

A SYSTEMATIC LITERATURE REVIEW ON OPEN GOVERNMENT DATA USE IN SMALL AND MEDIUM SIZED ENTERPRISES

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The concept of open data has evolved significantly over the past decade, in line with increasing government policies and initiatives, the quality, volume and accessibility of public data has increased as well. As a result, expectations that open data will help create value, innovation, and a range of economic, social, and environmental transformations are very high. Despite the great potential and high expectations, little is known about the use of open data, especially in enterprises. The overall research goal is to assess the use of open data in Slovene small and medium sized enterprises. To address this problem, we first conducted a systematic literature review to 1) understand the open data field through a historic lens, 2) identify key areas of research, and 3) identify research gaps. Based on the findings we will develop a research agenda.

Keywords:

open data, open government data, open data use, open data maturity assessment, maturity multi-criteria decision model, DEX

1 Introduction

In the last decade the paradigm of open data (OD) has evolved significantly, driven by the interest exhibited by governments and civic society. This evolution is particularly noteworthy in the light of increased emphasis on transparency and accountability of governmental expenditure and public fund allocations. In addition to the above, significant economic benefits deriving from open data are anticipated. In this literature review we will focus on what previous research on the utilization of OD has addressed.

The initiatives of opening the government data to public in European Union (EU) started in 2003 when a *Directive 2003/98/EC of the European Parliament and of the Council of 17 November 2003 on the re-use of public sector information* (European parliament, 2003) was issued, displaying intent to make public information available to anyone interested. The EU directive was revised several times until it was replaced in 2019 by a new version the *Directive (EU) 2019/1024 of the European Parliament and of the Council of 20 June 2019 on open data and the re-use of public sector information* (European parliament, 2019), Slovenia followed shortly after when in 2003 the Public information access act (ZDIJZ, 2003) was accepted. It was not until 2009, after US president Barack Obama, only one day after his inauguration, supported the idea of open government data with its open data initiative signing the Memorandum of (Transparency and Open Government, 2009), when concrete academic interest started.

Governments worldwide have implemented the concept of open government data (OGD) to a varying extent. A significant challenge has emerged: when releasing extensive volumes of data, it becomes ineffectual if mechanisms for meaningful comparison, visualization, analysis and other essential applications are lacking (Jamieson et al., 2019). Recognizing this, the academic community started extensive research on how to enhance the utility of open data for civic society, economic applications and the researchers themselves.

To understand the influence of OD on different groups of users, such as economical, civil society, entrepreneurs or other, we must first assess the extent of their knowledge about open data, the current state of its usage and their available infrastructure to extract and transform the vast volumes of data into usable

information (Lassinantti et al., 2019). In essence, an assessment of maturity level of distinct societal groups needs to be done.

2 Methodology

We conducted a systematic literature review to scrutinize prior research focus and conclusions. A literature review provides an insight into the current state of research in the research domain, an insight into the most common methodologies used and the related research areas.

A systematic literature review procedure follows the four main steps, according to (Attard et al., 2015):

1. Define search terms,
2. Select sources (digital libraries),
3. Application of search terms on sources and
4. Selection of primary studies by application of inclusion and exclusion criteria on search results.

To define the right keywords, we first defined the research question, indicating the exact extent of our review. The question was defined as follows:

RQ: What is the maturity level of small and medium sized enterprises (SME-s) for open government data use?

After a preliminary study, based on the research question, the best keywords to answer our research question were defined:

- Open data
- Open government data
- Open data use
- Open data maturity assessment
- Maturity multi-criteria decision model
- DEX
- Slovene enterprises.

In order to access the most relevant results, we surveyed digital libraries Web of Science, Scopus and ProQuest, using specific combinations of keywords. Google Scholar was initially included in the libraries examined; however, it was later excluded due to excessive output and low relevance of the results. Another abundant source of literature were the references of the results gained from the chosen digital libraries.

The primary search term “Open data” returned an unmanageably large number of results, so we narrowed the term down with its expansion to “Open government data”. That resulted in fewer outcomes, however the correlation of those results to our research question was still low.

To obtain results that corresponded with our research theme we excluded publications that:

- Did not focus on open data, it was only mentioned,
- Focuses on other keywords but does not relate to open data,
- The language was not English.

Applying other keywords and exclusion criteria in the end resulted in 71 related articles that represented the base of our literature review.

