

# The research trend of open government data utilization: A systematic review

**Abstract.** The open government data (OGD) movement has stimulated the opening and sharing of government data significantly. Data use, reuse and distribution, as well as value creation, is the next vital step in the global OGD movement. Summarizing current research progress of OGD utilization (OGDU) would lay a foundation for follow-up research and provide theoretical support for future practice. This poster conducted a systematic review on OGDU research mainly based on research articles, while other document types (e.g., important scientific reports) were also considered to demonstrate a more holistic scenario. The research trends of OGDU were summarized and future research directions were proposed based on research results. This poster revealed three research tendencies in OGDU studies. First, previous OGDU study was driven by the supply side, while current study tends to be motivated by the demand side. Second, previous OGDU study was normally conducted from a macro viewpoint, while fine-grained research is more preferred currently. Third, previous research paid more attention on data usage by government departments, while data usage by the public attracts an increasing amount of attention currently. Several research topics are worth researching in the future, i.e., the value of OGDU, diverse contexts for OGDU and solid support measures for OGDU.

**Keywords:** Open government data, Government data, Data utilization, Data reuse.

## 1 Introduction

The purpose of the Open Government Data (OGD) movement is to promote the utilization, reuse and distribution of government data, and to create social value through data exploration, development, and innovation. The focus of the global OGD movement has shifted from "sharing" to "utilization" recently. The United Nations (UN) pointed out that OGD utilization (OGDU) has a positive impact on innovation, transparency, accountability, participatory governance and economic growth, and further promotes *the 2030 Agenda for Sustainable Development* [1]. A series of policies, regulations and strategic plans view OGDU as an important development goal. For example, the United States released the *Federal Data Strategy* in 2020, which encompasses a 10-year vision for how the federal government will accelerate data usage to deliver on mission, serve the public, and steward resources.

Although the OGD movement is booming around the world, the core task of the OGD movement (i.e., data utilization) has not received adequate attention. The *Open Data Barometer - Leaders Edition* published by the World Wide Web Foundation in 2018 pointed out that "governments release selective information without providing an environment for people to use it" "there is little historical evidence of real benefits from open government data initiatives" [2]. Research focused on OGDU emerges in recent

years, mainly focusing on data value [3], influence factor [4] and promotion method [5], etc. It is now necessary to summarize current OGDU research systematically, clarify valuable research directions, and lay a foundation for follow-up research.

Several OGD related reviews exist. Attard, J. et al. reviewed OGD initiatives and described the OGD life-cycle [6]. A detailed taxonomy of research areas and corresponding research topics of the OGD domain was presented by Charalabidis, Y et al [7]. However, these two reviews were not concentrated on the utilization of OGD. Safarov, I. et al. revealed OGDU research situation from the aspects of type, effect, condition and user based on research papers [8]. Whereas, important studies published in other forms may be ignored, if only research papers indexed in several databases are considered. Moreover, the research trend of OGDU over time, which is essential for academia to understand the development tendency in this domain, have not been revealed yet. Thus, this poster intends to conduct a systematic review on OGDU research to reveal not only the topics distribution of OGDU research, but also its research trends overtime, based on both research articles and other related documents.

## 2 Data Collection and Method

This article collected OGDU related papers through Web of Science core collection (*SCI-EXPANDED*, *SSCI*, *A&HCI*). The search terms were as follow: TS=("open government data" OR "opening government data" OR "opening up government data" OR "government data" OR "government data and information") AND TS=(use OR using OR user OR reuse OR re-use OR usage OR usability OR utilis\* OR utiliz\* OR accept\* OR applicat\* OR exploit\* OR discover\* OR explor\* OR find\* OR distribut\* OR redistribute\* OR analyz\* OR analys\* OR analytics OR release\* OR publish\* OR disseminat\* OR exchang\* OR consum\*). 407 search results were obtained. 121 most related results were filtered manually according to following criterions. (1) the research topic should be "open government data utilization", rather than "open/sharing of government data"; (2) studies that merely use OGD as research data, rather than research topics is excluded; (3) research focused on open data, rather than OGD is excluded. Google Scholar and search engine (Google) were used afterwards as a complement to obtain other document types, i.e., government document, meeting minute, important institution/project report and book.

This poster first revealed three research angles and their evolution in OGDU research (supply-side, resource-side and demand-side perspectives). The research perspectives of articles were encoded manually according to their themes and contents. Then, article keywords were cleaned, clustered and visualized using Cortext [9] to demonstrate topic distribution. Finally, the research trends and potential research areas of OGDU were discussed accordingly.

### 3 Three Research Perspectives

#### 3.1 Supply Side Perspective

Fig. 1 reveals the number of articles using three perspectives in OGDU research over years. Studies with supply side perspective placed their focus on data provider (i.e., government), aiming at exploring the development of policies and regulations, organization management, and infrastructure construction. Research with the supply side perspective dominated OGDU research in early days.

