



ODECO

Towards a sustainable Open Data ECosystem

D3.1

Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem



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Table of Contents

Abbreviations	6
1. Introduction	7
1.1. Problem Definition	7
1.2. Conceptual Framework	7
1.3. Role of this deliverable in the ODECO project	9
2. Methodology	11
2.1. Data collection	11
2.2. Data Analysis	11
3. Results	12
3.1. Non-specialist open government data users	12
Data Collection Approach	12
Results	12
Limitations	13
3.2. Journalists	13
Data Collection Approach	14
Results	14
Limitations	15
3.3. Elementary school students	15
Data Collection Approach	15
Results	16
Limitations	18
3.4. NGOs	18
Data Collection Approach	18
Results	19
Limitations	20
3.5. Local governments	20
Data Collection Approach	21
Results	21
Limitations	22
Data Collection Approach	23
Results	24
Limitations	25
3.6. Commercial users	25
Data Collection Approach	25
Results	26
Limitations	26
3.7. Intermediaries	27
Data Collection Approach	27
Results	27
Limitations	29
3.8. Summary of (potential) contribution and value user groups provide to the ODE	29
4. Presentation of the modelled user contributions to the ecosystem	38
5. Conclusions	41
6. Bibliography	42

List of Figures

Figure 1: Linear OGD Ecosystem 9
Figure 2: Circular OGD Ecosystem 9
Figure 3: Screening criteria of the literature review on value and contributions of national and central governments to OGD ecosystems23

List of Tables

Table 1: Methods applied during the Generative research with 9th grade teachers and students..... 16
Table 2: Intermediary activities of non-profit organisations in the open data ecosystem.19
Table 3: Values in literature on national governments.....24
Table 4 : Contributions and descriptions of the users in the open data ecosystem29
Table 5: Thematic categorisation of contributions of open government data users to the open data ecosystem.....38
Table 6: Thematic categorisation of values in the open data ecosystem38
Table 7: Matrix of values and contributions of open government user groups in the ODEA40

Abbreviations

D	Deliverable
ESR	Early Stage Researcher
M	Milestone
NGO	Non-Governmental Organisation
NPO	Non-Profit Organisation
OD	Open Data
ODE	Open Data Ecosystem
OGD	Open Government Data
PBL	Project-Based Learning
WP	Work Package

Nr	Partner	Partner name	short	Country
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2	Katholieke Universiteit Leuven	KUL		Belgium
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5	Panepistimio Aigaiou	UAEGEAN		Greece
6	Aalborg Universitet	AAU		Denmark
7	Università degli Studi di Camerino	UNICAM		Italy
8	Farosnet S.A.	FAROSNET S.A.		Greece
Partner organisations				
1	7eData	7EDATA		Spain
2	Digitaal Vlaanderen	DV		Belgium
3	City of Copenhagen	COP		Denmark
4	City of Rotterdam	RDAM		Netherlands
5	CoC Playful Minds	CoC		Denmark
6	Derilinx	DERI		Ireland
7	ESRI	ESRI		Netherlands
8	Maggioli S.p.A	MAG		Italy
9	National Centre of Geographic Information	CNIG		Spain
10	Open Knowledge Belgium	OKB		Belgium
11	SWECO	SWECO		Netherlands
12	The government lab	GLAB		United States of America
13	Agency for Data Supply and Infrastructure	ADSI		Denmark

1. Introduction

In recent years, there has been a significant increase in the amount of Open Government Data (OGD) that has been made available to the public (K. Janssen, 2012; Kuk & Davies, 2011; Wang & Shepherd, 2020). This growth has been driven by the aim to enhance the transparency (Ruijter et al., 2020), encourage citizen participation (Sangkachan, 2021), support public administration's functions (Fuentes-Enriquez & Rojas-Romero, 2013) and boost the economic impact of and value creation through OGD (Publications Office of the European Union., 2020). However, researchers suggest that collaboration beyond government efforts is necessary to gain value from using open data (Harrison et al., 2012; Pollock, 2011; Zuiderwijk et al., 2014). To achieve this, data sharing across various sectors, also known as the third wave of open data, is crucial (Verhulst et al., 2020). Recent developments, such as the Data Governance Act passed by the European Commission and applicable since September 2023 (European Commission, 2023), reinforce this perspective.

Advocates and researchers have emphasized the importance of considering an Open Data Ecosystem (ODE) perspective to harness the potential of the open data (Davies, 2011; Pollock, 2011; Van Loenen et al., 2021). The ecosystem approach highlights the interconnectivity and interdependence of various actors in the ODE (Dawes et al., 2016; Zuiderwijk et al., 2014). Users from different sectors play a crucial role in shaping the evolution of the ODEs (M. Janssen et al., 2012; Van Loenen, 2018), and understanding the value and contributions of these diverse actors requires a collaborative and user-centred approach, which is necessary to create a sustainable value-creation within the ODE (Charalabidis et al., 2018; Van Loenen, 2018).

1.1. Problem Definition

Despite the significant attention given to OGD and the value created, researchers have pointed out a lack of understanding from the user's perspective. This leads to a gap between promises and reality (M. Janssen et al., 2012). Some studies have identified technical, economic, social, cultural, and political dimensions of value creation impact by highlighting that open data has no intrinsic value, and instead, it needs to be used to become valuable (Attard et al., 2016; Hossain et al., 2016; Onsrud & Rushton, 1995; Tai, 2021; Virkar & Viale Pereira, 2018). However, the generalization of value conceptualization assumes a direct relationship between the usage of OGD and its outcomes.

According to Safarov et al. (2017), further empirical research is necessary to confirm the hypothesized effects of OGD and establish causal links between the type of utilization and its results. Additionally, the study performed by Zuiderwijk et al. (2019) of 156 Open Government Data Initiatives worldwide found that these initiatives often offer benefits in areas unrelated to their stated objectives. This suggests a gap between the objectives and outcomes of such initiatives, making it even more relevant to identifying the specific outcomes, effects, benefits, impact, or value according to the uses of specific user groups. Moreover, if the goal is to transition from an open government perspective (supply-driven) towards a circular, user-driven ODE we need to examine how the users of OGD contribute back into the ecosystem and create circularity by adding value back to the ODE.

1.2. Conceptual Framework

According to the Cambridge Dictionary, the term "value" can have multiple meanings. It can serve as a noun referring to the numerical representation of an amount and the monetary or utilitarian worth of something. As a verb, it denotes the act of appraising and recognizing something as significant. Additionally, the plural form of "values" describes personal beliefs about right and wrong and what is most significant in life, which can ultimately influence one's behaviour (Hein et al., 2021). In his work, anthropologist David Graeber argues that the production of monetary value and personal values share a common root in the act of valuing and that the separation of these two aspects occurred more recently, particularly since the Industrial Revolution (Graeber, 2013). On its part, experts like economist

Mariana Mazzucato stress the importance of distinguishing how value is discussed as our understanding can shape economy (Mazzucato, 2020).

In her work, Bos-de Vos (Faculty of Industrial Design Engineering, Delft University of Technology, The Netherlands & Bos-de Vos, 2020) seeks to enhance the understanding of value in collaborative design processes. She delves into the multiple forms that value can take, ranging from economic, use, emotional, public, social, or ecological conceptualizations, which may vary depending on the context and stakeholders involved. Within these different conceptualizations of value, Bos-de Vos identifies two key perspectives across the different understandings of value. The first, "Values as Guiding Principles," regards values as the ideals guiding people's actions and choices. Values serve as criteria to assess behaviour and determine what individuals consider significant in their lives. Personal needs, cultural factors, and social relationships can influence these values. The second perspective, "Values as Qualities with Worth," views value as a particular quality with worth that can be achieved through a solution. In this perspective, value is not restricted to monetary terms but may encompass non-monetary values like social, ecological, and use value. These values can be subjective and may depend on individual perceptions.

The different interpretations of public value can exemplify the two perspectives on value by Bos-de Vos. The singular form of the concept of public value refers to the objective pursued by public sector managers (Moore, 1995), while the plural form, "public values," is defined as "social norms, principles, and ideals that government officials and organizations strive to achieve and uphold" (, 2018, p. 60). In the OGD literature, there is often a disconnect between the singular and plural perspectives (Zuiderwijk et al., 2019), and the studies addressing the impact or value of open government data tend to fail to distinguish the two natures of value by presenting them as general concepts (Safarov et al., 2017). Therefore, for the purpose of this report, we will focus on understanding the outcome perspective, or as suggested by Bos-de Vos, on the "Values as Qualities of Worth" by taking a perspective on value as *Social Use Value*.

Our understanding of Social Use Value involves a comprehensive understanding of the value derived from OGD. This concept builds upon the classical "use value" notion employed by economics and management scholars, which refers to how individuals perceive the qualities and utility of products, services, or activities (Bowman & Ambrosini, 2000). However, the conceptualisation extends beyond individual utility and recognises that value is not solely created for the user. Instead, it acknowledges a broader spectrum of values, encompassing societal, organisational, and community dimensions (Den Ouden, 2012). The Social Use Value is not confined to mere utility but can also encompass a wide array of social benefits, such as enhancing well-being, expressing identity, signalling social status, or evoking emotions (Cabitza et al., 2020) and the society-wide (at local, national, or international) production of goods and services, which can then be measured in monetary terms (Mazzucato, 2020). Social Use Value considers the extent to which these benefits impact society as a whole and how people perceive this impact instead of taking a public or private perspective on it (Halmos et al., 2019).

Finally, the assessment of Social Use Value can be quantitative, focusing on the tangible effects and benefits resulting from open data use or qualitative by describing the collective perception of the OGD's utility in shaping decision-making and expected outcomes (Cabitza et al., 2020). Both approaches are essential, as they offer complementary insights into the societal significance of OGD, that can later be translated into competitive advantage or monetary value (Porter, 1985). Therefore, this report will focus on the Social Use Value that we understand as the tangible and perceived effects of using OGD by a specific societal group of actors and how these affect the ODE. For the effects of this report, we will refer to the tangible outputs of using OGD as contributions. These contributions can also be understood as the means, actions or resources that can lead towards obtaining the perceived effects or outcomes that we will refer to as values. By describing these two aspects, we can map what the actors achieve with

OGD (values) and how they do it (contribution), as well as how the said contributions enhance the ODE through creating circularity and adding value back to it in this process.

1.3. Role of this deliverable in the ODECO project

In ODECO deliverable “3.1. Understanding potential contributions of OGD users to the ODE”, we aim to map the potential contributions of the OGD users and take the first step in breaching the gap from linear (see Figure 1) to circular (see Figure 2) open OGD as this deliverable will be used as the basis for the 3.2 and 3.3 deliverables of the project.

