Towards a sustainable Open Data ECOsystem

D5.2
Strategies to balance and distribute value in open data ecosystems

ODECO

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Abbreviations

AI	Artificial Intelligence
AIoT	Artificial Intelligence of Things
API	Application Programming Interface
CARE	Collective Benefit, Authority to Control, Responsibility, Ethics
D	Deliverable
ECHR	European Court of Human Rights
ESR	Early Stage Researcher
EU	European Union
FAIR	Findable, Accessible, Interoperable and Reusable
HOT	Humanitarian OpenStreetMap Team
HRDAG	Human Rights Data Analysis Group
IATI	International Aid Transparency Initiative
ODE	Open Data Ecosystem
OGD	Open Government Data
OGP	Open Government Partnership
OSM	OpenStreetMap
OSMF	OpenStreetMap Foundation
NGO	Non-Governmental Organisation
NPO	Non-Profit Organisation
SDK	Software Development Kit
SME	Small and Medium-sized Enterprises

Nr	Partner	Partner short name	Country
Beneficiary			
1	Technische Universiteit Delft	TU Delft	Netherlands
2	Katholieke Universiteit Leuven	KUL	Belgium
3	Centre National de la Recherche Scientifique	CNRS	France
4	Universidad de Zaragoza	UNIZAR	Spain
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
14	GFOSS Open Technologies Alliance	GFOSS	Greece

15	Inno3 Consulting	IC	France
16	Regione Marche	RM	Italy
17	Open Data Institute	ODI	United Kingdom
18	Swedish National Archives	SwNA	Sweden

Executive summary

This task explores how different open data values interact with each other and how open data values may be balanced to arrive at a sustainable open data ecosystem in which value creation and value capture processes are optimal. For this, we first explore open data ecosystem values, highlighting their multifaceted nature and revealing both opportunities and tensions in dealing with values in the context of open data ecosystems. Throughout different chapters, this deliverable unpacks various dimensions of value - conceptual, financial, social, and legal, thereby bringing clarity to the interactions, interdependencies, and conflicts between these dimensions.

The deliverable emphasizes the centrality of 'value' in open data ecosystems, framing it as not merely economic but encompassing social, ethical, and functional dimensions. The shift from unidirectional models of value generation (data release by governments) to circular models of co-creation has underscored the need for inclusivity and mutual interdependence. These conceptualizations foregrounded the challenges of defining and measuring values when multiple stakeholders—government agencies, private companies, Non-Governmental Organisation (NGOs), and citizens—participate with diverse motivations and capacities.

In a dedicated chapter on financial value, the report delves into the monetization potential within open data ecosystems (ODEs), exploring how actors capture and provide financial value. This chapter reveals a 'data divide', i.e. start inequalities between actors which undermine the broader objective of equitable value distribution. A chapter on the social value of open data ecosystems emphasizes that the utility of open data extends beyond financial metrics. The chapter argues for a 'purpose-driven' approach to open data initiatives, aligning them with specific social goals and values rather than merely increasing data availability.

Finally, the deliverable explores the inherent conflicts between different types of value in ODEs, particularly between efficiency, equity, and privacy. These conflicts often stem from power asymmetries, where dominant actors prioritize their goals—such as profit generation or operational efficiency—over broader societal benefits. Legal and governance pathways are proposed to address these tensions between values.

The main conclusion of the deliverable is that the overarching challenges for open data ecosystems lie in balancing diverse and often conflicting values while ensuring their sustainability. These conflicts often arise because different stakeholders, such as governments, private companies, NGOs, and citizens, prioritize values like transparency, profitability, privacy, or equity differently, leading to tensions in decision-making and resource allocation. For example, while businesses may emphasize innovation and economic gains, civil society may advocate for social justice and inclusivity, creating trade-offs that are difficult to reconcile. Purpose-driven data initiatives, governance reform, capacity building, innovative incentives, and continuous research and collaborations can be important components in addressing this challenge.

1   Introduction

1.1   Aim and scope of the deliverable

An open data ecosystem can be defined as a user-driven, cyclical, cross-border, cross-sector, and inclusive environment oriented around agents that are mutually interdependent in the creation and delivery of value from open data (Van Loenen et al, 2021). Value, value creation and value delivery are key concepts in this definition, as well as in many other definitions and conceptualizations of (open) data ecosystems. According to Oliveira and Loscio (2018) the concept of data ecosystems itself even suggests a specific perspective that emphasizes data-driven value (co-)creation as the shared goal among all actors. It is often argued that (open) data ecosystems should be described as a set of interconnected actors that share and jointly create value from data (Jacobides et al., 2018, Palmié et al., 2022).

While there is this growing body of literature that recognizes the importance of the concept of value in open data ecosystems (e.g. Oliveira and Loscio, 2018; Jacobides et al, 2018), a systematic understanding of the mechanisms and processes of value creation and sharing in open data ecosystems is still lacking. This deliverable aims to address this understanding by addressing the following two main questions:
1. What types of value are prioritized in open data ecosystems and how do different types of value interact with each other?
2. What strategies can be employed to design open data ecosystems that balance values while ensuring inclusive and sustainable value distribution?

