerakkody, Kapoor, et al., 2017; Zuiderwijk, Janssen, et al., 2015)<br>Benefitting society (Choi & Tausczik, 2017; Khayyat & Bannister, 2017), e.g., solving a city's problems (Gama, 2017; Hivon & Titah, 2017)<br>Broadening social networks (Gama, 2017; Hellberg & Hedström, 2015; Hutter et al., 2011; Jarke, 2019; Purwanto et al., 2018) |
| *Technical factors* | Perceived ease of use (Fitriani et al., 2019; Jurisch et al., 2015; Weerakkody, Kapoor, et al., 2017; Wirtz et al., 2018, 2019)<br>System quality, i.e., drivers related to the characteristics of the system/platform/technology that provide access to data:<br>● Having functionalities/features that support capabilities, e.g., for data processing, user-level feedback (Charalabidis et al., 2014; Osagie et al., 2017; Talukder et al., 2019), knowledge sharing (Smith et al., 2016), interaction with other users (Osagie et al., 2017)<br>● User-friendly (Smith et al., 2016; Talukder et al., 2019) characterized by, e.g., simplicity, consistency, intuitiveness (Osagie et al., 2017)<br>● Available when accessed (Purwanto et al., 2018; Talukder et al., 2019), which sometimes is related to response time (Charalabidis et al., 2014)<br>Data quality, i.e., drivers related to the characteristics of the OGD itself:<br>● Relevant (Talukder et al., 2019; Toots et al., 2017), i.e., necessary data is provided<br>● Complete (Talukder et al., 2019), i.e., provided data is sufficient<br>● Timely (Talukder et al., 2019), i.e., provided data is up-to-date<br>● Reliable (Talukder et al., 2019), i.e., provided data can be trusted<br>Service quality, i.e., drivers related to the characteristics of the support services provided for the data and system usage:<br>● Help from, e.g., a specific person or group, for assisting users or support service is available (Osagie et al., 2017; Smith et al., 2016; Talukder et al., 2019; Wang et al., 2018), examples and success stories of open data use (Zuiderwijk, Susha, et al., 2015)<br>● Ease of influencing the data provision (Smith et al., 2016), e.g., citizen feedback is followed up correctly (Wijnhoven et al., 2015) |
| *Political factors* | Trust in government (Fitriani et al., 2019)<br>Need for change/improvements (e.g., increased government efficiency) (Cranefield et al., 2014; Hutter et al., 2011; Kuk & Davies, 2011; Wijnhoven et al., 2015)<br>Political participation, i.e., drivers related to citizen participation in public issues:<br>● Political interest and expectancy (Hutter et al., 2011; Jurisch et al., 2015; Wirtz et al., 2019), e.g., the creation of public good (Cranefield et al., 2014), transparency (Cranefield et al., 2014; Khayyat & Bannister, 2017; Wirtz et al., 2019) and anti-corruption (Purwanto et al., 2018; Wang et al., 2019) |