For the successful completion of this task, we have researched and analysed the different kinds of participants, “actors” and “stakeholders” in the ODE, the various ways they (could) contribute to the “life” of the ecosystem by producing, consuming or producing and consuming at the same time OGD.

More specifically, the different participants of the ecosystem that have been examined are:

- Non-specialist data users
- Journalists
- Students
- NGOs
- Local governments
- Central/regional governments
- Commercial users
- Intermediaries

Accordingly for the above actors and stakeholders, the specific way each one of them contributes to the ODE has been examined. Additionally, for each one of them, the processes of value creation through the use of open data within the ecosystem has been analysed and modelled. Here we have strived to also depict the process through which the OGD used by the actors of the ecosystem are transformed and redirected back into the ODE in the form of new artefacts like datasets, for example. These artefacts create additional value in the ecosystem that surpasses the value of the initial data by adding the expertise, knowledge and additional information of the actor that processed them.

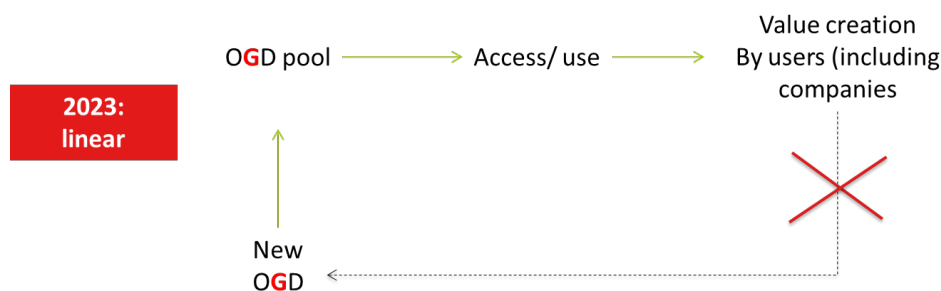


Figure 1: Linear OGD Ecosystem

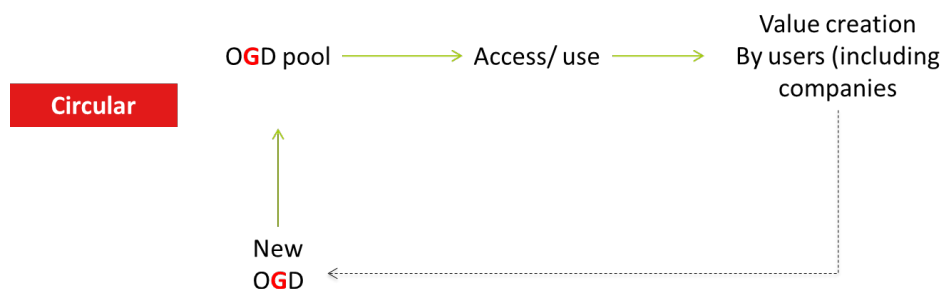


Figure 22: Circular OGD Ecosystem

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

This work lays the foundation for closing the open data cycle by understanding the contributions of OGD users and identifying avenues of organising this both in a technical and governance perspective in the following Tasks of this Work Package: “3.2. Promoting open data users' contribution from a technical perspective” and “3.3. Promoting open data users' contribution from a governance perspective”.

2. Methodology

2.1. Data collection

The first step taken was to explain the data collection process separately for each user group studied here as part of the OGD ecosystem and the types of sources utilized. The data collection phase was vital in ensuring the accuracy and reliability of our report. For each group we have outlined the methods employed, what type of sources were used, including primary (interviews, questionnaires, focus groups etc) or secondary (literature review, uses cases analysis etc), so we could gather comprehensive and diverse data for the creation of this report.

2.2. Data Analysis

The second step was to clearly identify, for each user group, the role of the user group in the ecosystem, the values it is currently contributing or may be contributing to the future if current hinderances towards delivering back to the ODE were eliminated. After drawing conclusions from these findings on the contribution of each user group within the ecosystem, and the values created by them, we have visually presented our findings through a modelling approach. More specifically, the following tasks have been performed.

Definition of User Potential Contributions: The potential contributions of OGD users to the ecosystem encompass both the roles they play in the system and the artefacts generated by each user group. These artefacts can, amongst others, include newly added-value products derived from existing open datasets, definitions specifying how open datasets can be effectively utilized, and evaluation studies aimed at enhancing the quality of existing open datasets.

Definition of User Contributions' Value: The values corresponding to each contribution that users bring or could bring back into to the ecosystem has been extracted by thematically analysing the descriptions of their contributions to the ecosystem and the interactions they have with other users within it, in a way that creates circularity.

Creation of a Visual Representation of how the user value is incorporated in the ecosystem: We have developed a visual model that presents the users' contributions and values in the ecosystem. The modelling consists of a matrix that depicts the values and contributions. The position of each contribution and the corresponding value that each user provides to the ecosystem is thus immediately observable.

3. Results

In this chapter, we provide an introduction to the different OGD users researched. There is a brief introduction of the user groups and their importance in the ODE, after that the data collection approach that was followed for the collection of the pertinent data that is presented, and finally, the results of the research, along with the relevant limitations specific to each user group that is described.

3.1. Non-specialist open government data users

Non-specialist OGD users are citizens with little or no data literacy. These users do not possess specific data-related skills or capacity, such as the ability to analyse datasets and gather insights, or the ability to produce data visualizations. The term “non-specialist” refers to the capabilities of users, which affect “citizens’ potential roles when engaging with OGD” (Purwanto et al., 2020). Van Loenen et al., (2021) call for more inclusive ODEs, which would see specific efforts to engage non-specialist users. However, at present, individuals who reuse and benefit from open government datasets are usually “skilful individuals or private organizations” (Tai, 2021). Non-specialist data users can offer an important contribution to ODEs, as they possess diverse knowledge otherwise not available to specialized developers and data users (Jaskiewicz et al., 2019). The inclusion of non-specialist users can lead to an increase in “transparency and inclusiveness” and more innovative public services (Tai, 2021).

Data Collection Approach

Most studies assume the need to acquire data-related skills to engage in the reuse of open data. However, not all users are willing to acquire these skills and become data scientists. To derive the value and the contribution of non-specialist users to the ecosystem, we analysed two studies from the literature: Whitney et al. (2021) and Jarke (2019). These two studies have been selected for the following reasons: (1) they represent different ways of engaging users in ODEs; (2) they engage users with diverse backgrounds and expertise; and (3) they show a variety of contributions to ODEs.

Results

Whitney et al. conducted a “Slightly Dystopian hackathon” to speculate about the risks associated with the installation of 4.000 “intelligent” streetlights in San Diego. The streetlights would collect video, and even analyse it to show “where pedestrians are, how fast they are moving, and in what direction, in real time” (Whitney et al., 2021, p. 4). Data from the streetlights would be shared as an open data API. While the hackathon itself was attended by university researchers and students, this case shows an interesting collaboration between academia, non-specialist users (citizens), journalists, and local government in trying to advocate against surveillance technology in the city. In this case, researchers collaborated with a coalition of local organizations and community activists, which provided insights about the possible harms of surveillance technology. Hackathon outcomes were shaped by the input of the coalition. A policy report was then produced and shared with local government officials, citizens, and journalists. The policy report is available on a public repository (Irani & Whitney, 2021), and contains a critical analysis of an open data initiative of the City of San Diego and a private company. The report was also used by citizens to raise concerns during local council hearings, ultimately leading to defunding of the smart streetlights project. The policy report is an example of non-specialist users’ contribution to the OGD ecosystem, which comes in the form of knowledge about the harms of surveillance, and in the form of mobilization and advocacy efforts for policy change. Whitney et al. remark that San Diego’s streetlights initiative stated an intention to promote civic engagement, but ended up ignoring the very communities it was supposed to serve, and mostly engaged technology and industry panels. This experience is evidence of the need to include a diverse set of users and stakeholders from the very beginning of OGD initiatives, who can highlight possible risks and harms, resulting in more balanced initiatives and policies around OGD.

The second study we analysed, Jarke (2019), highlights the multi-faceted nature of non-specialist users' value contribution. Jarke (2019) studied the participation of non-specialist users (older adults) in the design of a digital neighbourhood guide which relies on local open datasets. Through a series of "data walks", participants could "contribute their local and/or historical knowledge" (Jarke, 2019, p. 1014), while using their existing skills. During the data walks participants collected data for the digital guide by taking notes, photographing, and validating existing OpenStreetMap data. Moreover, the walks established these non-specialist data users as experts of their district who added their local knowledge back into the digital neighbourhood guide making them in the process confident in their value as contributors. This is convergent with the findings from (Whitney et al., 2021) on the benefits of leveraging local knowledge to criticize or improve OGD initiatives. In the study by Jarke, non-specialist users also acted as organizers by recruiting participants, and scheduling visits. According to Tai (2021), the involvement of citizens "with varying knowledge" can both increase transparency and promote public service innovation.

Non-specialist users already have great capacity to contribute value to ODEs. We have shown two cases in which non-specialist data users provided insights into societal issues by adding local and historical knowledge to the OGD. Moreover, they are able to mobilize the public and advocate with the contextualized OGD for a policy change. The case described in Whitney et al. (2021) shows how non-specialist users, working together with specialist users, can increase transparency and hold local government accountable for OGD initiatives that do harm, or fail to deliver on their promises. However, the contributions we outlined are sporadic examples. In the context of ODEs, there are few examples of long-term engagement efforts targeting non-specialist users. We suggest that further value can be created by fostering deeper collaborations between specialist users and coalitions of non-specialist users, with the latter being able to indicate local needs, issues, and priorities. Further value can also be realised by recognizing the need for contextual information. Depending on the intended use, large open datasets may lack the contextual information, or "thick data" needed to gather new insights. Value can also be created by recognizing the need for the diverse expertise provided by non-specialist users. In the context of an OGD ecosystem, diverse expertise means not only being able to build and imagine technical solutions for open data sharing and reuse, but also having the necessary knowledge to critically evaluating the impact of OGD initiatives on local communities.

Summary: non specialist OGD users contribute the following values to the ODE:

1. Adding local knowledge to the OGD resulting in new insights to societal issues
2. New knowledge resulting in mobilization of the mass resulting in influencing political agendas
3. New knowledge resulting in advocacy efforts for a policy change

They potentially can also add the following values to the ODE:

1. Fostering deeper collaborations between specialist and non-specialist users
2. Recognizing the need for contextual information, or "thick data" that is key in gathering new insights from open datasets
3. Diverse expertise, meaning not only technical knowledge on how to realize OGD initiatives, but also knowledge needed to critically evaluate OGD initiatives' impact on local communities

Limitations

Findings from this analysis need to be corroborated by expert interviews and first-hand observations. Additionally, we only selected a few cases for analysis under the perspective of value contribution to the ecosystem. We also acknowledge that it is inherently difficult to distinguish between "specialist" and "non-specialist users, as the users themselves might not be aware of their own data skills.