Through these questions, the deliverable directly supports the objective of developing strategies to balance and distribute value in open data ecosystems. By exploring the interactions, conflicts, and mechanisms of value creation and sharing, the deliverable provides actionable insights into designing governance frameworks, inclusive processes, and collaborative initiatives that can ensure equitable and sustainable value distribution among diverse stakeholders. These strategies aim to address power imbalances, promote inclusivity, and foster a purpose-driven approach that aligns with the overarching goals of open data ecosystems.

1.2   Role of this deliverable in the ODECO project

This deliverable is one of the three deliverables prepared under the ODECO work package on developing a sustainable open data ecosystem, which aims to use the findings from previous ODECO activities and outputs to design comprehensive strategies for a sustainable open data ecosystem.
- Deliverable 5.1 aims to design and review different models of allocating roles, tasks and resources in open data ecosystems.
- Deliverable 5.2 focuses on strategies for balancing and distributing value in a sustainable open data ecosystem.
- Deliverable 5.3 aims to develop an overarching sustainable framework/strategy to arrive at a user-driven, circular and inclusive open data ecosystem.

This deliverable builds upon three previous ODECO deliverables dealing with the value of open data ecosystems. These deliverables are:
- The deliverable on 'Understanding potential contributions of open government data users to the open data ecosystem' (Deliverable 3.1), which defined five categories of values in the open data ecosystem: knowledge enrichment, informed decision-making, stakeholder engagement (collaboration), transparency and accountability and service enhancement (efficiency).
- The deliverable on 'Promoting open data users' contribution from a technical perspective' (Deliverable 3.2) which explored various strategies to enhance circularity in open data portals

- The deliverable on 'Motivations of Non-Government Actors to Become Active Contributors to the Open Data Ecosystem' (Deliverable 4.1) which identified and analysed motivations of different types of data holders to actively contribute to open data ecosystems.

In the next chapter of this deliverable, we provide a short summary of these three deliverables, and how they define and conceptualize value in open data ecosystems. In addition to these three deliverables, value also is a central concept in the – individual and joint – research projects of several of the ODECO Early Stage Researchers (ESRs). In this deliverable we will therefore look into the research and research findings of several of the ODECO ESRs on value in open data ecosystems. In her research on 'Disentangling Data Ecosystems: Exploring Data Physicalisation Tools for Criticality', Silvia Cazacu (KU Leuven) developed a critical understanding of values in data ecosystems., highlighting the complexities of value interactions and conflicts within these environments, directly addressing the question: *What types of value are prioritized in open data ecosystems, and in what ways do these values interact or conflict with one another?*

María Elena López Reyes (AAU) looked into the use of Open Government Data for Social Value Creation in her research on 'Maximising the use of local government open (geo)data', offering insights into the mechanisms for creating and sharing social value, thereby contributing to the question: *What strategies can be employed to design open data ecosystems that balance competing values while ensuring inclusive and sustainable value distribution?*

The financial value of open data is central in the research of Ashraf Shaharudin (TU Delft) on business models of open data intermediaries for sustainable open data ecosystems and addressed in several research activities of Héctor Ochoa Ortiz (UNICAM). Together, their work sheds light on how value is created, captured, and redistributed across stakeholders, also addressing the second research question.

Meanwhile, the research of Ramya Chandrasekhar (CNRS) focuses on Open Licensing of Non-Government Data, while Caterina Santoro (KU Leuven) investigates the equitable use of (open) data in/by the public sector to resolve value-related tensions, addressing the critical question: *What strategies can be employed to design open data ecosystems that balance competing values while ensuring inclusive and sustainable value distribution?*

For this deliverable, Ramya and Caterina collaborated to explore conflicting values in open data ecosystems and approaches to address them, providing actionable insights into governance and legal pathways that support balancing and redistributing value.

1.3 Structure of the deliverable

This deliverable is structured as follows. After this introductory chapter, **Chapter 2** examines definitions and conceptualizations of the value concept, as discussed in three previous ODECO deliverables. By synthesizing earlier insights on value categories and their dynamics, this chapter primarily addresses the question R1: *What types of value are prioritized in open data ecosystems and how do different types of value interact with each other*?

Chapter 3 investigates how value is defined and understood in current research on open data ecosystems through a literature review. By providing a comprehensive overview of theoretical frameworks and empirical findings, this chapter contributes to answering both R1: *What types of value are prioritized in open data ecosystems and how do different types of value interact with each other?* and R2: *What strategies can be employed to design open data ecosystems that balance values while ensuring inclusive and sustainable value distribution?*

Chapter 4 delves into financial value in open data ecosystems, exploring how different actors, such as governments, companies, and non-profits, provide and capture financial value. This chapter aligns closely with both research questions by focusing specifically on financial dimensions.

Chapter 5 shifts the focus to social (use) value in open data ecosystems, highlighting how open data contributes to community-oriented outcomes, such as resilience, inclusivity, and public benefit. This chapter addresses research questions by emphasizing non-financial, societal impacts.

Chapter 6 explores conflicts in values that arise within open data ecosystems and proposes pathways to address these conflicts, such as governance reforms and legal frameworks. This chapter directly addresses the question *R2: What strategies can be employed to design open data ecosystems that balance values while ensuring inclusive and sustainable value distribution?*

Finally, **Chapter 7** concludes the report by summarizing the findings from previous chapters and offering actionable recommendations on balancing and redistributing value in open data ecosystems. By synthesizing insights from all chapters, this section responds holistically to all three research questions, with a particular emphasis on strategies for sustainable and inclusive value distribution.