**Table 9. The overview of factors inhibiting individual citizens from engaging with OGD**

| Category | Inhibitors |
|---|---|
| *Citizen's profiles* | Age: the older citizens are, the less willing they are to engage (Wijnhoven et al., 2015)<br>Resources: lack of time (Hjalmarsson et al., 2014; Khayyat & Bannister, 2017; Ruijer et al., 2017; Smith & Sandberg, 2018), lack of resources (financial, educational and infrastructural) (Hjalmarsson et al., 2014; Khayyat & Bannister, 2017; Martin, 2014; Ruijer et al., 2017; Wijnhoven et al., 2015), lack of knowledge (Martin, 2014; Ruijer et al., 2017; Wijnhoven et al., 2015), lack of skills (Ruijer et al., 2017)<br>Awareness: lack of interest (Osagie et al., 2017), low awareness of citizen groups that data exists and provided (Canares, 2014), lack of demand (Martin, 2014), little data literacy (Hivon & Titah, 2017)<br>Experience: lack of experience (Veeckman & van der Graaf, 2015; Zuiderwijk et al., 2016)<br>Voluntariness: voluntary citizens are less likely to engage (Khurshid et al., 2018; Saxena & Janssen, 2017; Zuiderwijk, Janssen, et al., 2015) |
| *Technical factors* | Task complexity, e.g., effort expectancy (Saxena & Janssen, 2017; Zuiderwijk, Janssen, et al., 2015), task complexity (Dittus et al., 2016; Khayyat & Bannister, 2017; Ruijer et al., 2017; Smith & Sandberg, 2018), too complicated (Whitmore, 2014; Wijnhoven et al., 2015), burnout effect (Dittus et al., 2016)<br>System quality, i.e., inhibitors related to the characteristics of the system/platform/technology that provide access to data:<br>● Documentation, e.g., lack of proper documentation (Beno et al., 2017), lack of information about the dataset (Beno et al., 2017; Ruijer et al., 2017), lack of information about the APIs (Beno et al., 2017; Smith & Sandberg, 2018), fragmented documentation (Smith & Sandberg, 2018), lack of examples available for smart use of open data (Ojo et al., 2016)<br>● Functionality, e.g., no advanced search, lack of feedback mechanism (Zuiderwijk et al., 2012), inadequate preview, mapping, visualization, multiple data layering features (Ojo et al., 2016), lack of navigation (Zuiderwijk et al., 2016), lack of community functions (Smith & Sandberg, 2018)<br>● User-friendliness, e.g., lack of user-friendly interface (Martin, 2014; Ojo et al., 2016; Zuiderwijk et al., 2016)<br>● Integration, e.g., data platform silos (Benitez-Paez et al., 2018; dos Santos Brito et al., 2014)<br>● Responsiveness, e.g., unavailability, slow response times (Smith et al., 2016)<br>Data quality, i.e., inhibitors related to the characteristics of the OGD itself:<br>● Timeliness, e.g., uncertainty about data stream continuity (Cranefield et al., 2014; Khayyat & Bannister, 2017; Martin, 2014; Smith et al., 2016), stability (Martin, 2014), old data is gone off (Ojo et al., 2016; Zuiderwijk et al., 2012), data timeliness and latency (Khayyat & Bannister, 2017; Ruijer et al., 2017), lack of updates of published data (Benitez-Paez et al., 2018; Ojo et al., 2016; Zuiderwijk et al., 2012)<br>● Interoperability, e.g., lack of standards for data and cataloging, describing and linking data (dos Santos Brito et al., 2014; Ojo et al., 2016; Zuiderwijk et al., 2012), lack of standard (Beno et al., 2017; Khayyat & Bannister, 2017), no interoperability of open data infrastructures with other systems (Zuiderwijk et al., 2012), data cannot be combined (Crusoe et al., 2019)<br>● Format, e.g., no user-friendly file-formats (Ojo et al., 2016), layered request-based structure and format (Smith et al., 2016), the format is not machine-readable (Beno et al., 2017; Ruijer et al., 2017), lack of data format (Smith & Sandberg, 2018), formats are too complex to handle (Whitmore, 2014)<br>● Completeness, e.g., datasets are not complete (Beno et al., 2017; Osagie et al., 2017; Ruijer et al., 2017; Whitmore, 2014; Zuiderwijk et al., 2012), only limited datasets available (Smith & Sandberg, 2018; Whitmore, 2014)<br>● Accessibility, e.g., difficulty in locating and accessing data (Benitez-Paez et al., 2018; Cranefield et al., 2014; de Kool & Bekkers, 2016; Ojo et al., 2016; Ruijer et al., 2017; Wang et al., 2018)<br>● Metadata, e.g., contextual metadata is lacking (Zuiderwijk et al., 2012), limited metadata (Martin, 2014), inconsistent metadata, incomplete metadata, non-existent metadata (Beno et al., 2017)<br>● Availability, e.g., data are not published, data are not available for free (Zuiderwijk et al., 2012), lack of data (Crusoe et al., 2019; Smith & Sandberg, 2018; Whitmore, 2014)<br>● Accuracy, e.g., lack of accuracy of the data (Osagie et al., 2017; Whitmore, 2014; Zuiderwijk et al., 2012)<br>Service quality, i.e., inhibitors related to the characteristics of the support services provided for the data and system usage:<br>● Availability, e.g., no support or help or training for the use of the data is provided (Zuiderwijk et al., 2012), lack of engagement support for users (Ojo et al., 2016), lack of support (Smith & Sandberg, 2018)<br>● Communication, e.g., communication is more difficult with civil servants who are data owners (Hivon & Titah, 2017), difficulties when trying to gain insight to the activities of the OGD providers (Smith & Sandberg, 2018)<br>● Feedback mechanism, e.g., difficulties when trying to influence the actions of the OGD providers (Smith & Sandberg, 2018) |
| *Political factors* | Trust, e.g., lack of trust (Ruijer et al., 2017)<br>Political participation, e.g., voters in the last election are less likely to engage (Wijnhoven et al., 2015) |

also hypothesize that the citizen's profiles moderate the driving and inhibiting relationships between the factors and engagement. The profiles can affect the strength of the relationships.

Different factors, as found in the analysis, can influence citizens to engage with OGD in a positive (driving) or negative (inhibiting) way. These relationships can be affected by citizen's profiles. For example, although a citizen needs particular competence to engage with OGD and wants to gain advantage from the engagement, this motivation can be decreased or inhibited if the citizen lacks resources to engage with OGD. Another example concerns the citizen who is motivated by the intellectual challenge of OGD engagement. The citizen's capabilities and competency can strengthen this motivation.

Furthermore, some factors that drive and inhibit citizen engagement are the opposite side of the same coin. For example, the citizen's perceptions of ease of use and task complexity in handling OGD are such contrary factors. When handling open data is easy for the citizens, the perceptions of ease of use increase, and task complexity decreases. In contrast, when handling OGD becomes too complicated, the perception of ease of use decreases, and the task complexity increases. As a result, the citizen may be inhibited from engaging with OGD. The capabilities and experience of citizens can modify this relationship. Although the open datasets can become too complicated to handle and thus, task complexity is increasing, the perception of the ease of use of a citizen who has capabilities in programming and has experience in handling OGD may not be affected nor decreased.