Government was already regarded as one of the main actors in knowledge production, when the American economist Fritz Machlup put forward the concept of "knowledge industry" in the 1960s [10]. More recently, the concept of freedom of information promoted open data, through which users could obtain government data by request [11]. Government was thought to play a major role by providing technical infrastructure, regulation, and data resource [12]. Scholars began to carry out OGDU research using supply side perspective since the beginning of the 21st century.

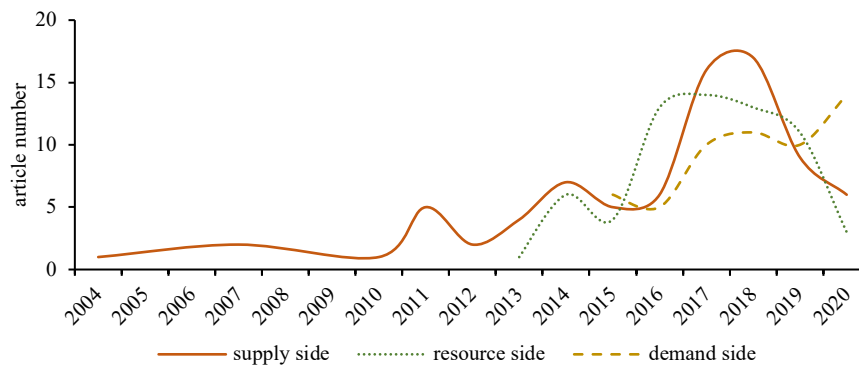


Fig. 1. Three research perspectives on the open government data utilization.

#### 3.2 Resource Side Perspective

OGD movement promoted government to open data by default. More articles switched their focus from government to data resources (resource side angle) after 2015. The value of OGD and the improvement of OGD usability were widely discussed.

In terms of OGDU value, research projects such as "PIRA" and "MEPSIR" revealed the commercial value of OGD at the beginning of the 21st century [13]. OGD's potential in economic growth, political development, and social transformation was widely revealed subsequently [3,14,15].

In terms of OGD usability improvement, diverse researches were conducted. First, some scholars developed OGD quality assessment frameworks [16], intended to establish a unified data quality standard. Second, simply opening data is not enough to realize the potential value of OGD. Linked and multi-sourced OGD analysis is the basis for

data value realization [17]. Data organizing and analyzing technologies were investigated, e.g., linked data, ontology construction, and visualization [17,18,19]. Third, the value generation mechanism of OGD and its influencing factors attract research interests [3,20,21].

### **3.3 Demand Side Perspective**

Although a large number of OGD were published, the effect was not significant. Data offered by government did not meet the actual demand of the public. Ruijter et al. believed that open data practices should be based on rich interaction with users, rather than a government-centric implementation [22].

Research from the demand side perspective attracted research interests in recent years consequently, emphasizing on understanding user needs in specific scenarios and seeking corresponding OGD development strategies. Studies that aiming at understanding the psychology and behavior of data users emerged [23,24,25]. The diversity of users and scenarios was emphasized [21,26,27]. Ruijter et al. stressed the design of environmentally sensitive open data, which is helpful to transform raw data into meaningful information [15].

## **4 Research Theme of OGDU**

As Fig.2 shows, research keywords that closely related to OGDU are located in the center of the network, such as “data usage”, “data reuse”, “data user” and “citizen engagement”. Meanwhile, these research topics are related to themes such as “e-government”, “big data”, etc., but the distance between them are significant, indicating that a relatedly independent research system on OGDU have formed. This poster analyzed the topic distribution of OGDU research in detail based on Fig.2 in the following sections, along with representative research results.

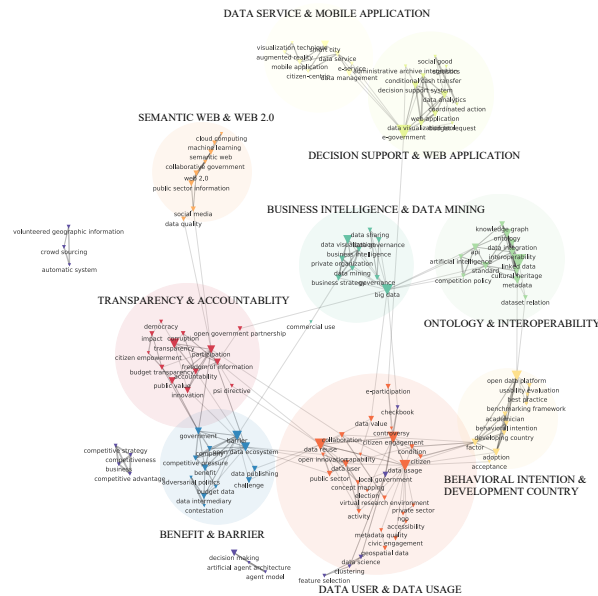


Fig. 2 Topic distribution of open government data utilization.