2 Conceptualizing value in the ODECO project

2.1 Introduction

The concepts of value, value creation and value sharing have been addressed and explored throughout the ODECO project and several of its deliverables. This chapter briefly summarizes how value has been defined and operationalized within the project and three of its deliverables:

- Closing the Cycle: Understanding Potential Contributions of Open Government Data Users to the Open Data Ecosystem (ODECO Deliverable 3.1)
- Closing the Cycle: Promoting Open Data Users' Contribution from a Technical Perspective (ODECO Deliverable 3.2)
- Motivations of Non-Government Actors to Become Active Contributors to the Open Data Ecosystem (ODECO Deliverable 4.1)

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

The deliverable on 'Understanding potential contributions of open government data users to the open data ecosystem' (ODECO Deliverable 3.1) emphasizes the circular model of value, where open data users not only consume but also contribute back to the ecosystem, enabling a self-sustaining cycle. It highlights the transformative benefits for businesses, NGOs, and citizens in addressing societal issues and driving economic development. However, the deliverable also identifies barriers, such as the digital divide and governance challenges, which limit the equitable distribution of value across different stakeholders.

The deliverable provides an in-depth exploration of how open data can foster collaboration, transparency, and innovation across various sectors. It highlights the circular model of value, where users not only consume data but also contribute back, creating a self-sustaining ecosystem. This model is crucial in solving societal issues, improving public services, and boosting economic growth. Open data allows governments to release datasets that businesses, journalists, and citizens can leverage to innovate, hold institutions accountable, and engage with public policy. Transparency is a key strength, empowering citizens and civil society to monitor government activities and participate more actively in democracy, thus fostering public trust. Economically, small and medium-sized enterprises (SMEs) benefit by accessing data that would otherwise be too costly, driving innovation and competitiveness, particularly in data-driven sectors. However, the deliverable also highlights significant challenges, such as the digital divide, where larger organizations with technical expertise capitalize on open data while smaller, less-resourced actors struggle. The emphasis on economic value can sometimes overshadow the social benefits of open data, such as promoting civic engagement, and addressing local issues and benefit communities, non-for-profit institutions, NGOs, and enterprises of the social and solidary economy. Governance issues, including inconsistent data standards and weak regulatory frameworks, further limit the effectiveness of ODEs. The deliverable concludes that addressing these structural barriers, closing the digital divide, and establishing robust governance frameworks are essential for fully realizing the potential of open data ecosystems to drive sustainable and inclusive value creation.

2.3 Closing the cycle: Promoting open data users' contribution from a technical perspective

The deliverable on 'Promoting open data users' contribution from a technical perspective' (ODECO Deliverable 3.2) narrows its focus to non-governmental actors, discussing both economic opportunities and barriers for smaller entities like NGOs and small businesses. It underlines how open data fosters civic engagement but also points out technical challenges, legal complexities, and the unequal distribution of resources that hinder broader participation.

This deliverable examines how non-governmental actors, such as NGOs and small businesses, interact with open data ecosystems, focusing on both opportunities and barriers to value creation. Open data offers significant potential to drive economic, social, and community value. For businesses, it provides opportunities to enhance services and products, often resulting in economic gains. For example, companies like Esri use open data to attract new customers while integrating proprietary services. Socially, NGOs and civil society organizations utilize open data to promote transparency, raise awareness, and drive civic engagement on issues like environmental concerns and public health. Community-driven platforms, like OpenStreetMap, demonstrate how crowdsourced data can create valuable resources benefiting various stakeholders, from local communities to global corporations. However, the deliverable also outlines barriers to full engagement in ODEs. Chief among these is the "data divide"—larger organizations, particularly in the private sector, are better equipped with technical expertise and financial resources, allowing them to capitalize on open data. In contrast, smaller organizations often lack the data literacy, tools, and infrastructure to meaningfully contribute or derive value. Legal and licensing issues also complicate the landscape, as organizations are often hesitant to share data due to concerns over intellectual property and licensing compatibility. Additionally, there is often tension between community-driven initiatives and corporate involvement, as communities fear that corporate dominance could undermine the collaborative nature of these platforms. In conclusion, the deliverable argues that addressing these technical, legal, and resource disparities is crucial for realizing the full potential of open data ecosystems and ensuring that all stakeholders can benefit.

2.4 Motivations of non-government actors to become active contributors to the open data ecosystem

The deliverable on 'Motivations of non-government actors to become active contributors to the Open Data ecosystem' (ODECO Deliverable 4.1) is the third project deliverable in which value is a central concept. The deliverable echoes the concerns mentioned in the report on promoting open data users' contributions, highlighting structural inequalities and socio-technical limitations that prevent non-governmental actors from fully engaging in ODEs. It points to a persistent "data divide" that benefits larger, resource-rich organizations at the expense of smaller, less-equipped entities.