Figure 5. The conceptual model of OGD citizen engagement
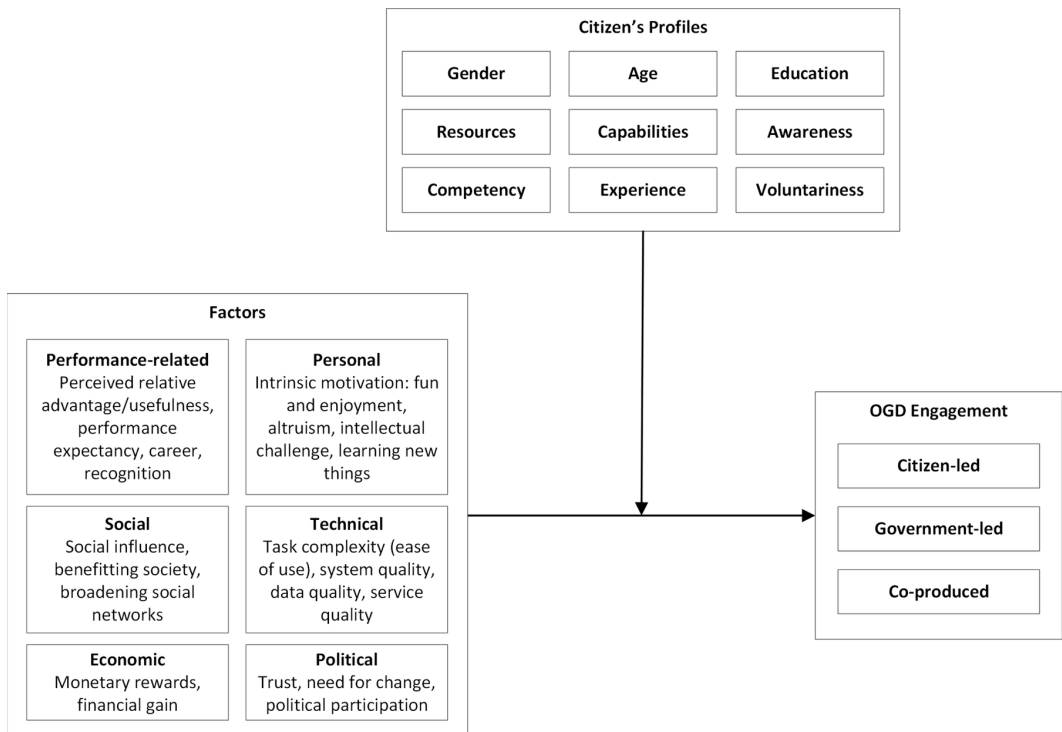


## DISCUSSION

In this section, we synthesize and discuss the main findings of our research. As presented in the previous section, various methods have been used to study the phenomenon of citizen engagement

with OGD. However, the case study and survey-based research methods are substantially dominant, and only a modest number of studies apply mixed methods, log data analysis, and action research. Other research methods, such as critical studies, are barely used in open data research despite its potential contribution to supporting more effective OGD engagement that caters citizens who are left behind (Gurstein, 2011). As critical approaches also enable context-rich analysis by asking "state-of-the-actual" questions (Selwyn, 2010), researchers can open the black box of the context of OGD engagement and take into account the unintended consequences of such engagement. For example, from our sampled studies, we barely see citizens from marginalized communities such as the older adults or the poor being invited in open data innovation contests and even more see their perspectives taken into accounts.

We found that various studies, mainly using quantitative survey approaches, mostly did not state whether the citizens participating in such research had experience with engaging in OGD or not. Only six out of 52 reviewed studies reported they that asked questions about citizen's experience with OGD. This finding indicates that most of the citizens, who responded to such a research inquiry, might be *new* to OGD (*first timer*) or have no experience at all with OGD. On the one hand, the finding can significantly contribute to urge the improvement of OGD provision for increasing citizens' awareness and data literacy to stimulate engagement, as well as provide insights into factors that drive new users to engage with OGD. On the other hand, literature is lacking about what factors drive more experienced citizens, such as application developers, or data analysts, to engage with OGD continuously. Therefore, we suggest that open data researchers identify the knowledge and experience of study respondents to analyze and compare newcomers to more experienced OGD users.

Also, we noticed that only a quarter of the reviewed studies investigated both the capabilities of citizens and their roles in OGD engagement. Understanding citizens' capabilities support open data research efforts in un-black boxing the context of OGD (Zuiderwijk, Janssen, et al., 2015) and enable an analysis of their motivations, which then could be used for identifying and assessing the impacts of OGD (Johnson & Robinson, 2014). For example, in different contexts, company employees developing apps are motivated to perform well in their jobs (Smith & Sandberg, 2018), while developers creating app prototypes are driven by their feelings of fun and joy while exploring data (Purwanto et al., 2019). Therefore, we encourage future OGD engagement studies to take both capabilities and roles into the research inquiry to prevent treating citizens as a big uncharted blob.