3.2. Journalists

In modern society, journalism is a vital force, shaping public opinion and upholding transparency and accountability, often regarded as 'the fourth constitutional power'. The digital age has revolutionized

journalism through 'data journalism,' (Gray et al., 2012; Knight, 2015) where information is sourced, compiled, and visualized using data at every stage of the journalistic process. Data provides journalists with undeniable evidence, enhancing their ability to scrutinize governments and institutions, elevating their role as custodians of transparency in democratic societies. The advent of open data initiatives has further fuelled this evolution, making a wealth of data accessible to journalists. The convergence of open data and journalism presents a compelling synergy, promising to amplify transparency and accountability in the years to come, positioning journalism as a crucial pillar of democratic function. This innovative approach of integrating open data research within journalism marks a novel frontier, harnessing data's power to drive meaningful insights and informed narratives.

Data Collection Approach

The methodology of this research on journalism, utilizing OGD and exploring its potential contributions to the ODE, comprises three approaches. Initially, a structured literature review (Papageorgiou et al., 2023) was conducted to assess the prevalence of their use within the domain. This review unveiled the primary themes in academic research on the subject, serving as a guiding step to comprehend the domain and plan the subsequent phases of the research. Furthermore, semi-structured interviews were carried out with employees from three distinct media organizations across the European Union. These interviews play a crucial role in gathering qualitative insights into the utilization of open data in journalistic practices. The third pillar of this research involves action research. Being placed in one of the beneficiaries of ODECO, a media organization (Farosnet – publisher of the Greek Edition of Huffpost), has enabled a continuous collaboration with journalists and data analysts in a newsroom environment throughout the project. Through active engagement with professionals in their workplace, the research aims to reveal how OGD is incorporated and utilized in a medium-sized media organization.

Results

Through the research, it was revealed that journalists can take several roles in the ecosystem and, as users of OGD, they can produce a variety of values. Their main role is that of the communicator through which they provide information to the public on complex topics that are not easily understandable. Through this process OGD is made available to the public in an easily comprehensible fashion in a way that it not only informs the public, but it also engages with social issues and generates social empathy (Araújo, 2019; Lawson, 2022). This process is achieved by the incorporation of three different elements in news articles. The journalists can present visualizations of the collected data to make it easily understandable to the public. They can provide web services powered by open data that the public can use to be informed in real time about pressing issues (Papageorgiou et al., n.d.). Most importantly, they can reach out to experts who can provide further explanations on subjects where, although the data is freely available, it requires specialized knowledge to be understood.

The other pillar of OGD usage in journalism pertains to the interaction of journalists with the data producers (local governments, intermediaries, NGOs, central/regional government). Journalists, in this case, can play a variety of roles: Demander of additional information and data from the governments in the process of their investigative efforts, Aggregator of information provided in different open government datasets, Validator of the provided data. Therefore, they can enhance the transparency of the overall system and hold public or private institutions accountable for their actions (Shehu et al., 2016). This not only promotes transparency but also may increase the trust and legitimacy of data provided by governmental organizations (Grimmelikhuisen, 2012) or, on the opposite side, challenges them to improve their data and the services provided by them towards the public.

Although the majority of journalists are utilizing information and data released by local and regional governments, they are not adequately trained to use OGD directly in the form of raw data because of a lack of the necessary skills and resources. If these inadequacies were eliminated journalists could help establish a closer two-way collaboration with the providers of OGD. This collaboration would help address gaps or inconsistencies that not only journalists detect in their work, but also citizens (with

whom journalists are in constant communication) identify through their insights on the data. In such a way, journalists can regularly monitor open data related to government performance and work as evaluators of the effectiveness of governments and public policies individually but also with the help of their audiences.

Limitations

In the research on the values and contributions of journalists in the ODE, a significant limitation has been detected in regard to data collection. Initially, the literature on using open data in journalism could be more extensive, especially on case studies. Furthermore, the interviews and the action research part of the research are not yet concluded, consequently, the results presented in this report are based on preliminary data mainly.

3.3. Elementary school students

School students could be seen as part of the large percentage of citizens without technical backgrounds, often called non-specialists, non-data experts or lay audiences (Boyles, 2020; Concilio & Mulder, 2018). Considering youngsters as future active citizens in a fast changing and data-driven society, elementary school students aged 14 to 16 years old have been at the centre of long-term Open Data Literacy initiatives (Pellegrino & Antelmi, 2023). Furthermore, integration of OD in schools has been defined as a key strategy for achieving inclusion and fairness in ODEs (International Open Data charter, 2015). More in detail, integration of OGD in school education has been shown to, not just support subject teaching, but also enhance students' skills for the labour market and civic engagement (Atenas et al., 2015; Saddiqa et al., 2021). For example, experiments of (Saddiqa et al., 2019) have revealed that using open datasets from student's own municipalities increases their awareness about local and global issues. Potentials of the use of OD in the classroom has been firstly related to the connection of classroom to real facts, and secondly, to increasing teacher's and student's motivation (Coughlan, 2020). Furthermore, (Coughlan, 2020) has identified main drivers that encourage teachers to use OD in teaching such as public engagement with OD, and the potential of OD as material for learning important skills.

Although the research importance of OD in elementary education has been increasing, the approach has been focused on elementary school students and teachers as users of OGD rather than contributors. According to (Van Loenen et al., 2021) current OD systems in education are mainly exclusive and mostly linear. Ongoing research is advancing on developing learning designs that support elementary school students in an active role as contributors in inclusive, circular, skill-based and user driven ODE.

Research on OD competencies has identified two central groups of skills for using OD in education: firstly, the Data Skills group focused on data management competencies and secondly, the Context Skills group related to the student's engagement with their local context (Celis Vargas et al., 2023). According to (Celis Vargas et al., 2023) OD learning activities focus on different combinations of Data and Context skills as expected learning outcomes, which influences the role of students in their local ecosystem and sheds light on learning designs of Open Data in education. In other words, OD learning designs in elementary school focus on advancing students' data management and context engagement skills, which drives civic engagement competencies. Then, the most effective contribution of students to OD ecosystems might occur when students not just use OGD but also collect their own local data and engage with real communities.

Data Collection Approach

Looking at elementary school students as potential contributors in ODEs is a novel approach. Therefore, this exploratory study focusses on answering the research question: What are the potential contributions of students to an OD ecosystem and their value? Firstly, a systematic mapping review on Open Data skills and learning approaches (Celis Vargas et al., 2023) helps to uncover potential contributions by analysing current Open Data experiments in different educational levels. Secondly, a qualitative generative research approach was adopted to dive into the latent knowledge of students and teachers to answer the research question. A generative Research focuses on mapping the context

around a user experience to learn about needs, wishes and motivations of the people involved (Sanders & Stappers, 2012). In a generative research process different methods are used to dive into what people do, say and know. For example, interviews are used to gain explicit knowledge on what people say and think, meanwhile, observations focus on what people do and use, and generative sessions focus on the tacit or latent knowledge hidden on what people know, feel or dream. Generative research helps to make the implicit more explicit, gaining knowledge about latent needs. In the current study, a generative research approach was conducted with focus on students and teachers' practices, needs and desires around the development of a learning design for OD competencies. Participants included 9th grade teachers and 15- and 16-years old students in a Danish school. Different research methods were applied to gain explicit and latent knowledge.

Table 1 provides an overview of the research activities conducted including interviews, workshops, and co-design sessions.

Table 1: Methods applied during the Generative research with 9th grade teachers and students.

Who	Method	Participants	Description
9th grade school teachers	Interview	5	Focus on what teachers say and think. Semi-structured interviews lasted around 60 minutes.
	Co-design	1 Teacher coordinator	Focus on what teachers do and know. Co-design of a learning activity (workshop for students) was developed Including an after-workshop interview.
9th grade school students	Workshop	42	Focus on what students do and know. A 2h workshop (OD learning activity) was developed. It repeated three times with different students.
	Interview	3 groups of 5 students (15 students)	Focus on what students feel and dream, informal interviews were conducted with a group of students after the workshop.
	Survey	39	Focus on what students say and think. At the end of the workshop, students answered a brief survey.

Analysis of the qualitative data was done following a thematic network analysis approach (Attride-Stirling, 2001). Firstly, mapping the potential contributions, and secondly, uncovering their value for OD ecosystems.

Results

Learning designs for OD competencies in elementary school might involve different interactions or collaborations with other actors or systems which determines the different potential contributions. In a circular and skill-based OD ecosystem (Van Loenen et al., 2021), elementary school students might adopt different roles. For example, students could engage as providers, consumers and intermediaries of OD depending on the learning objectives and learning activities. Six potential contributions of elementary school students to OD ecosystems were identified through a systematic mapping review and a generative research approach with 9th grade teachers and students in a Danish school. Potential contributions are (i) Local datasets, (ii) visualisations and data stories, (iii) training of OD skills, (iv)

improving quality of OGD and metadata, (v) awareness on local problems, and (vi) creating dialogue. Potential contributions require that students adopt different roles to act in the ecosystem which might be enabled by OD learning designs. Roles were mapped according to the roles of open data intermediaries used in (Pilshchikova et al., 2022) and (Shaharudin et al., 2023). Finally, from the potential contributions, four types of value were uncovered. Values were found to be the result of different interactions of students and other user groups in an OD ecosystem.

Students can potentially contribute with (i) local datasets creating knowledge about their local environment and experiences. In this way, elementary school students adopt a role as data providers potentially interacting with research institutions, NPOs and journalists.

As intermediary communicators between local governments and local communities. Students could create contextual understanding in learning activities focused on the creation of (ii) visualisations and data stories. Visuals or data stories are then means to explain local issues to members of local communities based on local OGD or own collected data. For example, in (Flasher, 2020) students are engaged in publishing visualisations of OGD to explain municipality services and performance to the local community.

Elementary school students might potentially (iii) train OD skills. In interactions among elementary school students and citizens or non-specialised users, students could act as intermediary educators to train skills on members of local communities. For example, in (Gaspari et al., 2021) undergraduate students, not just learn about geographical data and mapping tools in an academic course, but as active member of a mapping community, students engage with vulnerable communities to teach them open mapping tools and map the local area together.

Authentic learning activities invite students to act as professional in real-world would do. For example, elementary school students might act as data scientist or OD experts. Adopting the role of real practitioners working with OGD, students might focus on (iv) improving the quality of datasets and their metadata. In this scenario, students could potentially adopt the role of intermediary aggregators in an OD ecosystem.