#### 4.1 Data Value

Current research explored the value of OGDU from the perspectives of economy, citizen and government respectively (see the clusters of BUSINESS INTELLIGENCE & DATA MINING, TRANSPARENCY & ACCOUNTABILITY and DECISION SUPPORT & WEB APPLICATION in Fig 2). The citizen and government values of OGDU were merged into political value for analysis, considering that these two values are overlap with each other and the total number of related papers is small.

The economic value of OGDU refers to the value generated by applying OGD to economic activities directly or indirectly. It can be reflected by various economic indicators. The EU published the *Commercial exploitation of Europe's public sector information (PIRA report)* in 2000, using Gross domestic product (GDP) to measure the economic contribution of OGDU [29]. Many other methods were also used to measure OGDU economic value afterwards, from both macro level [13,30] and micro level [31,32,33].

The political value of OGDU refers to the positive impact of OGDU on social management and services, decision-making, transparency and social participation. The political value of “opening” and “utilizing” OGD is different. The former one refers to the positive impact caused by the opening of OGD, which has been widely discussed in the early stage of OGD movement; The latter refers to the political value of data, information, products or services generated from data reuse after OGD is open. The political value of OGDU is difficult to quantify. Researches mainly concentrated on exploring

innovative ways of OGDU to prove its value in various political contexts, such as war prediction [34], corruption prevention [35], public opinion analysis [36], etc.

#### **4.2 Data User**

Data user is increasingly being studied recently. The cluster DATA USER & DATA USAGE discusses the OGDU practice of different user types (Fig.2). Another two clusters (BEHAVIORAL INTENTION & DEVELOPING COUNTRY and BENEFIT & BARRIER) are closely related to DATA USER & DATA USAGE, focusing on user willingness and the influence factors of OGDU.

Successful data reuse depends on an active re-user ecosystem. The participants of this system can be divided into open data source and civil society re-users (including direct re-users and end users) [37]. Different data users have different degrees [38,39] and types of participation in OGDU.

The drivers and hindrances for the public to participate in OGDU are multiple. Zuiderwijk et al. pointed out that OGDU is significantly affected by factors such as performance expectations, effort expectations, social influence, and willingness to use [40]. They further comprehensively summarized 118 OGD obstacles [41] and emphasized that the most significant obstacles are related to data utilization rather than data sharing [42].

#### **4.3 Promotion Method**

Three clusters in Fig 2 explored OGDU from the perspectives of technology and service, aiming at enhancing OGDU level (i.e., ONTOLOGY & INTEROPERABILITY, SEMANTIC WEB & WEB 2.0 and DATA SERVICE & MOBILE APPLICATION).

From the perspective of technology, the true value of OGD comes from the analysis of linked datasets, which could unveil unexpected relationships from multi-source data [17]. Thus, scholars proposed diverse data organization, retrieval and mining solutions (e.g., metadata, ontology, linked data, information retrieval, semantic web, etc.) [43,44,45].

From the perspective of service, research concentrated on emphasizing data demand and user empowerment. On the one hand, user needs and data provision in specific contexts do not match currently [46]. It is necessary to consider users' data requirements, rather than simply control OGD quality when releasing data [15]. On the other hand, users' ability in OGDU are equally important, but always be neglected. The solutions for user guidance, education and empowerment were increasingly discussed recently [47,48].

## 5 Discussion and Conclusion

### 5.1 Research Trend

The research trends of OGDU changed greatly during these years. First, the research motivation of OGDU shifted from “supply-driven” to “demand-driven”. Early research was driven by the reality that “there is data to be used”, while “there is user demand to be met” is a more common motivation for OGDU research currently. Second, the research angle shifted from “general” to “specific”. Early research focused on general OGDU activities, while more research pay attention to specific groups of people and contexts currently. Third, the research object shifted from “government” to “public”. Early research focused on the government's role in OGDU, while other stakeholders were ignored. The importance of the public has been highlighted afterwards, because insufficient data utilization hinders the realization of OGD value.

### 5.2 Future Direction

Several research topics are worth investigating in future research. First, the actual value of OGDU could be further explored. The potential value of OGDU in the field of economy and politics has been widely discussed. However, the actual value of OGDU is difficult to measure due to a lack of appropriate method. Second, diverse OGDU contexts need to be explored. Different data users and settings lead to different OGDU strategies, while current research does not emphasize the importance of OGDU contexts yet. Third, the promotion methods of OGDU should be enriched. Current development strategies proposed in OGDU research mainly focused on supply and resource sides, while more user-centered questions need to be explored to facilitate OGDU, such as Who are key data users? How to understand user demands? How to empower users with data literacy? etc.

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