3 Results

The literature review included 71 articles that provided a thorough insight into what academic society has found essential for better understanding and increasing the utilization of open data. The authors of these articles have predominantly concentrated on one or more of the following topics: users, quality, policies, research categorization, drivers and barriers, impact and/or maturity. The synthesis of these articles reveals a diverse knowledge about the topic of the research. In the next sections we will overview these main topics.

3.1 Users

Key focus that seems to prevail others in academic view is identifying user types. The most elemental division is into two categories the providers and the consumers of the open data. On the provider side, the main question revolves around the

methods and measures that need to be undertaken to ensure the highest quality of the data, provided in a way that ensures uncomplicated usability for the end users. On the consumer side, the main objective is to identify the users by understanding their primary motivation for open data use.

Numerous researchers seek factors that predict the use of open data. Some have focused on established theories of human behavior to understand the motivations for open data use. A study by (Saxena & Janssen, 2017; Shao, 2023; Talukder et al., 2019; Zuiderwijk et al., 2015) employed an adjusted Unified Theory of Acceptance and Use of Technology (UTAUT). (Khurshid et al., 2022) explored the factors that influence citizens' intention to use OGD using Information Systems Theory (IST), (Lassinantti et al., 2019) used the Relevant Social Groups (RSG) theory to establish what motivates users to utilize OGD and explain for what purpose they are using it. Surveys integrating an extended Technology Acceptance Model (TAM) to clarify the user's intent in OGD adoption were conducted by (Weerakkody et al., 2017; Wirtz et al., 2019).

To determine what motivates employees in organizations (H. J. Wang & Lo, 2020) use the socio-technical perspective to develop a model, on which a survey was based and (Zhou et al., 2023) investigated how leadership style affects the OGD utilization among employees based on Organizational Commitment Theory. Another survey based on the Social Cognitive Theory, highlighted the factors that impact the intention of individual user innovators to adopt OGD (H.-J. Wang, 2020). How OGD can be used to generate business intelligence for the identification of market opportunities and strategy formulation was the objective of (Gottfried et al., 2021) research. Regarding business owners and their intent to use OD (Alawadhi et al., 2021) conducted a study to determine whether they have sufficient knowledge about the concept of OD and their willingness to use it for service improvement. Alexopoulos et al. (2023) proposed a model where four groups of users were identified: *beginners*, *followers*, *fast trackers* and *trendsetters*, depending on their level of OD adoption maturity. The motive (legitimacy-seeking or realizing OD value creation potential) to invest in OD technologies in public and private organizations was investigated by (Temiz et al., 2022).

Action-based research in which civil servants' and citizens' initiatives collaborated to find solutions for public problems using an open data platform from a provider's standpoint was conducted (Ruijter et al., 2020). The results of actual OGD use were examined in a survey of 266 government agencies. (Mustapa et al., 2022) and (Shepherd et al., 2019) focused on the roles and responsibilities of IT professionals who enable the delivery of OGD to citizens.

In the literature it has been observed that the motivation driving users' intent to adopt OGD is multifaceted, tied to the social aspect of the individual and their distinct requirements. Individual's position significantly influences their willingness to utilize the available OGD. Additionally, an important aspect of the OGD adoption from a user's standpoint is its usefulness which can only be determined if the data is provided with tools for its interpretation, analysis and visualization.

3.2 Impact

The concept of impact stands out as one of the most important aspects of OD, as noted by (Attard et al., 2016a, str. 10) "The main challenge in releasing social and commercial value is that open data has no value in itself, yet it becomes valuable when it is used." Various authors and institutions have researched how open data is impacting or is impacted by society.

To identify the impact of OGD numerous research has been done gaining insights into the OD use. A systematic literature review has been conducted by (Ruijter & Martinius, 2017) to present expected and found impact of OGD on democratic processes. Case studies of OD actual use have been conducted (Apanasevic, 2021; Coutinho & Freitas, 2021; De La Cruz & Lee, 2015; McBride et al., 2019; Shao, 2023). Ferencek (2021) Proposed an automated impact assessment model. How value is created from OGD and what processes exist to create value from it were the main objectives of (Attard et al., 2016b; Magalhaes & Roseira, 2020). The types of open data that are currently in use and the prevalent industries that exploit OGD were identified (Magalhaes & Roseira, 2020) and a literature review conducted by Attard et al. (2016b) revealed what processes exist to create value from OD. To what extent OD drives innovation was the main objective of Huber et al. (2022).