Furthermore, our study shows that more than half of the reviewed papers did not report the type of OGD engagement they examined. This finding indicates that most of the sampled studies did not consider the prospective relationship between the citizen profiles and the type of OGD engagement. Our results suggest that there exists a relationship between particular profiles and types of engagement. For example, citizens who engage in citizen-led initiatives are likely to be activists aiming at advancing transparency and accountability agenda in different fields, including older adults in OGD-based service design (Jarke, 2019), or mapping a humanitarian crisis (Dittus et al., 2016). Such profiles also present in studies on the election counting processes (Purwanto et al., 2018), war spending (Whitmore, 2014), and electoral candidacy (dos Santos Brito et al., 2014). The activists, who are sometimes the researchers themselves, advance the transparency and accountability agenda of OGD engagement. Contrary, government-led engagement might lure more hobbyists and employees than activists. Our review also shows that the literature rarely investigates co-produced OGD engagement. Co-produced engagement might attract different profiles of citizens compared to other types of engagement; citizens who are interested in science or generating knowledge are more likely to participate and involve in such engagement. It is, therefore, essential for future research to take the type of engagement into account when investigating citizens' behavior toward OGD.

Moreover, despite the use of various theories and theoretical models by the sampled studies presented in section 4.2.3, we notice that some theories and models are rarely integrated. For example, motivation theories from Self-Determination Theory (SDT) are seldom integrated with acceptance and use models such as Unified Theory of Acceptance and Use of Technology (UTAUT) and Information

System Success Model within a single study. Many theories used in the sampled studies have some or multiple similar, related, or overlapping constructs; researchers can build, extend, or develop OGD engagement theory based on such theories. For example, Diffusion of Innovation Theory's perceived relative advantage and UTAUT's performance expectancy are constructs rooted in SDT's extrinsic motivation. Researchers may combine different elements of various existing theories to create an overarching theory that can be used to understand, explain, and address better the challenges related to citizen engagement with OGD.

Finally, most of the reviewed studies did not investigate the effect of the capabilities and roles of citizens to either drivers or inhibitors. Only a few studies examine the link between capabilities and roles to drivers (e.g., Purwanto et al., 2019; Wang et al., 2019) and between capabilities and roles to both drivers and inhibitors (e.g., Smith & Sandberg, 2018). For example, the 'performance expectancy' factor is more likely to drive data analysts to engage with OGD than to drive application developers, who are more driven by the 'fun and enjoyment' factor (Purwanto et al., 2019). Another example concerns hobbyists who are more driven by the intellectual challenge to solve problems and inhibited by a lack of resources. At the same time, company employees are more driven by performing work tasks and hindered by a lack of data format (Smith & Sandberg, 2018). Therefore, the application of particular drivers or inhibitors (or both) in OGD engagement studies should be made cautiously by taking capabilities and roles related to such factors.

## CONCLUSION

The aims of this study are twofold: 1) to systematically review the literature on individual citizens' drivers and inhibitors for engaging with OGD, and 2) to develop a conceptual model of citizen engagement with OGD based on the findings of the literature review. Employing an SLR approach complemented with a backward and forward search approach, we selected 52 studies published in the period 2011 to 2019 reporting research into citizen engagement with OGD. We found that the reviewed studies use different research methods. Yet, there is a lack of critical research approaches. In light of the citizens understudy, our findings indicated that most of them are new to OGD and lacking experience in engaging with OGD. We also found that most reviewed studies do not take the type of OGD engagement into account, while the relationship between different citizen profiles and types of engagement might emerge. We synthesized a comprehensive list of drivers (i.e., factors driving citizens to engage with OGD) and inhibitors (i.e., factors inhibiting citizens from engaging with OGD). Seven categories of drivers of citizen engagement are identified: citizen's profile, personal, performance-related, economic, social, technical, and political. We also found that these drivers are rarely integrated into a theoretical framework; they are typically investigated separately. At the same time, three groups of inhibitors are also identified: citizen's profile, technical, and political. We found that the factors driving and inhibiting citizen engagement are often at ends of the same seesaw, showing an opposed relationship; the increase of drivers will result in the decrease of inhibitors, and vice versa.

Most drivers relate to personal, intrinsic motivations. The intrinsic motivations include having fun and enjoyment when using OGD, doing good unto others (altruism), and intellectual challenge. The extrinsic motivations include the perceived relative advantage of OGD in performing work tasks. The identified inhibitors mostly relate to the complexity of handling OGD and its quality problems associated to 1) data such as lack of updates, lack of standards, not machine-readable format, and incomplete datasets, 2) system providing access to data, e.g., lack of documentation and lack of functionality, and 3) support provided to citizens such as the absence of help and lack of communication. However, further research is needed to assess whether specific drivers and inhibitors are more important and relevant than others since our analysis does not indicate the importance and relevance of these drivers and inhibitors.

The conceptual model that we developed describes the relationships between factors that might stimulate (drive) citizens to engage with OGD or hinder (inhibit) citizens from engaging with OGD.

Citizen engagement with OGD can be positively or negatively influenced by different factors such as personal, performance-related, economic, technical, social, and political factors. Furthermore, the model postulated that citizen profiles such as age, gender, education level, capabilities, competency, resources, awareness, experience, and voluntariness could affect the strength of this relationship. This model can be used to analyze the determinants of citizens' intentions to engage with OGD and the moderating factors that influence the relationship between the determinants and the intentions.