Two more intangible contributions were identified (v) raising awareness on local problems and (vi) creating dialogue among local communities. For achieving these potential contributions, OD learning designs might facilitate students' development of competencies for real-world problem solving and active citizenship. Considering students as experts of their own local experience, OD learning activities might support them to build networks in their local communities and to raise their voice in different scenarios. In this way, students adopt roles as problem owners, and intermediaries between local governments and citizens.

Finally, four potential values were uncovered by identifying the potential contributions. Firstly, a potential value contribution may be in adding local or contextual understanding as the result of local datasets, visualisations and data stories. Secondly, students may add community knowledge as the result of training OD skills in the school community. Thirdly, students can enhance quality by improving the quality of open government datasets and metadata while using them in learning activities. Finally, they can bring social value to the ODE by raising the voice of local communities and creating networks and dialogue among actors in the school ecosystem.

Considering elementary school students as potential active contributors of OD ecosystems might be equivalent as considering them active members of their local communities. It can be seen as an empowering role underpinned by OD learning designs that develop competencies for Data Literacy and Real-world Problem solving. According to (Celis Vargas et al., 2023) this approach could be seen as OD Literacy for responsible citizenship. In other words, Open Data Literacy in education might contribute

to creating complex learning ecosystems (Raffaghelli, 2020) where Open Data is blended with civic engagement (Celis Vargas et al., 2023). In other words, OD learning designs are grounded on the vision of students as active actors both in society and in local OD ecosystems. OD learning designs not just encourage the use of OGD but also the engagement of students in decision-making processes. In the long-term this vision contributes to the sustainability of OD ecosystems.

Limitations

On the current investigation there are limitations related to the novelty of the field, the methodology used for data collection and the scope of the study. First hand data was collected in a Danish school which recently adopted the project-based learning (PBL) approach from 9th grade. The results of the current investigation are then grounded in the Danish context and the school characteristics. Further research is needed for extending or comparing the current results to different contexts. Several qualitative cases addressing the research question may allow for generalisation (Aberdeen, 2013). Secondly, although the current investigation considered the use of OGD in general, considering domain related OGD such as geographical, social, or environmental OGD could shed light on more and more specific contributions of students to the OD Ecosystem.

3.4. NGOs

Non-Governmental Organisations (NGOs), also interchangeably called Non-Profit Organisations (NPOs), in the open government ecosystem are not mere users, as there exist communities of the end-users they are addressing (Enaholo, 2017). They reuse OGD to create tools, write reports, and contribute through other activities. Moreover, they can produce additional open data to enhance OGD they use. Due to that, they potentially interact with all other user groups to perform these activities and bring various types of value to the ecosystem. In this section, we discuss the contributions of the NGOs and what value they can create.

Data Collection Approach

For this report, we refer to the systematic literature review we conducted on the current activities of NPOs and their effects on usability barriers (Pilshchikova et al., 2022). Activities of NPOs are what we consider their contributions to the ODE that creates value. The review uses the intermediary activities framework based on the previous research by Gonzalez-Zapata & Heeks (2015) and den Haan (2018) to outline and group the contributions.

The case studies are part of our research in progress and look into the contributions of the NPOs/NGOs with additional analysis of value creation. The selection criteria for the case studies are:

1. Non-profit organisations should have different missions/focuses/aims.
2. Each case should have more than one type of open data activity being performed.
3. The cases work on different levels, i.e., municipal/regional/national.
4. The cases involve organisations and people who are willing and ready to cooperate in the research and to share information that is required to conduct this research.

The two cases we have focused on are of non-profit organisations Open Knowledge Belgium and CityLAB Berlin. Three semi-structured interviews were conducted per case. For the analysis, we used a blended approach, which is a mix of inductive and deductive approaches. Using this approach, we can use existing theories and concepts while still getting new findings from the data (Skjott Linneberg & Korsgaard, 2019). The research builds on the intermediary activities from Gonzalez-Zapata & Heeks (2015) and den Haan (2018), with NPOs' existing contributions collected through the systematic literature review. To outline the social use value creation, the inductive approach is used to analyse the contributions of the NPOs.

Results

In this section, the groups of NGOs' contributions identified based on the systematic literature reviews and case studies are discussed in terms of the value they can create. Moreover, potential contributions are proposed based on the existing ones and the limitations that NGOs as users face.

Existing contributions of NGOs in the open data ecosystem

Gonzalez-Zapata & Heeks (2015) define intermediaries as actors in the ODE that can bridge the barriers between data providers and user groups. They identified five groups of intermediaries with corresponding activities: demanders, producers, validators, developers and communicators. den Haan (2018) identified an additional educational group. In Table 2, we can see the examples of existing activities/contributions of NGOs found in the literature and grouped by Pilshchikova et al. (2022) according to the framework based on the previous research.

Table 2: Intermediary activities of non-profit organisations in the open data ecosystem.

NPO activities	Examples
Demanding	Demanding data from the local government; pointing out the lack of data to the specific government agencies
Producing	Re-sharing data requested from the government; carrying out investigations to assess projects performances; scraping data
Validating	Analysing and interpreting the data; cleaning data
Developing	Producing tools; implementing platforms; building a data repository
Communicational	Providing data in machine-readable and open formats for government offices; developing a toolkit to understand government policy; publishing reports; creating data visualisation tools; supporting communities' use of secondary data
Aggregating	Consolidating and translating raw data into usable data; data aggregation or integration
Educational	Providing training and workshops to the general public, private and public sector to raise their skill level and knowledge of open data

Case studies also outline the additional organisational group of activities of NGOs, encompassing activities such as organising meet-ups, hackathons, conferences, and online spaces for other actors in the OGD ecosystem to engage, collaborate and build a community.

Potential contributions of NGOs in the open data ecosystem

NPOs/NGOs create platforms that use enhanced, i.e. cleaned or aggregated, OGD that would provide services that the government does not provide or improve pre-existing services (Mutuku & Mahihu, 2014; Open State Foundation - Bron, 2018). That can be done in cooperation with the government itself (Open State Foundation - Complaints, n.d.) or with other user communities such as journalists, academics, or citizens. Through this, NPOs can contribute to social value by improving the services available to the citizens. Moreover, NPOs organise hackathons (Johnson & Robinson, 2014) or conferences, bringing government, developers, NGOs and other actors together, while also providing data literacy and OGD awareness training to get citizens more involved (Open Knowledge Foundation, n.d.). That contributes to creating innovation value out of OGD use. However, NPOs' contributions in this area are dependent heavily on the government's desire and ability to collaborate, so there exists more potential contributions and value created out of such collaborations.

One of the important focuses of many NPOs is government data openness, which they achieve by campaigning, re-publishing the government's data as open or helping the government with OGD

standardisation and policies (Enaholo, 2017; Schalkwyk et al., 2015). Additionally, a significant part of many NGOs' aims is to affect policymaking with evidence based on the OGD (idem.). For that, there is a need for collaboration between NGOs, the government, and other possible relevant communities that NGOs are targeting. Moreover, NPOs report on OGD openness, which can keep the government accountable. Through these, NPOs contribute to transparency and accountability values, which can increase the trust towards and legitimacy of the government in the long term. However, as before, for these contributions to be more impactful or exist at all in certain contexts, governmental organisations should be cooperative with the NGOs.

NGOs can help build a community by organising meetups, online forums, hackathons or conferences. Additionally, the NPOs bridging the gap between different actors can help with dialogue and negotiation between the data provider and users and help OGD users enact a degree of social control over the government's spending, policies, and level of transparency (Schalkwyk et al., 2015). Different communities of users, by using OGD, can build up their self-reliance with the help of NGOs, which can provide training that improves data literacy skills and, hence, the use of the data by the users to address their needs (Gascó-Hernández et al., 2018; Yoon et al., 2018). NPOs, thus, have the potential to contribute towards citizen engagement value.

NGOs use OGD to write reports and create visualisations to improve contextual understanding of community issues through storytelling with the data (Yoon et al., 2018; Yoon & Copeland, 2019). They can also enhance OGD with the collected data or create datasets themselves with the community's help that the government can later use (Ricker et al., 2020). By interacting with the community, providing them with OGD interpretation and tools, raising their knowledge, and improving their data literacy skills, NGOs can potentially contribute to critical consciousness as a value created for the community (Yoon et al., 2018).

In conclusion, NGOs' current and potential contributions can be in the form of different values that constitute social use values, as these organisations cover a wide range of activities and exist as intermediaries rather than in sole end-user form. They are helping the users and the data provider by collaborating and addressing both of them and by adding value through these collaborations.

Limitations

Limitations of this research are related to the data collection and data analysis. First, the systematic literature review's research question was not focused on values but on the roles and contributions of non-profit organisations. The case studies interview questions were also not explicitly focused on the value but on the roles and contributions of non-profit cases. Second, using the inductive approach instead of a specific framework might not capture all the possible values that NGOs' contributions can create.

3.5. Local governments

In broad terms, local governments constitute the state's most basic level of public administration. They represent a fundamental pillar of both administration and community development (Goldsmith, 1992) by fostering a sense of political identity, promoting economic development, providing social welfare, and governing the community (Stoker, 2011). The digitalisation of public services (Wäsپی et al., 2022) and the growing relevance of OGD availability have led to an increased emphasis on the role of local governments in operationalising such efforts (Davies & Perini, 2016). For this report we refer to local governments as the governmental officials belonging to the different public institutions that are tasked to operationalise the state's goals on a local or municipal scale. This section describes the value and contributions to the OGD efforts based on the results of a multiple exploratory case study on voluntary geographical OGD in the Danish context.

Data Collection Approach

A multiple exploratory case study that investigates the uses of open geographical government data from Denmark was our main source to base our analysis of the value and contributions of local governments as users of OGD according to the methodology proposed for this report. Case studies have proved effective in shedding light on decision-making processes and their outcomes, while being particularly useful in comprehending new phenomena that require deeper understanding or targeted investigation (Travers, 2001). Our selection criteria for the case included a focus on OGD use, which, for this study, is voluntary open geographical government data and the involvement of local governments in using that data to generate value. Voluntary open geographical government data refers to geographical government data made openly available by voluntarily publishing it through a government public-facing data repository instead of being published to comply with governmental policies. Seven semi-structured interviews were conducted with different actors from national ministries, governmental associations, non-profit and private organisations to collect the data for this study. Our analysis centred on the social use value derived from using open government geographical data and local governments' contributions to leveraging OGD use. The results of our study are presented in the following section.