Wieczorkowski (2019b) demonstrated the business opportunities of sharing OGD from the perspective of product and organizational innovation. To understand social-economic effects experienced by a municipality upon opening its data (Apanasevic, 2021) studied the main perceived benefits, the main challenges, issues and risks associated with the publication of the data and (Wilson & Cong, 2021) studied the effects regarding the use and impact of municipal OGD. McBride et al. (2019) and a better understanding of the societal value that OGD can generate (Coutinho & Freitas, 2021). Factors that influence the adoption of OGD for commercial service in cities explored Maccani (2016).

How the use of OGD can attribute to innovative solutions that can generate social and economic value was the focus of Jetzek et al. (2014). The actual use and impact of OGD in private sector was examined by (Ruijter & Meijer, 2020), (Hope et al., 2022) who found positive correlation between government transparency and operational efficiency, and (De La Cruz & Lee, 2015) in a review of 30 interviews with CEOs of companies that use the OGD.

Research has been done about perceived benefits and possibilities of OD by (Jamieson et al., 2019) where three main benefits are questioned. The author argues that without clear empirical evidence the level of the recognized benefits realization cannot be established.

3.3 Policies

Governmental strategy for definition of content and dissemination guidelines regarding OD is proposed through policies. To determine the maturity level of various governments policies to enable publication and reuse of OD (Attard et al., 2015) conducted a literature review, classifying it according to 4 key criteria: *Fiscal transparency*, *Access to information*, *Income and asset disclosures* and *Citizen engagement*. (Ruijter, et al., 2020) developed an analytical framework for studying the politics of OGD.

The interest in what makes the data genuinely open and what policies should have been accepted to maximize the adoption and impact of OD, has been observed in the literature repeatedly. How macro policies were formed to effectively use OD in social services was investigated by (McLoughlin et al., 2019). Concerning the

openness of data (Attard et al., 2015) reviewed existing models for assessing that aspect, such as the Five-star scheme by (Berners-Lee, 2009), 8 government data principles by (O'Reilly & Malamud, 2007), W3C eGov Interest group. In their examination of OD utilization in shared economies (Lee & Wan, 2021) recommended a policy for managing the OD including technological standards, legal framework and managing policies.

What strategies can help advance the OGD ecosystem in countries that are just beginning to develop OGD policies was the objective of (Van Loenen et al., 2020) and (Zhou, Wang, Huang, et al., 2023) surveyed 10-year panel data from 477 Chinese listed firms, to understand the actual impact of OGD policies on firm performance.

Various countries adopt different policies regarding OD, yielding diverse results. While some governments adhere to legal requirements by making data publicly available, they may not prioritize its practical use. An example would be data published in formats that do not enable its reuse (e.g. .pdf format), or the data is released in formats that require licensed software (e.g. .xlsx format) so that its reuse is limited. A framework for comparison OD policies, their implementation and their impact, has been developed by (Zuiderwijk & Janssen, 2014). For the assessment of how countries implement OD policies various benchmarks exist. The authors (Zuiderwijk et al., 2021) addressed the challenge of divergent results among various benchmarks by conducting comparison of the most relevant benchmarks.

The OGD initiative supposedly enabled numerous benefits including “Increasing transparency and accountability, stimulating innovation, improving and supporting decision-making, stimulating data reuse, counteracting corruption and providing new services and products” according to (Zuiderwijk et al., 2019, str. 647-648). The objective of their survey was to investigate how OGD initiative objectives are achieved and what impact do they generate while (Hossain et al., 2021) identified the factors affecting OGD initiative performance.

3.4 Drivers and barriers

The initial incentive for OD use emerged primarily from global directives and legislation adopted by governments worldwide. The European Union directive (European parliament, 2003) and particularly the US presidents Barack Obama

initiative (Transparency and Open Government, 2009) advanced the adoption, promotion and research of OD. Subsequently it was upon government agencies, academic society, civil representatives, enterprises and individuals to use the OD and advocate its further utilization.

To enable a more comprehensive use and to expedite the utilization of OD the European Commission issued a report (Granell et al., 2022) of a series of experiments identifying potential application of emerging technologies and tools for data-driven innovation.