This study contributes scientifically by providing insights into the drivers and inhibitors of citizen engagement with OGD from the individual level of analysis that are barely systematized in the open data literature. These drivers and inhibitors were synthesized and organized into a comprehensive list of factors that drive citizens to engage with OGD and factors that inhibit citizens from engaging with OGD. The extensive list of factors can be used to explore differences between citizens' drivers and inhibitors of OGD engagement in real-life cases in various contexts, such as cases of existing OGD engagement in different countries and cases involving different types of citizens. The practical contribution of this study is offering the list of drivers and inhibitors to assess the current OGD infrastructures and design new OGD programs that stimulate the driving factors and reduce the inhibiting factors. Furthermore, this study is the first essential step towards developing incentives for the engagement of citizens in OGD initiatives.

This review has some limitations, mainly related to the design and execution of selection criteria, which can contribute to the exclusion of relevant publications. We only sought for peer-reviewed, empirical papers published in journal and conference outlets. As a result, books, practical reports, and research thesis on citizen engagement with OGD that might be relevant for this review are not included. The second limitation concerns the use of specific terms depicted in Table 1 on the title, abstract, and keywords of the searched publications; relevant papers that use these terms only in the body of the texts might be excluded. Lastly, we included only publications written in English. Yet, we believe that OGD is widely studied by researchers from different cultures and language backgrounds, and relevant knowledge on citizen engagement that they produce might not be written in English.

Several possible research avenues were identified in this study. We recommend future studies to use a critical lens, which is scarcely used in investigating OGD engagement. We also recommend future research to particularly examine the relationship between citizens' capabilities and roles and the driving and inhibiting factors. Another recommendation concerns the conceptualization of an integrated theory for describing and explaining OGD engagement, as well as longitudinal studies that investigate the evolution of recurring inhibitors over time. Lastly, we recommend future research to empirically test the usability and completeness of our list of drivers and inhibitors of citizen engagement with OGD.

## REFERENCES

Afful-Dadzie, E., & Afful-Dadzie, A. (2017). Open Government Data in Africa: A preference elicitation analysis of media practitioners. *Government Information Quarterly*, *34*(2), 244–255.

Benitez-Paez, F., Degbelo, A., Trilles, S., & Huerta, J. (2018). Roadblocks Hindering the Reuse of Open Geodata in Colombia and Spain A Data User's Perspective. *International Journal of Geo-Information*, *7*(1).

Beno, M., Figl, K., Umbrich, J., & Polleres, A. (2017). *Open Data Hopes and Fears: Determining the Barriers of Open Data*. Paper presented at the 2017 Conference for E-Democracy and Open Government (CeDEM), Krems, Austria.

Canares, M. P. (2014, 27-30 October). *Opening the Local: Full Disclosure Policy and its Impact on Local Governments in the Philippines.* Paper presented at the 8th International Conference on Theory and Practice of Electronic Governance (ICEGOV), Guimaraes, Portugal.

Charalabidis, Y., Loukis, E., & Alexopoulos, C. (2014). *Evaluating Second Generation Open Government Data Infrastructures Using Value Models*. Paper presented at the 47th Hawaii International Conference on System Sciences (Hicss).

Choi, J., & Tausczik, Y. (2017). *Characteristics of Collaboration in the Emerging Practice of Open Data Analysis*. Paper presented at the 20th ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW 2017), Portland, USA.

Cranefield, J., Robertson, O., & Oliver, G. (2014). *Value in the MASH: Exploring the Benefits, Barriers and Enablers of Open Data Apps*. Paper presented at the 22nd European Conference on Information Systems (ECIS 2014), Tel Aviv, Israel.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and Conducting Mixed Methods Research* (3rd ed.). SAGE Publications, Inc.

Crusoe, J., Simonofski, A., Clarinval, A., & Gebka, E. (2019). *The Impact of Impediments on Open Government Data Use: Insights from Users*. Paper presented at the 13th International Conference on Research Challenges in Information Science (RCIS), Brussels, Belgium.

Davies, T. (2010). *Open data, democracy and public sector reform: A look at open government data use from* data.gov.uk (Master). University of Oxford, Oxford, UK. Retrieved from www.opendataimpacts.net/report/wp-content/uploads/2010/08/How-is-open-government-data-being-used-in-practice.pdf

de Deus Ferreira, G., & Farias, J. S. (2018). The Motivation to Participate in Citizen-Sourcing and Hackathons in the Public Sector. *Brazilian Administration Review, 15*.

de Kool, D., & Bekkers, V. (2015). The Perceived Impact of Open Inspection Data on the Quality of Education in Dutch Primary Schools: A Parent Perspective. *Social Science Computer Review*, *33*(5), 645–659. doi:10.1177/0894439314560853

de Kool, D., & Bekkers, V. (2016). The perceived value-relevance of open data in the parents' choice of Dutch primary schools. *International Journal of Public Sector Management*, *29*(3), 271–287. doi:10.1108/Ijpsm-02-2016-0022

Dietrich, D. (2015). The Role of Civic Tech Communities in PSI Reuse and Open Data Policies. In *European Public Sector Information Platform Topic Report 05/2015*. European Union.