Results

Local governments hold a crucial role in leveraging the use of OGD. A multiple exploratory case study on the uses of a government open geographical dataset in Denmark highlights local governments' values and current and potential contributions in this regard. Local governments collect, use, and maintain data to understand and address their communities' challenges as part of their public duties. The publication of this data is known as OGD. Therefore, as data holders, local governments naturally contribute by publishing data, often enforced by national and European policies obliging governmental bodies to make non-private data publicly available. In such cases, they also contribute to safeguarding data accuracy, consistency, compliance with data standards, and maintaining up-to-date data.

Local governments also use or re-use OGD to deliver their public tasks. In Denmark, these data can be registry datasets, environmental data, meteorological or statistical data, to name a few. At least 23 different national data sources in Denmark publish government data as open data. Some others are only shared with specific user groups for certain purposes, and some are only available for public authorities' re-use (Agency for Digital Government, n.d.). When local governments use this kind of data, they must discover the data they need and assess its reliability by considering its accuracy, consistency, and integrity. If data is unavailable, they may request access. They contribute by repurposing this data and integrating it with other data sources for analysis, visualisations or as a source for digital data-based applications. They are important contributors to the maintenance, monitoring, and feedback for such datasets and their data infrastructures, helping to ensure their timeliness and meaningfulness.

In some other cases, government data publication might be subject to its use for local government-owned projects, multi-scale projects involving various levels of government, or cross-sectorial partnerships. In some of these cases, the publication of data as OGD can be voluntary and not necessarily subordinated to policy compliance. For example, the open government geographical data repository considered for this analysis offers specific data for various domains like outdoor infrastructure, roads, traffic, school planning, and mobility, available in standard exchange formats and free of charge. This makes it accessible to public authorities, businesses, NGOs, and citizens alike.

Denmark's local governments use the open government geographical data repository to repurpose and incorporate existing data for novel initiatives, research, or analysis. For example, they may create a digital data-based tool for tourist information or representation tools so that citizens can visualise information about the municipality. In these cases, they will streamline the efforts, manage data, and collaborate with intermediaries to process, integrate data with other data sources, prototype and deploy the digital applications. They also use the platform to make specific data available when they are

involved in collaboration projects with other municipalities, within a region, across the country or as the storage for data-sharing for cross-sectoral partnerships. These collaborations can happen with companies, NGOs, and research institutes in relation to specific topics. In both types of collaborations, local governments will participate by processing and transforming raw data into usable formats. This may be done by specialised local government officials with technical expertise or through third-party intermediaries. In such cases, they will also contribute by verifying, tracking, and updating the OGD when needed.

The analysed case of Denmark's voluntary open government geographical data is a collaboration between the national institution in charge of data supply and an association of the local governments across the country. This kind of institutional infrastructure can facilitate that local governments contribute in some other ways to leveraging the use of OGD. For example, they could contribute by bridging local issues and community knowledge to decision-making by identifying specific issues that data can help address and functioning as problem owners. They could also coordinate and champion the efforts to ensure access to data by providing guidance on the appropriate use and interpretation of data. Depending on the topic, they may also offer expertise in their domain fields, for example, urban development, social welfare, health and mobility, to identify new use pathways. They can contribute by enhancing data legitimacy by ensuring data relevance and accuracy within those domains and identifying data needs. They may also bridge stakeholder collaboration and engagement to promote openness and sharing. They may be able to take responsibility for data and make decisions on its access, use and dissemination. Finally, with access to the tools, skills and amount of OGD, local governments may also incorporate predictive knowledge into their planning and decision-making activities.

Finally, OGD can provide significant value to local governments. It enables them to have a better understanding of community challenges and helps them make informed decisions. By using data-driven approaches, governments can also improve public task delivery and operational efficiency, ensuring that resources are allocated effectively. Furthermore, sharing data openly promotes transparency and trust with the community, which fosters accountability within governmental structures and encourages citizens to become more engaged and informed. This leads to more effective policymaking and better allocation of economic resources that benefit local communities. By automating processes and using digital platforms to optimize operational efficiency, governments can further enhance the advantages of open data, improving service delivery efficiency and overall governance at local, regional, and national levels.

Limitations

The results present some limitations. This study focuses on a specific group of users in Denmark from a specific type of OGD, which limits its generalizability and applicability to other contexts. The selected case study might also face selection bias, as the selected case study considered users who are already adopters of an open data culture within their organisational structures; this means that the views and opinions shared by the participants might be biased by their positive perspective towards the use of OGD. Moreover, the lack of controlled conditions can make it difficult to establish cause-and-effect relationships and limit replicability. The results presented in this section come from the analysis of using a single type of OGD in one specific context and where the interview focus was on the practices of using that data, which may limit its reliability. Despite these limitations, the results are a valuable starting point for discussion to consider the different contributions the actors involved in the value delivery of using OGD might bring to an ODE.

National and Regional governments

Governments play different and peculiar roles in an OGD ecosystem. The variety of roles is reflected in the range of values and contributions that governments can bring to OGD ecosystems. Such values and contributions are different based on the level of government (central, regional, and local level) taken into account (Reggi & Dawes, 2022; Tai, 2021). In this section we will focus on central and regional

governments and, through a literature review from a public administration lens, we will answer the following research question: *what are the values and the current and potential contributions of central and regional governments as a user in an open government data ecosystem?* To respond to this question, we use a public value perspective wherein we refer to the public value (singular) as the contributions of the central and regional governments using OGD, and to the public values (plural) as values (see section 1.2 for conceptual framework). Following the typical political structure of division of powers in Europe, we refer to central governments as the national authority responsible for governing a country and exercising control over national affairs (i.e., Belgium), and as a regional government to the administrations or authorities over specific geographic regions within a country (i.e., Flanders). In the following subsection, we present the research methodology. Then, we investigate the current contributions of central and regional governments to the OGD ecosystem. Finally, we reconcile value, contribution, and potential contributions of central and regional governments under the same analytical framework.

Data Collection Approach

This section draws its analysis from a literature review on value and contribution of national and central governments to the OGD ecosystem. The literature review combined search in the Web of Science database using keywords "open government data", "value", "national" (n=21 articles), with "open government data", "contribution", "national" (n=3 articles), "open government data", "value", "regional" (n=3 articles), and "open government data", "contribution", "regional" (n=0 articles), as illustrated in Figure 3. After the elimination of duplicates, the search led to 24 articles for review.

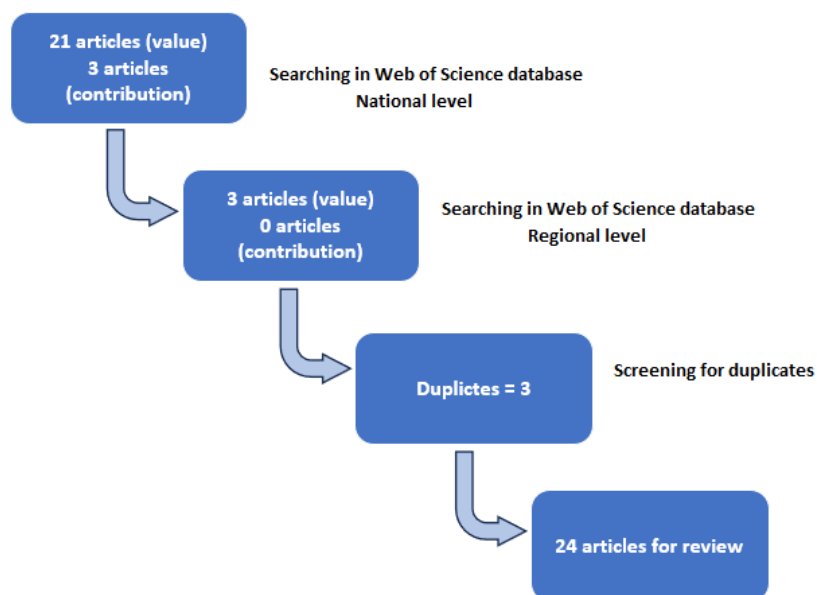


Figure 3: Screening criteria of the literature review on value and contributions of national and central governments to OGD ecosystems

The literature on national governments (see Table 3) assigns a prominent role of transparency and accountability as the main values underpinning the adoption of OGD in national governments. Transparency and accountability are referenced in isolation or combined with their relationship with engagement in policy-making (Lněnička et al., 2021) or accountability in policy-making (Raca et al., 2022). Other values represented in literature are citizens' engagement and innovation, with only one reference to a generic economic and social value.

Table 3: Values in literature on national governments

Values	Literature
Transparency	(Hermanto et al., 2018; Lněnička et al., 2021; Nikiforova & McBride, 2021; Raca et al., 2022; Saxena, 2018a; Saxena & Muhammad, 2018a, 2018b)
Accountability	(Bankuoru Egala & Afful-Dadzie, 2022; Hermanto et al., 2018; Nikiforova & McBride, 2021; Raca et al., 2022; Saxena, 2018b; Saxena & Muhammad, 2018a, 2018b)
Citizen's engagement	(Saxena, 2018c, 2018d; Saxena & Muhammad, 2018b; Shepherd et al., 2019)
Innovation	(Hermanto et al., 2018; Nikiforova & McBride, 2021; Saxena & Muhammad, 2018a)
Economic value	(Saxena, 2021)
Social value	(Saxena, 2021)

Literature on regional governments is scarce (Tai, 2021). Two articles identified in the literature review consider accountability (Maione et al., 2022) and collaboration (Avella et al., 2023).

Results

The literature does not provide a full overview of the contribution of central and regional governments to OGD ecosystems. However, we can derive such contribution indirectly by examining the object of the studies. Most of the literature sees open data sharing through national governmental platforms as the main contribution that governments bring to OGD ecosystem (for example, Lněnička et al., 2021; Nikiforova & McBride, 2021; Raca et al., 2022; Saxena, 2021). Governments, however, also function as regulators and policymakers, which accounts for a second relevant contribution (Bankuoru Egala & Afful-Dadzie, 2022; Saxena, 2018c; Shepherd et al., 2019).

Values and contribution are also connected to the different interactions and activities of the government in the OGD ecosystems. Although central and regional governments might engage in various ways with OGD, we can characterize their contributions into three clusters. The first one is also the most peculiar and it refers to policymaking (Reggi & Dawes, 2022). The policy-maker role corresponds to the unique contribution that governments can offer in terms of regulation. As responsible for policy formulation and decision-making, central and regional governments use open data from different regional or local levels to inform their policy decisions. This data can provide them with insights on the trends, challenges and successes of policy implementation. Governments operate also as publishers, and facilitators of OGD implementation. As publishers of OGD, governments essentially release their data through their open governmental platforms (Reggi & Dawes, 2022) by encouraging the adoption of common data standards at all levels of government and promoting interoperability. The contribution, in this case, is mainly constituted by the shared datasets, acting as facilitators of OGD use breaching siloed structures of public administration to accessing data from different governmental scales and departments (Reggi & Dawes, 2022; Young, 2020).