However, the focus of the research was primarily on the lack of the use of OD and the barriers for its adoption. Çaldağ & Gökalp (2022) conducted a literature review to highlight organizational barriers of OGD use and (Wieczorkowski, 2019a) researched the Central Repositories for Public Information of Poland, USA, the UK and Germany to identify barriers to the implementation of OGD-based solutions. Technological, organizational and legal barriers of OGD use were addressed in (Crusoe & Melin, 2018). Identification of potential risks that might emerge at various stages of OGD lifecycle (Wang et al., 2019) led to construction of a taxonomy model for them. An analysis of barriers, namely: 1. *OD acquisition and assimilation barrier*, that derives from *Difficulties in identifying sources and usefulness*; 2. *OD acquisition and assimilation capability*, that is a construct of *Ability to develop organizational culture for open data OI* and *Ability to engage with OD publishers*; and 3. *OD acquisition and assimilation benefit*, that is a construct of *Proprietary data substitution* and *Access to new, previously unavailable data*, and the main capabilities needed to overcome them to successfully manage OD in SMEs has been done by Huber et al. (2020). barriers limiting open data about water resources from realizing its full potential, e.g. *improved transparency, citizen participation, innovation and water resource decision making* has been researched by (Sugg, 2022).

Various user groups experience the drivers and barriers of OD implementation in different ways. (Mutambik et al., 2021) describe the issue from a government official and technological experts' perspective.

3.5 Quality

In the conducted literature review the aspect of quality was questioned notably often. The emphasis on data quality is understandable, since the quality of data is crucial for enabling its meaningful use. The accuracy of the data, considering the parameter value as well as the accuracy of the meta-data giving it context, is essential since any inaccuracies can lead to misleading outcomes, when applied.

Researchers have focused on different aspects of the quality of data, highlighting the issues involving implementation, maintenance and governance of OGD as in the (Bachtiar et al., 2020; Schultz & Kempton, 2022) study or analyzing the quality of available OD like (Ham et al., 2019; Krasikov et al., 2020).

The issue of low-quality OD was further addressed. Based on decision-making trial and evaluation laboratory (DEMATEL) technique, (Moradi et al., 2022) have formed a comprehensive method for improving the quality of OGD and increasing citizens willingness to use the data. Increasing the quality of OD was also one of the objectives in a study by (Zuiderwijk et al., 2014), where they reviewed the main elements of OD ecosystems, that would facilitate a straightforward process for the publication of OD and its use.

Governments globally are making substantial investments into making their data accessible to the public, reflecting a commitment to transparency. However, solely the act of publication is futile if the data provided is of insufficient quality.

3.6 Research categorization

Given the growing volume of research on OD, that has been increasing since the concept of OD has appeared, required its categorization. Authors (Ansari et al., 2022; Cruz & Lee, 2016; Ferencek et al., 2022; Safarov et al., 2017; Saxena, 2018) proposed categorization groups based on literature reviews. While (Ansari et al., 2022) summarized the academic research about OD tools for visualization, (Cruz & Lee, 2016) conducted a research based on a socio-technical model and proposed a framework for future categorization of OGD research. (Safarov et al., 2017) analyzed 101 academic studies about OGD that discussed at least one of the four identified factors of OGD utilization: *OGD types*, *OGD conditions*, *OGD effects* or *OGD*

users. (Ferenček et al., 2022) took a more quantitative approach implementing hierarchical clustering and found that the authors are generally focusing on one of two directions: one that summarizes *government policies, initiatives and portals for OGD sharing* or the other that summarizes *regional use cases, adoption of OGD, platforms and barriers for OGD implementation*.

Further, the empirical research for the categorization was conducted by (Wirtz et al., 2022) who developed a framework for theoretical review of antecedents, decisions and outcomes and found that the empirical research can be categorized into six groups, namely 1. *OGD theory: General / conceptual development*; 2. *OGD antecedents: Drivers / barriers*; 3 *OGD decisions: Adoption / usage / implementation*; 4. *OGD outcomes: Success / performance/ value*; 5. *OGD impacts: Acceptance / satisfaction / trust in government*; and 6. *OGD governance: Policies / regulation / law*.

3.7 Maturity

The readiness of companies to adopt OD is another concept that interested the academic society. OD maturity level serves as an indicator of how well-prepared organizations are for the integration of OD.