Dittus, M., Quattrone, G., & Capra, L. (2016). *Analysing Volunteer Engagement in Humanitarian Mapping: Building Contributor Communities at Large Scale*. Paper presented at the 19th ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW 2016), San Francisco, CA.

dos Santos Brito, K., dos Santos Neto, M., da Silva Costa, M. A., Garcia, V. C., & de Lemos Meira, S. R. (2014). Using parliamentary Brazilian open data to improve transparency and public participation in Brazil. *Proceedings of the 15th Annual International Conference on Digital Government Research*.

Evans, A. M., & Campos, A. (2013). Open Government Initiatives: Challenges of Citizen Participation. *Journal of Policy Analysis and Management*, *32*(1), 172–185. doi:10.1002/pam.21651

Fitriani, W. R., Hidayanto, A. N., Sandhyaduhita, P. I., Purwandari, B., & Kosandi, M. (2019). Determinants of Continuance Intention to Use Open Data Website: An Insight from Indonesia. *Pacific Asia Journal of the Association for Information Systems*, *11*(2), 96–120. doi:10.17705/1pais.11205

Gama, K. (2017). *Crowdsourced Software Development in Civic Apps - Motivations of Civic Hackathons Participants*. Paper presented at the 19th International Conference on Enterprise Information Systems, Porto, Portugal.

Graft, A., Verhulst, S., & Young, A. (2016). Indonesia's Kawal Pemilu. Elections: Free, Fair, and Open Data. In The Global Impact of Open Data: Key Findings from Detailed Case Studies Around the World (pp. 97-112). O'Reilly Media Inc.

Gurstein, M. B. (2011). Open data: Empowering the empowered or effective data use for everyone? *First Monday*, *16*(2). Advance online publication. doi:10.5210/fm.v16i2.3316

Hellberg, A.-S., & Hedström, K. (2015). The story of the sixth myth of open data and open government. *Transforming Government: People*. *Process and Policy*, *9*(1), 35–51.

Hivon, J., & Titah, R. (2017). Conceptualizing citizen participation in open data use at the city level. *Transforming Government: People*. *Process and Policy*, *11*(1), 99–118. doi:10.1108/TG-12-2015-0053

Hjalmarsson, A., Johannesson, P., Juell-Skielse, G., & Rudmark, D. (2014). *Beyond innovation contests: A framework of barriers to open innovation of digital services*. Paper presented at the 22nd European Conference on Information Systems (ECIS 2014), Tel Aviv, Israel.

Hossain, M. A., Dwivedi, Y. K., & Rana, N. P. (2016). State-of-the-art in open data research: Insights from existing literature and a research agenda. *Journal of Organizational Computing and Electronic Commerce*, *26*(1-2), 14–40.

Huijboom, N., & Van den Broek, T. (2011). Open data: an international comparison of strategies. *European journal of ePractice, 12*(1), 4-16.

Hutter, K., Füller, J., & Koch, G. (2011). *Why citizens engage in open government platforms?* Paper presented at the INFORMATIK 2011 Jahrestagung der Gesellschaft für Informatik, Berlin, Germany.

Hwang, M. I., & Thorn, R. G. (1999). The effect of user engagement on system success: A meta-analytical integration of research findings. *Information & Management*, *35*(4), 229–236.

Jarke, J. (2019). Open government for all? Co-creating digital public services for older adults through data walks. *Online Information Review*, *43*(6), 1003–1020. doi:10.1108/OIR-02-2018-0059

Johnson, P. A., & Robinson, P. J. (2014). Civic Hackathons: Innovation, Procurement, or Civic Engagement? *The Review of Policy Research*, *31*(4), 349–357. doi:10.1111/ropr.12074

Juell-Skielse, G., Hjalmarsson, A., Johannesson, P., & Rudmark, D. (2014). *Is the Public Motivated to Engage in Open Data Innovation?* Paper presented at the 13th International Conference on Electronic Government, Dublin, Ireland.

Jurisch, M. C., Kautz, M., Wolf, P., & Krcmar, H. (2015). *An International Survey of the Factors Influencing the Intention to use Open Government*. Paper presented at the 48th Hawaii International Conference on System Sciences (HICSS), Kauai, HI.

Kappelman, L. A., & McLean, E. R. (1992). Promoting information system success: The respective roles of user participation and user involvement. *Journal of Information Technology Management*, *3*(1), 1–12.

Khayyat, M., & Bannister, F. (2017). Towards a model for facilitating and enabling co-creation using open government data. *Information Polity*, *22*(4), 211–231. doi:10.3233/IP-170406

Khurshid, M. M., Zakaria, N. H., Rashid, A., & Shafique, M. N. (2018). Examining the Factors of Open Government Data Usability From Academician's Perspective. *International Journal of Information Technology Project Management*, *9*(3), 72–85.

Kitchenham, B., Brereton, O. P., Budgen, D., Turner, M., Bailey, J., & Linkman, S. (2009). Systematic literature reviews in software engineering–a systematic literature review. *Information and Software Technology*, *51*(1), 7–15.