This deliverable delves into the motivations and challenges that non-governmental actors—such as NGOs, small businesses, and intermediaries—face in contributing to open data ecosystems. It emphasizes the unequal distribution of value within these ecosystems, where larger commercial organizations, with their access to resources and technical expertise, often derive significant benefits from open data by enhancing their services or developing new products. In contrast, smaller organizations, particularly NGOs and civil society groups, struggle to engage fully due to a lack of financial and technical resources. This disparity creates a "data divide," skewing the benefits of open data toward larger entities and leaving smaller, resource-poor organizations at a disadvantage. NGOs, while often motivated by social goals like promoting transparency or addressing societal challenges, lack the capacity to share and leverage data effectively, limiting the potential social value they can create. The deliverable also highlights technical barriers, noting that many NGOs lack the necessary data literacy, tools, and infrastructure to manage and publish open data in ways that contribute meaningfully to the ecosystem. Legal and licensing issues further complicate participation, as organizations are often uncertain about how to share data without infringing on intellectual property rights or violating open data licenses. Additionally, community dynamics present challenges, with tensions arising between grassroots initiatives and corporate actors. For example, community-driven platforms like OpenStreetMap may resist corporate involvement, fearing that it could disrupt the open and collaborative nature of these projects. The deliverable concludes by emphasizing the need for targeted support and reforms to address these barriers, ensuring a more equitable distribution of value and fostering the long-term sustainability of open data ecosystems.

2.5   Conclusion

Foregrounded by these deliverables, open data generates economic, social, and community value by promoting transparency, innovation, and cross-sector collaboration. Large businesses can enhance their services and drive economic growth through open data, while NGOs use it to engage communities and address social issues. Despite these benefits, significant barriers remain, including a "data divide" where certain actors lack the resources and technical skills to fully capitalize on open data. Additionally, legal and governance challenges hinder equitable participation, making it essential to address these issues in order to foster inclusive value creation.

Together, the three deliverables underscore the need for targeted support, stronger governance, and inclusive participation to unlock the full potential of open data ecosystems. What remains unclear in these deliverables is how different types of value could interact and/or conflict with each other, and how the process of creating and sharing different types of value in open data ecosystems takes place. The aim of the next chapters is to address these research gaps.

3   An inclusive perspective on value in open data ecosystems

3.1   Introduction

While the previous chapter provided an overview of the ODECO conceptualizations and findings on value in open data ecosystems, this chapter will review and synthesize the existing literature on value in the context of (open) data ecosystems.

Open data ecosystems (ODEs) represent a growing area of academic and practical interest as societies and businesses increasingly recognize the potential of shared data to drive innovation and create value. Scholars from diverse fields, including data science, social sciences, and information systems, have contributed to understanding how value is generated, distributed, and sustained in these ecosystems. This analysis integrates insights from various academic articles, providing an equal focus on each, to explore how value is defined and understood in ODEs.

The selected articles all deal with value creation and sharing in the context of ecosystems, and open data ecosystems in particular. By drawing on literature from both data ecosystems in general and open data ecosystems in particular, we aim to incorporate a broader set of multidisciplinary perspectives. We believe the insights from data ecosystems can greatly benefit open data ecosystems, offering valuable frameworks and concepts that enrich the understanding of value creation and distribution within these environments. The goal of the chapter is to delve into the components of value creation, the various aspects of value, and how benefits are distributed within open data ecosystems.

3.2   Multiple views on value in open data ecosystems
Economic value creation in open data ecosystems

One of the most prominent themes across the literature is the economic potential of open data ecosystems. Attard et al. (2016) highlight the concept of the "data value network," where multiple actors transform raw data into valuable goods and services. This process is non-linear, with data being reused across different contexts, generating continuous value over time. Similarly, Gelhaar (2021) emphasizes the multidimensional nature of value creation, where economic, social, and governance aspects intersect. The focus in these articles is on how data aggregation and reuse drive innovation and market efficiencies.

Kapoor (2018) explores value creation from a platform ecosystem perspective, emphasizing the roles of suppliers and complementors in co-creating value. Kapoor's analysis is rooted in strategic management, identifying how interdependencies between platform owners and ecosystem participants drive economic gains. Hein (2019) extends this by examining boundary resources like Application Programming Interfaces (APIs) and Software Development Kit (SDKs), which reduce transaction costs and enable actors with diverse goals to collaborate, thus enhancing the generative capacity of platforms.

Toorajipour, Oghazi, and Palmié (2024) introduce the concept of the Artificial Intelligence of Things (AIoT) as a catalyst for economic value creation. AIoT systems enhance value by automating data processing, enabling real-time decision-making, and improving operational efficiencies. The integration of Artificial Intelligence (AI) and IoT technologies allows businesses to capture value more effectively by offering personalized and predictive services.

Autio (2019) discusses the concept of "generativity," where platforms enable unexpected innovations by allowing third-party developers and users to create new tools and services. This process is vital to the dynamic nature of ODEs, where value emerges from the recombination of

data and technological infrastructures. Autio's work underscores the importance of creating flexible, open systems that encourage continuous innovation.

Attard et al. (2016) and Azkan (2022) highlight the recurring nature of value in ODEs, where data, unlike traditional resources, does not diminish with use. Each instance of data reuse in different contexts creates new opportunities for economic value. However, the sustainability of this recurring value relies on effective feedback mechanisms that track how data is reused and what value it generates, a challenge noted by Garcia (2019) and Fang (2023).