Institutes globally are assessing countries for the adoption of OGD. These evaluations analyze accepted policies, the accessibility of OD for consumption, what tools they are offered along with the data etc. (Susha et al., 2015) compared the 5 benchmarks of OGD maturity levels (Open Data Readiness Assessment, Open Data Barometer, Open Data Index, Public Sector Information (PSI) Scoreboard and Open Data Economy benchmarking research) based on its meta-data, meta-methods and meta-theories. Later (Zuiderwijk et al., 2021) reviewed those benchmarks and expanded the selection of benchmarks based on newer research, adding Open data maturity in Europe, World Justice project Open Government Index, OGD Report, Open Data Inventory and OGD by The Economist Intelligence Unit, and excluding PSI Scoreboard

To measure the maturity level for OGD adoption, a theoretically supported model needs to be defined. (Dodds & Newman, 2015) created a model to assess the OD maturity level of an organization in which levels of maturity were divided in 5 sections along with the definition of corresponding activities that need to be

undertaken to achieve a certain level. (Solar et al., 2012) proposed a maturity model that consisted of 3 level hierarchical structure with 33 weighted critical variables to assess the OD maturity level of an organization. In a quality assessment of maturity models Çaldağ & Gökalp (2022) identified, based on predefined criteria: unambiguity, comparability, repeatability, completeness and objectivity, found that there are a limited number of OD maturity models and none of them fully satisfies the requirements.

4 Discussion

To understand the concept of open data, what has been researched by academic society, and what is its practical use in enterprises, we reviewed 72 academic articles from the Web of Science, Scopus and ProQuest. In a review of existing literature, we noticed that some key concepts, such as users, quality, policies, impact, drivers and barriers, research categorization and maturity, predominate others and its aspects surveyed more frequently.

The examination of user perspectives highlighted that the focus was in identifying predictors, that could explain the motivation driving users to utilize OD. Using various existing theories, such as UTAUT, TAM, RSG, etc., different authors derived various results. The motivation of individuals to adopt OD differs from the motivation driving employees in an organization or a public administration. Based on the findings in the literature review the most significant factor in an organization is top management support and competitive pressure, while at individuals the social factor seems to outweigh others. A distribution into groups *beginners*, *followers*, *fast trackers* and *trendsetters* was proposed in the literature concerning the level of adoption of OD where any individual, organization or country can be categorized.

The quality of OD emerged as a crucial aspect in investigating the OD agenda, since any meaningful use depends on it. Studies focused on several aspects of the quality of data throughout the life cycle of OD. Most studies revealed low quality of available OD, which was in consequence followed by propositions on how to increase the quality of OD. According to our literature review the issue of quality data should be the next objective to achieve higher levels of adoption among any user group.

The next major aspect of OD observed in the literature review was the implementation policies. Policies play a pivotal role in defining the publication of OD regarding its quality, usefulness, accessibility, actual openness etc. In the review conducted considerable classification of policies was done, managing framework and implementation guidelines were proposed and existing benchmarks were examined and improved. Only with the implementation of adequate policies governments can achieve a truly open society.

A critical aspect of OD is its impact. Academic society has explored of the perceived benefits, challenges, issues associated with the publication of OD and the main insight that can be extracted is that the open data's value is conditioned with its utilization by individuals, civil society or organizations.

Initial drivers of OD were government directives, after that, public institutions, organizations and individuals advocated for its further opening and adoption. In addition to the drivers, researchers focused on barriers of OD use, examining why the use of OD is not as widespread as it was initially envisioned. Barriers vary from technical, organizational, environmental to legal causes and to achieve higher utilization rates they will have to be addressed.

The growing amount of research indicated the need to categorize the literature itself, to identify the current state and propose future directions for research. With the use of various tools, models and quantitative methods researchers have proposed categorizations into groups.

The maturity level of enterprises for adoption of OD has also been one of the key objectives investigated by the academic community and the global institutes covering the OD agenda. The need for a theoretically supported model has been exposed and several models have been defined.

5 Conclusion

In conclusion, this literature review offers an in-depth analysis of the versatility of the concept of open data. Identifying and addressing the challenges, such as the need for improved data quality and the necessity of appropriate supporting policies, will be essential for further adoption and success in realization of the OD full potential.

Our review highlighted a lack of empirical research on how small and medium-sized enterprises use OD, what incentives could encourage its adoption and which policies would promote its long-term use. Addressing this research gap is essential to enable policymakers to introduce effective strategies for promotion of OD use and help SMEs use OD for innovation and economic growth.

Further research on open data quality, barriers for its adoption and, most of all, its impact are necessary to achieve the open society and economic growth envisaged in the first OD initiatives.

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