Kitchenham, B., & Charters, S. (2007). Guidelines for performing systematic literature reviews in software engineering. In *EBSE Technical Report EBSE-2007-01* (pp. 65). Keele, UK: Keele University.

Kuk, G., & Davies, T. (2011). *The Roles of Agency and Artifacts in Assembling Open Data Complementarities*. Paper presented at the International Conference on Information Systems 2011, Shanghai, China.

Martin, C. (2014). Barriers to the Open Government Data Agenda Taking a Multi-Level Perspective. *Policy and Internet*, *6*(3), 217–240.

Maruyama, M., Douglas, S., & Robertson, S. (2013). *Design Teams as Change Agents: Diplomatic Design in the Open Data Movement*. Paper presented at the 46th Hawaii International Conference on System Sciences (Hicss).

Obama, B. (2009). *Transparency and Open Government*. Retrieved from https://www.whitehouse.gov/the_press_office/TransparencyandOpenGovernment

Ojo, A., Porwol, L., Waqar, M., Stasiewicz, A., Osagie, E., Hogan, M., . . . Zeleti, F. A. (2016). *Realizing the Innovation Potentials from Open Data: Stakeholders' Perspectives on the Desired Affordances of Open Data Environment*. Paper presented at the PRO-VE 2016: Collaboration in a Hyperconnected World, Porto, Portugal.

Okoli, C., & Schabram, K. (2010). A guide to conducting a systematic literature review of information systems research. *Sprouts: Working Papers on Information Systems, 10*(26). Retrieved from http://sprouts.aisnet.org/10-26

Osagie, E., Waqar, M., Adebayo, S., Stasiewicz, A., Porwol, L., & Ojo, A. (2017). *Usability Evaluation of an Open Data Platform*. Paper presented at the 18th Annual International Conference on Digital Government Research, Staten Island, NY.

Purwanto, A., Zuiderwijk, A., & Janssen, M. (2018). *Citizen engagement in an open election data initiative: A case study of Indonesian's "Kawal Pemilu"*. Paper presented at the 19th Annual International Conference on Digital Government Research, Delft, The Netherlands.

Purwanto, A., Zuiderwijk, A., & Janssen, M. (2019, 2-4 September). *Citizens' Motivations for Engaging in Open Data Hackathons.* Paper presented at the Electronic Participation 2019, San Benedetto Del Tronto, Italy.

Purwanto, A., Zuiderwijk, A., & Janssen, M. (2020). Citizen engagement with open government data: Lessons learned from Indonesia's presidential election. *Transforming Government: People, Process and Policy*. ahead-of-print. doi:10.1108/TG-06-2019-0051

Renaud, K., & van Biljon, J. (2008). *Predicting Technology Acceptance and Adoption by the Elderly: A Qualitative study*. Paper presented at the 2008 Annual Research Conference of the South African Institute of Computer Scientists and Information Technologists on IT Research in Developing Countries, Wilderness, South Africa.

Rudmark, D., Arnestrand, E., & Avital, M. (2012). *Crowdpushing: The flip Side of Crowdsourcing*. Paper presented at the 20th European Conference on Information Systems (ECIS'12), Barcelona, Spain.

Ruijer, E., Grimmelikhuijsen, S., Hogan, M., Enzerink, S., Ojo, A., & Meijer, A. (2017). Connecting societal issues, users and data. Scenario-based design of open data platforms. *Government Information Quarterly*, *34*(3), 470–480.

Safarov, I., Meijer, A., & Grimmelikhuijsen, S. (2017). Utilization of open government data: A systematic literature review of types, conditions, effects and users. *Information Polity*, *22*(1), 1–24. doi:10.3233/IP-160012

Saxena, S., & Janssen, M. (2017). Examining open government data (OGD) usage in India through UTAUT framework. *Foresight*, *19*(4), 421–436. doi:10.1108/FS-02-2017-0003

Schmidthuber, L., Piller, F., Bogers, M., & Hilgers, D. (2019). Citizen participation in public administration: Investigating open government for social innovation. *R & D Management*, *49*(3), 343–355. doi:10.1111/radm.12365

Schwegmann, C. (2012). Open Data in Developing Countries. In *European Public Sector Information Platform Topic Report 02/2013*. European Union.

Selwyn, N. (2010). Looking beyond learning: Notes towards the critical study of educational technology. *Journal of Computer Assisted Learning*, *26*(1), 65–73. doi:10.1111/j.1365-2729.2009.00338.x

Smith, G., Ofe, H. A., & Sandberg, J. (2016). Digital Service Innovation from Open Data: Exploring the Value Proposition of an Open Data Marketplace. *2016 49th Hawaii International Conference on System Sciences (Hicss)*, 1277-1286. doi:10.1109/Hicss.2016.162

Smith, G., & Sandberg, J. (2018). Barriers to innovating with open government data: Exploring experiences across service phases and user types. *Information Polity*, 23(3), 249–265. doi:10.3233/IP-170045

Susha, I., Grönlund, Å., & Janssen, M. (2015). Organizational measures to stimulate user engagement with open data. *Transforming Government: People*. *Process and Policy*, 9(2), 181–206. doi:10.1108/TG-05-2014-0016

Talukder, M. S., Shen, L., Talukder, M. F. H., & Bao, Y. (2019). Determinants of user acceptance and use of open government data (OGD): An empirical investigation in Bangladesh. *Technology in Society*, 56, 147–156. doi:10.1016/j.techsoc.2018.09.013

Toots, M., McBride, K., Kalvet, T., & Krimmer, R. (2017). *Open Data as Enabler of Public Service Co-creation: Exploring the Drivers and Barriers*. Paper presented at the 2017 Conference for E-Democracy and Open Government (CeDEM), Krems, Austria.