In conclusion, based on the findings presented in this section, we believe that the insights from literature on data ecosystems are highly applicable to open data ecosystems (ODEs). Both ecosystems emphasize non-linear value creation through the aggregation, reuse, and transformation of data, with value emerging continuously across various contexts. The collaboration among diverse actors, including platform owners and complementors, plays a crucial role in co-creating value and driving innovation. Moreover, boundary resources, such as APIs, facilitate this collaboration by reducing transaction costs. The integration of advanced technologies, such as AI, further enhances the real-time extraction of value from data. Ultimately, both ecosystems rely on robust feedback mechanisms to track data reuse and sustain long-term value creation.

Social, ethical, and political value creation

While economic value is a key focus, several articles emphasize the importance of social, ethical, and political dimensions of value creation in ODEs. Arena et al. (2021) argue that value in ODEs should not be limited to financial returns but should also include social and environmental resilience. They propose a "shared value" approach, where economic gains are aligned with societal benefits, such as improved transparency, environmental sustainability, and community well-being. This perspective advocates for more inclusive value creation, where multiple stakeholders—ranging from businesses to civil society—benefit from open data.

Micheli et al. (2020) focus on the role of data governance in shaping who benefits from value creation. They argue that without equitable governance structures, ODEs can reinforce existing power imbalances, where large corporations and governments dominate data resources, marginalizing smaller actors like non-profits and local communities. Micheli et al. call for data governance models that prioritize fairness, transparency, and public interest, ensuring that value is distributed more equitably.

Oliveira (2019) explores the political potential of open data to promote transparency and accountability in governance. According to Oliveira, open data can empower citizens by providing them with the information needed to hold governments accountable and improve public services. This civic engagement perspective is critical in understanding the broader societal value of ODEs, which goes beyond commercial applications to include democratic and participatory processes.

Sorri and Seppänen (2021) add to this discussion by focusing on the co-creation of ecosystem-level value propositions. They argue that value in ODEs is not defined by a single actor but emerges from the collaborative efforts of multiple stakeholders who align their goals and capabilities. This co-creation process allows for the development of value propositions that reflect the collective needs of the ecosystem, ensuring that value is shared across different actors, including businesses, governments, and citizens.

Technological and generative aspects of value

Several articles highlight the technological infrastructures and generative mechanisms that drive value creation within ODEs. Hein (2019) and Gelhaar (2021) emphasize the importance of boundary resources like APIs, which enable actors with varying technical expertise to collaborate

and co-create value. These tools reduce friction and enable innovation by providing standardized interfaces that make data more accessible and interoperable across different systems.

Autio (2019) introduces the concept of "generativity," where open platforms enable innovation beyond their original scope. This generative capacity is a key feature of ODEs, allowing new actors to enter the ecosystem and create value by combining existing data and technologies in novel ways. The dynamic nature of this process makes ODEs particularly suited for fostering innovation across multiple sectors, from healthcare to urban planning.

Attard et al. (2016) and Azkan (2022) emphasize the importance of data reuse in driving value creation. Data in ODEs is not a finite resource; instead, its value increases with each instance of reuse, as new applications and insights are generated. This iterative process of data reuse and value generation highlights the unique potential of open data ecosystems to foster long-term innovation.

Toorajipour et al. (2024) explore how AIoT enhances the generative potential of ODEs by automating data collection, analysis, and decision-making processes. AIoT systems enable real-time data processing, allowing businesses to optimize operations and create more personalized and adaptive services. This technological advancement adds a new layer to the generative capacity of ODEs, enabling faster and more efficient innovation.

Fang (2023) and Garcia (2019) point out that while data reuse offers significant potential for value creation, many ODEs lack effective mechanisms to track and quantify the value generated through reuse. This feedback gap can limit the sustainability of value creation, as data providers may be unaware of the impact their data has, reducing their incentives to continue contributing to the ecosystem.

Who benefits from value creation?

The question of who benefits from value creation in ODEs is a recurring theme across the literature. Kapoor (2018) and Hein (2019) argue that platform owners and large corporations often capture the majority of the value generated in ODEs. These actors control the data infrastructures and boundary resources that facilitate value creation, giving them a disproportionate advantage over smaller players, such as non-profits and individual users.

Micheli et al. (2020) and Arena et al. (2021) critique this unequal distribution of value, arguing that ODEs often replicate existing power structures, where larger actors benefit disproportionately while smaller actors struggle to capture similar value. These articles call for more inclusive governance models that ensure equitable access to data and resources, enabling a broader range of stakeholders to participate in value creation.

Sorri and Seppänen (2021) offer a more optimistic view, arguing that value in ODEs can be co-created through collaborative processes that involve multiple stakeholders. By aligning their goals and resources, actors within an ecosystem can develop value propositions that benefit the entire ecosystem, rather than just a few powerful players. This approach emphasizes the importance of collective action in ensuring that value is shared equitably across different sectors and actors.

Toorajipour et al. (2024) focus on how businesses can capture value through AIoT-driven data ecosystems. They argue that companies that can integrate AIoT technologies into their operations will be better positioned to generate and capture value. However, they also acknowledge that smaller actors may face challenges in adopting these technologies, potentially leading to further inequalities in value capture.