Overall, we see a dominance of central and regional governments' use of OGD driven by transparency and accountability, in which their contribution is expressed through data sharing via national and regional open data portals. Governments, in these cases, operate mainly as publishers, but also demanders of open data to the various stakeholders of the OGD ecosystem, also positioning them as facilitators of collaboration across different levels of government by regulating data standards, monitoring performance and evaluating OGD policy implementation. Central and regional governments can also use OGD regulations towards other government levels to engage citizens to participate in the policymaking processes by making it accessible to the public and encouraging citizen involvement, feedback, and collaboration in addressing local and national challenges. By making government data

openly available, governments can also promote citizen surveillance and encourage citizens to monitor lower levels of government and hold them accountable for their actions and outcomes.

The position of central governments as regulators also contributes to coordinating services and policies across different regions. This is particularly important for public issues requiring response cooperation in domains such as health or transportation. In such cases, central and regional governments can also act as demanders of OGD on the needs and priorities of the different regions. This can help make decisions on efficiently allocating resources and integrating OGD with other data sources.

The aim of this research was to broaden our understanding of values and the contribution of national and regional governments to the OGD ecosystems. To achieve this objective, we conducted a literature review that allowed us to identify the most represented values and contributions in national and regional governments. By making this analysis, we can also derive the potential contributions they can bring into a circular OGD ecosystem. Central and regional governments can ensure that data is accessible to all the users of the OGD ecosystem, regardless of their technical expertise, by designing policies and regulations that prioritise equal access. These governmental levels might also enforce the adoption of standardized data formats and metadata to enhance interoperability and facilitate collaboration across sectors. They might also implement measures that can help to safeguard privacy and security by striking a balance between openness and protection of individual rights. Finally, the design and development of regulations towards OGD might also encourage collaboration between government agencies, stakeholders, and users to collectively contribute to improving data quality, relevance and promoting the adoption of governance models that enable these collaborations.

Limitations

The first limitation is related to the substantial lack of literature on OGD and public values in connection to national and regional governments. Also, the studies identified usually present only a general overview of values connected to OGD, without, in most of the cases, empirically investigating if such values are achieved. Concerning the identification of literature, in our review we used Web of Science as the only database for the analysis. A continuation of this investigation might benefit from the adoption of other databases (e.g., Scopus) and the corroboration through manual search and snowballing. Finally, the analysis presented in the previous sections is part of an ongoing project and needs corroboration through empirical research.

3.6. Commercial users

Commercial users are defined as those whose goal is to make an economic profit. This is illustrated in contrast to users who intend non-commercial use, which Creative Commons (Creative Commons, 2023) defines as “means not primarily intended for or directed towards commercial advantage or monetary compensation.” Therefore, commercial users take the role of users of OGD, when OGD use brings them a direct or indirect economic profit. Gonzalez-Zapata & Heeks (2015) introduce the economic perspective of OGD as “a mechanism to generate data-based economic value through new products, services, revenue, profits and jobs.”

Data Collection Approach

Relevant literature was identified and compiled in a literature review. Documents with keywords “commercial users”, “businesses”, “companies”, “co-creation”, “government data” and “open data” were searched in Google Scholar, Scopus and Web of Science. Each document was analysed for cases of commercial users in OGD ecosystems, where values and actors were defined, and barriers and drivers to circularity were discussed. Other documents cited inside each document were also examined, and only those with relevant information about the topic were chosen.

Results

OGD can play a vital role in the products and services commercial users provide, enriching them to create profits. Ferro & Osella (2013) propose a classification of different types of for-profit actors, which can coexist, depending on the tasks they perform in the data ecosystem: Enabler actors for retrieval, storage, categorization, and exposure of raw OGD, Re-users and advertisers as users of refined OGD, and finally, business end-users for the fit-for-purpose OGD. OGD goes through different stages within this value network, enriching the value of the raw data, released in its first stage by governments.

Crusoe (2016) explores the relationship between governments (in his case, municipalities) and commercial users (businesses) in an OD Ecosystem. He concludes that the roles of producers, users, and beneficiaries can be taken by the different actors. Those roles are not bound to them because of their inherent qualities (being a government or being a business) but rather from each actor's actions and integration in the ecosystem. As an example, governments can gain benefits from the OD they provide, transformed through the actions of commercial users. In this specific example the government takes the roles of producer and beneficiary, and the commercial user that of the user. In another case, the roles could be reversed or altered, and other stakeholder types could be brought into the ecosystem to take each role. Stakeholders may also have other roles outside the OD ecosystem that limit their dedication to their role in the OD ecosystem. As an example, a governmental entity may be an OD producer in the ecosystem, but at the same time must maintain a democratic process.

However, there is still a missing potential in the use of OD from commercial users. There is a lack of knowledge in OD availability, as well as a lack of skills and resources to extract value out of OD and a lack of belief in the direct profit of OD (Zuiderwijk et al., 2015). Commercial users who are application developers state that income comes from the commercialization of their applications, while costs are related to the infrastructure required to develop their applications (Kamariotou & Kitsios, 2022). The value of open data comes from lowering the costs of developing their applications. On the other hand, governments' low political prioritization and leadership, and the lack of communication channels with businesses can limit collaboration and value circularity (Crusoe, 2016).

The potential contributions come in ways to close the data value circle, which is when commercial users can find a profitable way of improving OGD data, bringing it back to the government as open data. One of the ways this can be achieved is with data-driven public service co-creation, where stakeholders (commercial users in this case) are actively involved in the production and creation of services (McBride et al., 2017).

OpenStreetMap (OSM) is an example of a successful platform where stakeholders of all types take part (OpenStreetMap, 2023), and OD produced both by governmental and non-governmental bodies including commercial users (OpenStreetMap Wiki, 2023) gets reused, co-created, and brought back to the producers. The constant improvement of OSM data by commercial users makes it financially profitable for them, as they get up-to-date and detailed geographical data for their business, improving their service quality. It is necessary to study these successful co-creation platforms to extract recommendations on how to improve governmental OD platforms and services to ensure barriers to co-creation are lowered, and commercial users see the benefit of contributing back.

Limitations

In the research on commercial users, some limitations were encountered. The domain is too broad to be thoroughly reviewed and analysed. Therefore, the research on the topic needs to be narrowed down to specific types of non-commercial users, or a specific data domain. Furthermore, the research has to be expanded to include qualitative and quantitative primary data sources such as interviews, focus groups, surveys, etc.

3.7. Intermediaries

Open data intermediaries are crucial in addressing the barriers to value generation from open data. They are "third-party actors who provide specialized resources and capabilities to (i) enhance the supply, flow, and/or use of open data and/or (ii) strengthen the relationships among various open data stakeholders" (Shaharudin et al., 2023). Examples are developers who process and include open data in apps/software, crowdsourcing platforms that gather and publish data as open data, and organizations that transform open data into easily digestible information such as visual forms. Open data intermediaries can be public organizations, companies, civil society organizations, research organizations, or others. They carry out various tasks depending on their specialized resources and capabilities, including compiling data, augmenting data, building data capacity, demanding open data, and channelling feedback to open data providers (Shaharudin et al., 2023).

Data Collection Approach

We drew the potential contributions and value of open data intermediaries for OGD through two methods. First, we gathered the existing tasks played by open data intermediaries through a systematic literature review of Shaharudin et al. (2023). Those tasks represent existing value contributions and value that open data intermediaries provide to the ODE. Second, we interviewed over 20 data intermediary organizations, OGD providers, and OGD users to identify shortcomings in current ODEs. We suggest potential contributions of open data intermediaries based on these shortcomings, and accordingly, potential value from open data intermediaries. Some may not be completely new, but they may not be widespread or well-developed enough; hence, they are worth highlighting.

Results

There are several existing contributions of open data intermediaries as users of OGD. First, some open data intermediaries contribute to developing applications based on open data for various activities. For example, applications that provide services to improve farm profit (Andrason & van Schalkwyk, 2017) and facilitate citizens' mobility (Frank & Waddell, 2014; Sangiambut & Sieber, 2017). In Ghana, an open data intermediary called Esoko, builds a platform based on OGD that helps enhance trust between farmers and traders (Andrason & van Schalkwyk, 2017). This contribution leads to increase in open data reuse for various practical purposes.

Second, certain open data intermediaries provide advisory services for the implementation of OGD including by helping public agencies assess OGD's usability and provide technological expertise (Park & Gil-Garcia, 2017). An open data intermediary in Indonesia, Perkumpulan IDEA, managed to convince a government agency to release open budget data by working with the agency to address the latter's concerns about opening data (Maail, 2017). This contribution enhances the capacity of government agencies to implement open data.

Third, several open data intermediaries initiate or lead engagement and interaction between open data stakeholders. For instance, (Chan et al., 2016) found that an open data intermediary, Nova Scotia's Community Counts Program, facilitates users to channel feedback to government departments that provide open data. City Life, an open data intermediary in Boston, engages with politicians and government officials to champion housing justice (Navalkha, 2021). Some open data intermediaries work with community organizations to understand their data needs (Yoon et al., 2018) and build the community's data skills through training and workshops (Reggi & Dawes, 2022; Robinson & Mather, 2017). This helps connect stakeholders in ODEs with each other to facilitate collective value creation as well as to provide feedback to each other.

Fourth, certain open data intermediaries provide contextual materials to citizens such as articles and visualisations that add relevant and specific background to OGD for it to be relatable and meaningful to the targeted audience. For instance, CSOs that advocate for budget transparency in Argentina, Mexico, and Uruguay, transform budget statistics into expenditure narratives so that the general public

may readily understand them (da Silva Craveiro & Albano, 2017). Meanwhile, some journalists create news articles for the general public using open data (Enaholo & Dina, 2020). By providing contextual materials, open data intermediaries make OGD more meaningful to the public.

Apart from existing value contributions, we identified seven potential value contributions of open data intermediaries as users of OGD. First, open data intermediaries could develop open-source software with pre-processed OGD with the open license of the data maintained. This would not only improve the usability of OGD by other users but also allow it to be reused with open-source software or any software of users' choice. Such flexibility would be valuable, especially to small and medium-sized companies and non-profit organizations that are financially constrained. While many developers have developed software based on open data, most of them are proprietary software, which are not only more costly but also often put conditionalities on the reuse of the data integrated into the software.

Second, open data intermediaries could also provide an OGD platform based on federated architecture. To some extent, this could address the current shortcomings where OGD across different domains and/or jurisdictions are segmented due to multiple OGD providers. The federated architecture means that users can easily integrate open data from multiple domains and/or jurisdictions based on interoperable data standards, but the maintenance of the data still falls under the responsibility of the original provider. This would be valuable to address complex global and local challenges requiring a multidisciplinary and multiscale data-based approach.