Ubaldi, B. (2013). *Open Government Data: Towards Empirical Analysis of Open Government Data Initiatives*. Academic Press.

Veeckman, C., & van der Graaf, S. (2015). The City as Living Laboratory: Empowering Citizens with the Citadel Toolkit. *Technology Innovation Management Review*, 6-17.

Wang, D., Richards, D., & Chen, C. (2018). *An Analysis of Interaction Between Users and Open Government Data Portals in Data Acquisition Process.* Paper presented at the 15th Pacific Rim Knowledge Acquisition Workshop, PKAW 2018, Nanjing, China.

Wang, D., Richards, D., & Chen, C. (2019). *Connecting Users, Data and Utilization: A Demand-Side Analysis of Open Government Data*. Paper presented at the Information in Contemporary Society. iConference 2019, Washington, DC.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *Management Information Systems Quarterly*, 26(2), xiii–xxiii.

Weerakkody, V., Irani, Z., Kapoor, K., Sivarajah, U., & Dwivedi, Y. K. (2017). Open data and its usability: An empirical view from the Citizen's perspective. *Information Systems Frontiers*, 19(2), 285–300. doi:10.1007/s10796-016-9679-1

Weerakkody, V., Kapoor, K., Balta, M. E., Irani, Z., & Dwivedi, Y. K. (2017). Factors influencing user acceptance of public sector big open data. *Production Planning and Control*, 28(11-12), 891–905. doi:10.1080/09537287.2017.1336802

Whitmore, A. (2014). Using open government data to predict war: A case study of data and systems challenges. *Government Information Quarterly*, 31(4), 622–630. doi:10.1016/j.giq.2014.04.003

Wijnhoven, F., Ehrenhard, M., & Kuhn, J. (2015). Open government objectives and participation motivations. *Government Information Quarterly*, 32(1), 30–42. doi:10.1016/j.giq.2014.10.002

Wirtz, B. W., Weyerer, J. C., & Rösch, M. (2018). Citizen and Open Government: An Empirical Analysis of Antecedents of Open Government Data. *International Journal of Public Administration*, 41(4), 308–320. doi:10.1080/01900692.2016.1263659

Wirtz, B. W., Weyerer, J. C., & Rösch, M. (2019). Open government and citizen participation: An empirical analysis of citizen expectancy towards open government data. *International Review of Administrative Sciences*, 85(3), 566–586. doi:10.1177/0020852317719996

Young, A., & Verhulst, S. (2016). The Global Impact of Open Data: Key Findings from Detailed Case Studies Around the World (S. Cutt Ed.). O'Reilly Media Inc.

Zuiderwijk, A., Janssen, M., Choenni, S., Meijer, R., & Alibaks, R. S. (2012). Socio-technical impediments of open data. *Electronic*. *Journal of E-Government*, 10(2), 156–172.

Zuiderwijk, A., Janssen, M., & Dwivedi, Y. K. (2015). Acceptance and use predictors of open data technologies: Drawing upon the unified theory of acceptance and use of technology. *Government Information Quarterly*, *32*(4), 429–440. doi:10.1016/j.giq.2015.09.005

Zuiderwijk, A., Janssen, M., & Susha, I. (2016). Improving the speed and ease of open data use through metadata, interaction mechanisms, and quality indicators. *Journal of Organizational Computing and Electronic Commerce*, *26*(1-2), 116–146.

Zuiderwijk, A., Susha, I., Charalabidis, Y., Parycek, P., & Janssen, M. (2015). *Open data disclosure and use: Critical factors from a case study.* Paper presented at the CeDEM15: Conference for E-Democracy and Open Government.

*Arie Purwanto is a PhD student at the Faculty of Technology, Policy and Management at Delft University of Technology. Prior to his PhD education program, he was a programmer and information system auditor at the Supreme Audit Board of Indonesia for more than 10 years. His research focuses on citizen engagement with Open Government Data.*

*Anneke Zuiderwijk is an Assistant Professor in open data at the Faculty of Technology, Policy and Management at the Delft University of Technology. Her research is focused on how open data sharing and use can be incentivized by means of infrastructural and institutional arrangements. More information: www.tbm.tudelft.nl/AZuiderwijkvanEijk.*

*Marijn Janssen is a Full Professor in Information and Communication Technology and Governance and chair of the ICT research group of the Technology, Policy and Management Faculty of the Delft University of Technology. His research is focused on ICT-architecting and design science in situations in which multiple public and private organizations need to collaborate, in which ICT plays an enabling role, there are various ways to proceed and socio-technical solutions are constrained by organizational realities and political wishes. More information: www. tbm.tudelft.nl/marijnj.*