3.3   Opportunities and challenges in open data ecosystem design

Governance: decentralization vs. power asymmetries

Decentralized governance offers a promising pathway to make ODEs more inclusive and equitable. Micheli et al. (2020) and Arena et al. (2021) argue that decentralized models, such as data cooperatives or public data trusts, enable a wider range of stakeholders—citizens, non-profits, local governments, and businesses—to participate in decision-making. These decentralized structures align with the principles of ODEs by distributing governance and control over data resources mitigate the risk of monopolization by large corporations or platform owners, addressing the power imbalances highlighted by Micheli et al. (2020) and Kapoor (2018).

Sorri and Seppänen (2021) highlight how co-creation of ecosystem-level value propositions fosters collaboration and ensures that value is shared more equitably. In the context of ODEs, "equitable" refers to ensuring that all stakeholders, regardless of size or power, have fair access to data resources and opportunities to participate in value creation. This means that smaller actors, such as local communities or non-profits, are not marginalized by larger corporations or platform owners, and that the benefits generated from data are distributed in a way that addresses inequalities, supports diverse contributions, and promotes collective well-being rather than concentrating value in the hands of a few dominant players (Schrage & West, 2020).

However, decentralized governance must overcome existing power imbalances. Micheli et al. (2020) and Kapoor (2018) warn that large corporations and platform owners often dominate data ecosystems. Large corporations like Google, Amazon, and Microsoft often control key resources such as cloud infrastructure, and data processing technologies. This centralized control limits access for smaller actors and skews the distribution of value, hindering equitable participation in the ecosystem.

This concentration of power can marginalize smaller actors, preventing them from fully participating or benefiting. Hein (2019) echoes this concern, noting that platform owners often dictate the terms of value creation, thus limiting inclusivity. To address this, ODEs must design governance frameworks that prevent monopolization by powerful entities and ensure that smaller players have a voice and access to the ecosystem's benefits.

Governance frameworks like multi-stakeholder models can theoretically ensure inclusive participation in open data ecosystems (ODEs), but in practice, they often struggle to engage smaller players meaningfully, as the process can still be dominated by more powerful actors (Bengtsson & Rydell, 2018). While data cooperatives offer potential for collective bargaining, their success depends on the willingness and ability of smaller actors to commit time and resources, which is not always feasible, particularly for those with limited capacity (O'Neil, 2021). Similarly, data trusts are designed to protect the interests of smaller entities, but in reality, they may still face challenges in ensuring equitable decision-making when larger entities hold significant power (Tene & Polonetsky, 2018). The Open Government Partnership (OGP) promotes transparency, yet its effectiveness in genuinely giving smaller actors a voice is often limited by bureaucratic hurdles and unequal access to decision-making processes (Bertot et al., 2010). Finally, open data platforms can provide an avenue for input, but their reliance on digital engagement may exclude those without the time, resources, or technical skills to participate meaningfully (Janssen & Kuk, 2016).

Innovation and generativity vs. standardization and interoperability

Open platforms that foster generativity present significant opportunities for continuous innovation. Autio (2019) and Hein (2019) argue that boundary resources like APIs enable diverse actors to collaborate and create new applications, tools, and services. This generative capacity allows for the dynamic recombination of data, driving innovation across sectors. Toorajipour et al. (2024) further highlight that AIoT technologies can amplify this by enabling real-time, automated

data processing, thus creating new business opportunities in industries like healthcare and logistics. However, ensuring that these platforms are interoperable and standardized remains a major hurdle. Gelhaar (2021) and Fang (2023) emphasize that without common data standards and formats, collaboration between different actors becomes difficult, limiting the potential for cross-sectoral innovation. D'Hauwers et al. (2022) show that in smart city projects, incompatible data formats often prevent effective collaboration between different departments and stakeholders. For ODEs to fully realize their innovation potential, there must be concerted efforts to develop open standards and protocols that facilitate seamless data sharing and interoperability across platforms and sectors.

Social and environmental value vs. resource disparities

In line with Bouckaerts and Crompvoets' (2011) framework, ODEs must integrate a variety of governance instruments to support smaller actors and ensure their active participation. By employing capacity-building instruments, such as training programs and technical support, ODEs can equip smaller players with the necessary skills to engage effectively. Additionally, incentives like subsidies or shared infrastructure can lower entry barriers, while collaborative instruments help foster partnerships and co-creation, ensuring a more inclusive and equitable governance structure that benefits all stakeholders in the ecosystem.

Trust and collaboration vs. privacy and security concerns

Trust is a cornerstone of successful ODEs, fostering collaboration and data sharing. Arena et al. (2021) and Gelhaar (2021) highlight the importance of building trust among participants to encourage openness and cooperation. When trust is established, actors are more likely to share data and collaborate on innovative projects. Sorri and Seppänen (2021) also argue that transparent governance models, where data use is clearly communicated, can strengthen trust and long-term engagement in the ecosystem.

However, trust is easily undermined by concerns over data privacy and security. Toorajipour et al. (2024) point out that AIoT systems, while enhancing data-driven innovation, introduce new risks related to real-time data collection, especially in sensitive domains like healthcare and smart cities. Without robust privacy frameworks and clear governance structures, participants may hesitate to share data, fearing misuse or breaches. Micheli et al. (2020) emphasize that governance models must include clear guidelines for data privacy and ethical use to maintain trust within ODEs.