Third, given the different practices in different professions, intermediaries could increase the use of OGD by transforming it into specific industry standards. This would not only increase the reuse of OGD but also ensure that different professions that sometimes work together on a project but take up different roles to use the same data. Over time, as more and more professions rely on OGD instead of paid data, the value of OGD would be more highly regarded, and more public investments would go into OGD development.

Fourth, open data intermediaries could provide public sector consultancy to facilitate the implementation of OGD. Internal OGD implementation is still an issue in some public agencies based on the interviews conducted. Open data intermediaries that undertake such a role could also be created within the public sector as they would be closer to the agencies needing help. This contribution by open data intermediaries would not only improve the OGD implementation but also the public sector technological adoption in general, as implementing OGD requires the internal data management process to be well implemented as well.

Fifth, open data intermediaries could integrate a formal feedback mechanism on their software or platform to instantaneously notify OGD providers of any error or issue with their data that users identify. While some open data intermediaries already channel such feedback to OGD providers, often, it is done on an ad-hoc basis and with no documentation of the response from data providers conveyed back to data users. A more formal feedback mechanism could allow OGD providers to rectify the error or issue promptly and ensure that users are informed about the rectification or possibly misunderstanding from the user's side.

Sixth, open data intermediaries could showcase more use cases of OGD via various means, such as through websites, events, or direct engagement with stakeholders. By demonstrating the potential use of OGD, open data intermediaries could convince (other) government agencies to release more data and allocate more budget towards the maintenance and development of OGD. It would also inspire other users to use data in certain ways or for certain purposes. This could, in turn, create a virtuous cycle where more OGD is released by public agencies who are convinced of the potential value of open data, and more OGD is used by users who are inspired by the demonstrated use cases by intermediaries.

Seventh, open data intermediaries could also run OGD-based incubator programmes, especially for civic technology. This could spur public-oriented value creation from OGD that would benefit society with self-sustaining business models. This programme could be carried out in collaboration with government agencies, especially the original OGD providers, hence facilitating matching the OGD demand and supply. Through this, government agencies could also encourage the use of their OGD by other independent organizations to create value aligned with the agencies' goals.

Limitations

The potential value contributions from open data intermediaries presented here are limited by what has largely been described in the literature and the interviews conducted. They are by no means exhaustive. Besides, due to the diversity of open data intermediaries, there are various potential value contributions that are not captured here, or even imagined yet.

3.8. Summary of (potential) contribution and value user groups provide to the ODE

Table 4 summarises the (potential) contributions of the various user groups of our research. The (potential) contributions and value these groups (may) add to the ODE is further described and discussed in the following chapter 4.

Table 4 : Contributions and descriptions of the users in the open data ecosystem

User Group	Interaction	Contributions	Description
Non-specialist data users	Intermediaries, Commercial Users, Local Government, NGOs	User-experience reports	Non-specialist users can stimulate government innovation by testing new solutions, providing feedback, and contributing their ideas and needs
	Local Government, NGOs, Commercial Users	Event schedules, professional and personal networks	Non-specialist users can act as links between data experts looking to for an information on a certain area or domain and local experts
	Intermediaries, Commercial Users, Local Government, NGOs	Citizen collected local datasets Contributions and corrections on local data for larger repositories Map-making	Non-specialist users can contribute "thick data" on the local context and problems, based on their lived experiences. Non-specialist data users can also act as problem-owners, provide citizen collected data, and indicate issues to prioritize.
Journalists	Citizens	Communicate through Articles, web services and interactive infographics.	Journalists bridge knowledge gaps and can communicate complex topics to the public using various tools, such as interviews with experts and infographics, making OGD more accessible and understandable.
	Citizens	Communicate through web services and interactive infographics.	Journalists can enhance citizens' decision-making by providing real-time web services based on OGD. This enables citizens to be informed immediately.

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
	Citizens	Communicate through Articles, web services and interactive infographics.	Through their work on open data, journalists can discover and shed light on emerging and important social issues.
	Citizens	Communicate through Articles, web services and interactive infographics.	As journalists serve as communicators of OGD to the public, they can establish two-way communication channels with the public, enabling citizens to identify potential issues or provide insights on the data
	Local governments, Intermediaries, NGOs, Central/Regional Government	Demanders and Validators of Open government datasets	journalists, through their work on open data, can function as validators of the data, thereby promoting transparency and accountability in contrast to the government.
	Local governments, Intermediaries, NGOs, Central/Regional Government	Demanders and Validators of Open government datasets	Closer two-way collaboration with the providers of OGD can increase the quality of the data through validation and immediate feedback
	Local governments, Intermediaries, NGOs, Central/Regional Government	Open data sets	journalists can regularly monitor open data related to government performance and work as evaluators of the effectiveness of governments and public policies
Elementary school students	With local governments, citizens and other actors in the ecosystem (research institutions, NPO, journalists)	Local datasets Visualisations and data stories	School as a relevant actor in local communities, and elementary school students as experts of their local experience on one hand can identify problems in their everyday environment or local community, collect data about those and open it as new local datasets. On the other hand, learning activities with a focus on local problem solving could generate outcomes such as visualisations and data stories grounded on OGD and own collected data.
	With citizens or non-specialised users	Training of OD skills	Students could train skills on members of local communities as a way of enhancing their own.
	With data providers and end-users	OGD enhancement	As part of learning activities and Data Literacy building, elementary school students could engage on OGD quality improvement activities such as curation

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
			of datasets or providing more context to metadata.
	With local governments and citizens	Awareness on local problems	The active participation of students in the local context creates bridges between local governments and citizens. This network between school, governments, local communities and external organisations increases the relational engagement of the ecosystem.
		Dialogue among local actors	
NGOs	Interaction with the governmental institutions as producers and users, journalists, commercial users, non-specialist data users, students, and other NGOs	Platform/application/ visualisation tools, Open data standards and regulations, collected feedback of OGD users, Lobbying campaigns for opening high-value datasets, Enhanced open government dataset with the collected data	NGOs improve the government's services – from OGD portals to improving existing government services through collaboration with the government and other stakeholders.
		Hackathons and conferences, Open data standards and regulations, Enhanced open government dataset with the collected data	NGOs organise hackathons and conferences to achieve value-optimisation by bringing different actors together.
		Training/workshops improving OGD awareness and data literacy skills, Hackathons and conferences	NGOs can organise hackathons and conferences to promote an innovation culture, bridging the government with developers, firms and citizens. For better participation of the citizens, NGOs provide them with training.
		Reports based on OGD to affect policy, Lobbying campaigns for opening high-value datasets	NGOs use OGD to create the narrative to influence policy-making through supporting data and visualisations.
	Interaction with the governmental institutions as producers and users, journalists, commercial users, non-specialist data	Platform/application/ visualisation tools, Re-published opened government datasets, Lobbying campaigns for opening data, enhanced open government dataset (cleaned; merged; validated; adding the	Many NGOs aim to improve the transparency of the government and the data it collects, which can also help build up trust and legitimacy. They do it through the creation of platforms that reuse OGD, standardisation or republishing government data.

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
	users, students, and other NGOs	collected/scraped data; turn into machine-readable format), Open data standards and regulations, Training/workshops improving OGD awareness and data literacy skills, Reports based on OGD	
		Hackathons and conferences, Meet-ups and online forums	Rapport building and engagement are supported by the creation of the community through meet-ups and online forums, and the involvement of stakeholders in hackathons and conferences.
		Platform/application/visualisation tools, Re-published opened government datasets, enhanced open government dataset (cleaned; merged; validated; adding the collected/scraped data; turn into machine-readable format), Training/workshops improving OGD awareness and data literacy skills, Hackathons and conferences	NGOs use OGD to facilitate dialogues between government and non-government actors and can help citizens monitor government activities.
		Training/workshops improving OGD awareness and data literacy skills, Reports based on OGD	NGOs by using OGD can help communities they are representing to be self-reliant.
	Interaction with the journalists, non-specialist data users, students, and other NGOs	Enhanced open government dataset (cleaned; merged; validated; adding the collected/scraped data; turn into machine-readable format), Platform/application/visualisation tools,	NGOs can use OGD with the data they collect to create a contextual understanding of the issues of different communities and improve social empathy through reports, visualisations or consultation tools. Reports, tools, and visualisations also contribute to the informed decision-making by the communities, their

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
		Reports based on OGD, Re-published opened government datasets	increased knowledge and critical consciousness.
Local Government	Intermediaries Regional and National Government	Local gov gather data from various sources and integrate it with OGD to get insights. They ensure accuracy, consistency and compliance with data standards.	Understand and address community challenges.
	Intermediaries Regional and National Government Artificial Users	Local gov gather data from various sources and integrate it with OGD to analyse, interpret and visualise information that helps them plan and make decisions. Using techniques like data mining, natural language processing and algorithmic models they can generate predictive knowledge.	Making informed decisions about public task delivery and operational efficiency based on data.
	Citizens Intermediaries Journalists Regional and National Governments	Local gov share data as OGD to comply with regulations. However, they reuse this data to create public-facing repositories, data visual representations, monitoring tools and e-participation platforms to disseminate OGD.	Fostering transparency and trust between local government and local communities.
	Regional and National Governments Intermediaries	Local gov share data as OGD to comply with regulations. However, they repurpose and incorporate existing data for novel initiatives, research and analysis.	Promoting accountability within governmental structures.
	Citizens	Local gov share data as OGD to comply	Stimulating citizen's surveillance. Cultivating a culture of collaborative

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
	Intermediaries Journalists Researchers	with regulations. However, they reuse this data to create public-facing repositories, data visual representations, monitoring tools and e-participation platforms to disseminate OGD.	innovation and decision-making in communities.
	Citizens Intermediaries Commercial Users Artificial Users	Local gov streamline efforts, manage data, and collaborate with experts to create data-based digital solutions to share information with citizens.	Empowering communities to make informed decisions and foster a deeper understanding of their local environment.
	Citizens Intermediaries Commercial Users Artificial Users National and Regional Governments	Local gov collect, publish, disseminate, share, re-use, maintain OGD while ensuring accuracy, consistency, and compliance with data standards. They streamline efforts to manage data, collaborate with experts and develop partnerships.	Legitimising public processes and encouraging trust, dialogue, and negotiation among stakeholders.
	Intermediaries Regional and National Governments Artificial Users Commercial Users	Local gov gather data from various sources ensuring accuracy, consistency, and compliance with data standards to repurpose and incorporate existing data for novel initiatives while streamlining efforts for collaboration.	Promoting data-driven value optimisations and enhancing service delivery efficiency.
	Intermediaries National and Regional Governments	Local gov collect, gather and integrate OGD while ensuring accuracy, consistency, and compliance with data standards. They collaborate with	Optimising operational efficiency through process automation and digital platforms.