Even though ODEs may not always involve personal data, trust concerns can still arise due to the nature of the data being shared, its potential use, and the risks of unintended consequences. For example, even non-personal data can be sensitive when aggregated or used in ways that might lead to privacy violations or the misuse of information. In cases like smart city data or environmental data, the sharing of open data could still pose risks related to its potential re-identification, misuse, or unintended exploitation (e.g., through AI models or third-party integrations) (Sweeney, 2000; Tene & Polonetsky, 2013). Therefore, the principles of data privacy and ethical governance are still critical in open data ecosystems to maintain trust among participants, particularly in sensitive or high-stakes sectors, like public health, urban planning, and research (Toorajipour et al., 2024; Micheli et al., 2020).

Long-term sustainability vs. data maintenance costs

The recurring nature of value in ODEs, where data can be reused multiple times to generate new insights and applications, offers long-term sustainability potential. Attard et al. (2016) and Azkan (2022) emphasize that unlike finite resources, data can continuously generate value as it is applied in new contexts. This creates opportunities for innovation and value creation that extend well beyond the initial data collection. However, sustaining this value requires continuous investment in data maintenance and quality assurance. Fang (2023) and Garcia (2019) highlight that data

quality, updating, and curation demand significant resources, which can be difficult to sustain over time. Many ODEs rely on voluntary contributions from data providers, but without proper incentives or feedback mechanisms that show how data is reused and what value it generates, providers may become disengaged (Van Der Aalst et al., 2020). Ensuring the sustainability of ODEs requires robust strategies for maintaining data quality and incentivizing ongoing contributions from data providers and/or users.

3.4   Conclusion

This chapter addresses the goal of exploring the components of value creation, the various aspects of value, and how benefits are distributed within open data ecosystems (ODEs) by reviewing the diverse factors that influence value generation in these ecosystems. It examines the economic, social, and technological drivers of value, highlighting how data reuse, innovation, and collaboration contribute to value creation. Additionally, the chapter discusses the challenges that affect equitable value distribution, including power imbalances, governance issues, and technological barriers. Through this analysis, the chapter illustrates how value in ODEs is not only generated through direct economic outcomes but also through social and ethical considerations, such as transparency, accountability, and participation. Finally, it underscores the need for governance frameworks that can ensure that the benefits of ODEs are shared equitably among all participants.

The literature on open data ecosystems (ODEs) reveals a complex landscape where value creation is driven by diverse economic, social, and technological factors. Across the 22 articles reviewed, there is agreement that ODEs hold significant potential for innovation and public benefit, particularly through data reuse, collaboration, and platform-based generativity. Economic value creation, as emphasized in much of the research, revolves around optimizing data flows, fostering innovation, and capturing value through strategic alliances and technological advancements like AIoT. At the same time, several scholars argue for broader conceptions of value that encompass social and ethical dimensions, including transparency, accountability, and equitable participation.

However, alongside these opportunities are considerable challenges. Governance issues, particularly power imbalances and control over data resources by dominant actors, remain a persistent barrier to equitable value distribution in ODEs. Technological barriers, such as the lack of standardization and interoperability, also limit the potential for collaboration and innovation across sectors. Additionally, building trust among ecosystem participants, particularly around data privacy and security, is a critical concern that must be addressed to ensure sustained collaboration and participation.

The long-term sustainability of ODEs further hinges on continuous investment in data quality and maintenance, as well as the ability to provide smaller actors with the resources needed to engage meaningfully in the ecosystem. While the generative potential of open platforms is clear, the ability to maintain and grow these ecosystems in a way that benefits all participants equally is far from guaranteed.

Overall, the future of open data ecosystems will depend on how effectively these challenges are managed. The design of governance frameworks that address power asymmetries, ensure interoperability, and build trust will be crucial in determining whether ODEs can deliver on their promises of innovation and public value. As such, the prospects for ODEs are neither guaranteed nor entirely optimistic, but contingent on the careful balancing of competing interests and the resolution of significant structural challenges.

4 Financial value in open data ecosystems

4.1 Introduction

In this chapter, we will take a closer look at financial value in the open data ecosystem. While economic value is often (mis)understood as financial value, the former has a broader meaning in the economic field. For example, classical economists such as Adam Smith, David Ricardo, and Karl Marx discussed economic value in terms of the amount of work and labour put into producing something (Mazzucato, 2020). The neoclassical economists such as Alfred Marshall then measure value of things in terms of their usefulness to the consumer and, in turn, how much they are willing to pay for them; hence, a shift from an objective measure (i.e., how much labour is put into production) to a subjective measure. Since then, while price (i.e., monetary terms) has often been the indicator of economic value, it is still not the only representation. Economists often consider direct versus indirect use value and market versus non-market values in their economic modelling and analysis, especially when they involve aspects that are not easily measured, such as environmental (Pearce, 2001), cultural (Angelini & Castellani, 2019), and social (Postelnicu & Hermes, 2018) aspects.