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
		intermediary actors to automate processes.	
	Intermediaries National and Regional Governments	Local gov collect, gather and integrate OGD while ensuring accuracy, consistency, and compliance with data standards to transform data into analysis, interpretation and visualizations.	Creating insights for informed decision-making at local, regional, and national levels.
	Intermediaries National and Regional Governments	Local gov collect, gather and integrate OGD while ensuring accuracy, consistency, and compliance with data standards to transform data into analysis, interpretation and visualizations.	Influencing policymaking and securing economic resources to benefit local communities.
	Intermediaries, National and Regional Governments Commercial Users Artificial Users	Local gov collect, gather, integrate, and repurpose OGD while ensuring accuracy, consistency, and compliance with data standards to create data-driven solutions and automate processes for their delivery of public tasks.	Improving public task delivery and operational efficiency.
Central/ Regional Government	Journalists, NGOs, Civic Tech communities, companies, researchers, and individuals	Regulations and policies	Acting as regulators of open governments data policies to stimulate their use and adoption in areas where cooperation is crucial like health or transportation.
	Intermediaries, Local Governments, companies	Regulations and policies	Governments can also act as demanders of ODG from different institutions and other ODE users. That way, they can understand the needs of other users and facilitate efficient resource allocation and integration of various data sources.
	Intermediaries, Local	Regulations and policies	They can promote equal access to open data for users with different

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
	Governments, companies, NGOs		technological competencies by promoting accessibility regulations.
	Intermediaries, Local Governments, companies, NGOs	Policies for technological adoption	They can enforce the adoption of specific data formats and metadata to enhance interoperability across different sectors of the government but also between other user groups of the ODE.
	Journalists, Intermediaries, Local Governments, companies, NGOs	Regulations	Governments can take action to safeguard privacy and security by striking a balance between openness and the protection of individual rights.
Commercial Users	Intermediaries (businesses, NGOs), Governments, Citizens, Academia as data providers	Use data from data providers	Commercial users use data to make a profit. This profit comes in providing data enriched services to their clients.
	Governments, Citizens, Academia, Businesses, NGOs as clients	Provide data enriched services to clients	
	Data providers	Improve data from data providers, and bring it back to them	Commercial users improve data and gives them back to the producers, so the original sources are of better quality. A better quality of the source data brings a better quality for the associated commercial services, thus making it profitable.
Intermediaries	OGD end-users	Web/mobile applications based on open data	Proliferate the reuse of OGD for practical purposes by offering ready-to-use applications to end-users
	OGD providers	Advisory services for the implementation of OGD	Enhance the capacity of government agencies to implement open data
	OGD providers and end-users	Engagement and interaction between open data stakeholders	Connect OGD stakeholders, facilitating collective value creation and feedback
	OGD end-users	Contextual materials	Make OGD more meaningful to the general public
	OGD end-users	Open-source software with pre-processed OGD and with open	Improve the usability of OGD, thus lowering the threshold for other users, while also allowing them to re-use the

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

User Group	Interaction	Contributions	Description
		license of the data maintained	data with open-source software or any software of their choice
	OGD providers and end-users	Data platform based on federated architecture	Improve the findability of OGD across different domains or jurisdiction, thus encouraging multi-domain/-jurisdiction approach to achieving economic, social, and political goals
	OGD providers and end-users	Data based on specific industry standards	Improve the ease of use of OGD by various professions, thus proliferating the reuse of open data in various sectors
	OGD providers and policy makers	Public sector data consultancy	Facilitate government agencies to implement OGD, including by improving their internal data management, thus enhancing the public sector technological service delivery
	OGD providers	Formal and automated feedback mechanism integrated on software/ data platform	Channel feedback on data errors or issues to data providers on instantaneous basis, thus allowing providers to rectify them promptly
	OGD providers and end-users	OGD use cases showcase (e.g., via websites, events, engagement with policymakers)	Demonstrate the use cases of OGD to convince more government agencies to release (more) data and to continue providing more fund for day-to-day maintenance of OGD as well as development of OGD
	OGD providers, end-users, and policy makers	OGD-based civic tech incubator programme	Spur the development of civic technology applications based on OGD with self-sustaining business models to generate various economic, social, and political values for the public

4. Presentation of the modelled user contributions to the ecosystem

In this chapter, we present the model we developed for depicting the (potential) contributions and values that each user group brings to the ODE. In creating the model, we collaborated to group the contributions of all the users into seven thematic categories, which are depicted in Table 5. Subsequently, we extracted the values from the descriptions in Table 4 and thematically categorized them into five value types, as depicted in Table 6.

Table 5: Thematic categorisation of contributions of open government data users to the open data ecosystem

Contributions category	Description
Data	<ul style="list-style-type: none"> • Sharing useful and easy-to-access open datasets. • Making sure data works well together and follows common standards.
Technological Infrastructure	<ul style="list-style-type: none"> • Creating strong systems to store, process, and share open data. • Building secure platforms for easy collaboration.
Process Automation	<ul style="list-style-type: none"> • Using technology to make collecting and sharing open data faster and more efficient. • Cutting down on manual work by automating open data processes.
Educational	<ul style="list-style-type: none"> • Teaching people how to understand and use open data. • Providing training and resources to help people become comfortable with open data.
Consulting Services	<ul style="list-style-type: none"> • Helping organizations use open data in the best way possible.
Organizational Changes	<ul style="list-style-type: none"> • Guiding organizations to make changes that support open data principles
Communication Products	<ul style="list-style-type: none"> • Creating tools, visuals and articles to share open data in a simple way. • Making user-friendly interfaces to help people easily understand open data.
Collaboration Spaces	<ul style="list-style-type: none"> • Setting up places for people to work together and share ideas about open data. • Building a community that works together to solve problems and be creative with open data.

Table 6: Thematic categorisation of values in the open data ecosystem

Value	Description of the value
Knowledge Enrichment	<ul style="list-style-type: none"> • Ongoing learning and improvement of understanding. • Enhancing expertise and insight through learning initiatives. • Continuous acquisition and application of new information.
Informed Decision-making	<ul style="list-style-type: none"> • Making choices based on well-informed and analysed information. • Utilizing open data and knowledge to guide decisions. • Considering a broad range of factors to arrive at the most beneficial choice.

D3.1 Closing the cycle: Understanding potential contributions of open government data users to the open data ecosystem

Value	Description of the value
Stakeholder Engagement (Collaboration)	<ul style="list-style-type: none"> • Collaborating with relevant parties for shared goals. • Involving and communicating with stakeholders. • Building partnerships and fostering cooperative relationships.
Transparency and Accountability	<ul style="list-style-type: none"> • Openness and clarity in actions, decisions, and processes. • Taking responsibility for one's actions and decisions. • Creating an environment where actions are visible and can be assessed.
Service Enhancement (Efficiency)	<ul style="list-style-type: none"> • Improving and optimizing processes for better performance. • Streamlining operations to achieve goals with minimal resources. • Enhancing the effectiveness and productivity of services provided.

To combine our thematic categorization of potential contributions and values with the specific types of users, we developed a matrix that includes contributions and values, accompanied by a color-coding index indicating the types of users. Below we are presenting the color-coded index and in Table 7 the matrix of our final modelling.









non-specialist data users	
journalists	
students	
NGOs	
local government users	
central/regional government	
commercial users	
intermediaries	

Table 7: Matrix of values and contributions of open government user groups in the ODEA

Value Contributions	Knowledge Enrichment	Informed Decision-making	Stakeholder Engagement (Collaboration)	Transparency and Accountability	Service Enhancement (Efficiency)
Process Automation	▲	▲ ▲	▲ ▲	▲ ▲	▲ ▲ ▲ ▲ ▲
Educational	▲ ▲ ▲	▲ ▲ ▲	▲ ▲	▲	
Data	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲	▲ ▲ ▲	▲ ▲ ▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲
Technological Infrastructure	▲ ▲ ▲	▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲
Consulting Services	▲ ▲	▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲ ▲	
Collaboration Spaces	▲ ▲ ▲	▲ ▲ ▲	▲ ▲ ▲ ▲ ▲ ▲ ▲	▲ ▲	▲ ▲
Communication Products	▲ ▲ ▲ ▲ ▲	▲ ▲ ▲ ▲	▲ ▲	▲ ▲ ▲ ▲ ▲ ▲	▲ ▲
Organizational Changes	▲ ▲ ▲	▲ ▲	▲ ▲ ▲ ▲	▲ ▲ ▲	▲

5. Conclusions

It is evident from the matrix provided in Chapter 4 (see Table 7), as well as from our research and the analysis provided in this deliverable, that all user groups examined are currently contributing back to the ODE and adding value through several different roles that they assume. From our thematic analysis of the potential contributions, the following contributions are the main ones that were identified:

- Data
- Technological Infrastructure
- Process Automation
- Educational
- Consulting Services
- Organizational Changes
- Communication Products
- Collaboration Spaces

From the above contributions the following main values were derived:

- Knowledge Enrichment
- Informed Decision-making
- Stakeholder Engagement (Collaboration)
- Transparency and Accountability
- Service Enhancement (Efficiency)

It is finally obvious that this list of contributions could potentially increase. Common challenges hinder this effort, including ongoing data collection, contextual specificity, user categorization, and limited adoption of open data practices, require nuanced approaches and ongoing research. Bridging these gaps necessitates collaborative initiatives to uphold the values of transparency, accountability, and inclusivity within the ODE. To overcome challenges, sustained engagement across diverse user groups is crucial, emphasizing the importance of collaborative efforts to foster a more circular open data landscape.

If the aforementioned challenges are eliminated, the contributions of the participants in the ODE can potentially increase, which would allow the ODE to become even more circular and vibrant. To promote the discussed potential contributions and urge all actors and stakeholders to achieve their full potential of active participation in the ODE, it is important to examine how this can be achieved from a technical, as well as a governance perspective. More specifically, when it comes to the technical aspects of this endeavour, we need to introduce the technical means that will make it very easy for the ODE participants to deliver value back to the ODE. These could be, amongst others:

- Interfaces for open data portals.
- Feedback tooling for open data.
- Artificial and collective intelligence systems to directly interact with the ODE.

Then, from a governance perspective we need to identify governance models to involve users in the ecosystem that could include for example:

- The motivations for each user group to deliver value back to the ODE
- the model strategy guidance tools that are necessary.

The above aspects are to be analysed in tasks 3.2 and 3.3 of this work package.

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