Therefore, this chapter focuses narrowly on financial value (i.e., dollar or euro terms) since economic value, a broader term, could also include public and social values, which are covered in other sections of this deliverable. As noted by (Welle Donker & van Loenen, 2016), much research has been done on the benefits of open data, but little attention has been given to the monetary aspects. Nevertheless, in practice, money plays a crucial role for actors in the open data ecosystem. For example, without sustained funding, open data providers may be unable to provide open data free of charge. Without the financial return expected from open data initiatives (e.g., cost savings), some companies may not consider investing sustainably in them (although others may consider societal goals that are not tied to financial value).

4.2 How different actors provide and capture financial value

Actors in an open data ecosystem (e.g., government agencies, companies, non-profit organisations, and citizens) are not wedded to any particular role (e.g., open data funder, provider, intermediary, end-user) (Oliveira & Lóscio, 2018). In other words, they can play multiple roles at the same time or different roles in different contexts. Therefore, to have a systematic overview of how different actors provide and capture financial value in the open data ecosystem, we should especially consider the various roles they can play.

Table 1 shows how different actors provide and capture financial value through different roles.

Table 1: Means of providing and capturing financial value for different actors in different roles

Type of actor	Role	Means of providing financial value	Means of capturing financial value	Sources
Government agencies	as a funder	• Budget allocation (via national treasury) to open data providers	• Tax revenue from economic activities enabled or spurred by open data	(European Commission, 2000; Onsrud, 1992; Vickery, 2011; Welle Donker & van Loenen, 2016)
	as an open data provider	• Cost savings to open data users	• Budget allocation (via national treasury) • Non-open data or value-added products and services • Transaction costs saving	(Hartog et al., 2014; Janssen et al., 2012; Welle Donker & van Loenen, 2016)
	as an open data intermediary	• Cost savings to open data users and providers	• Budget allocation (by national treasury) • Non-open data or value-added products and services	(Hartog et al., 2014; Janssen et al., 2012; Welle Donker & van Loenen, 2016)
	as an open data end-user	• Tax revenue from economic activities enabled or spurred by open data	• Cost saving by not having to negotiate and/or purchase or collect data • Profits from products and services based on open data	(Hartog et al., 2014; Janssen et al., 2012)
Companies	as a funder	• Donation or voluntary contribution to open data initiatives • Project-based funding to open data initiatives	• Cost saving by leveraging the open data initiatives they financially sponsored • Tax deduction through donation or voluntary contribution to open data initiatives	(OSM Foundation, n.d.; Overture Maps Foundation, 2024; Wikimedia Foundation, n.d.)

Type of actor	Role	Means of providing financial value	Means of capturing financial value	Sources
	as an open data provider	• Cost savings to open data users	• Cost saving by leveraging crowdsourced open data projects that they also contributed data to	(OSM Foundation, n.d.; Overture Maps Foundation, 2024)
	as an open data intermediary	• Tax revenue from economic activities enabled or spurred by open data	• Profits from products and services based on open data	(European Commission, 2000; Onsrud, 1992; Vickery, 2011; Welle Donker & van Loenen, 2016)
	as an open data end-user	• Tax revenue from economic activities enabled or spurred by open data	• Cost saving by not having to purchase or collect data • Profits from products and services based on open data	(European Commission, 2000; Onsrud, 1992; Vickery, 2011; Welle Donker & van Loenen, 2016)
Non-profit organisations	as a funder	• Donation or voluntary contribution to open data initiatives	• Cost saving by leveraging the open data initiatives they financially sponsored	(HOT, 2024; OSM Foundation, n.d.; Overture Maps Foundation, 2024; Wikimedia Foundation, n.d.)
	as an open data provider	• Cost savings to open data users	• Cost saving by leveraging crowdsourced open data projects that they also contributed data to • Donation or voluntary contribution	(HOT, 2024; Overture Maps Foundation, 2024)
	as an open data intermediary	• Cost savings to open data users	• Donation or voluntary contribution	(HOT, 2024; Overture Maps Foundation, 2024)
	as an open data end-user		• Cost savings by not having to purchase or collect data	(Janssen et al., 2012)

Type of actor	Role	Means of providing financial value	Means of capturing financial value	Sources
Citizens	as a funder	• Donation or voluntary contribution to open data initiatives	• Tax deduction through donation or voluntary contribution to open data initiatives	(OSM Foundation, n.d.; Wikimedia Foundation, n.d.)
	as an open data provider	• Volunteering in open data crowdsourcing projects		(OSM Foundation, 2024)
	as an open data end-user		• Cost saving by not having to purchase or collect data	(Janssen et al., 2012)

4.2.1 Government agencies

The government treasury often provides full or partial funding to government open data providers. A common expectation is that the treasury will be able to regain financial value via tax revenue from the economic activity and employment enabled or enhanced by open data (European Commission, 2000; Onsrud, 1992; Vickery, 2011; Welle Donker & van Loenen, 2016). Nevertheless, a few variables are at play (Welle Donker, 2018). First, the economic gains by companies through open data are not necessarily translated into increased taxable income. For example, open data may result in an overall technological shift in a sector, and a company does not gain any competitive advantage over the others simply by using open data because (almost) everyone else does so too. Second, companies that use open data provided by government agencies could be based outside those agencies' tax jurisdiction. Third, even if open data from government agencies led to increased tax revenue, it is difficult to quantify the additional revenue and determine how much it covers the costs of providing open data. Additionally, how much open data providers should be compensated based on this additional revenue is also reliant on political decisions. Some open data providers among government agencies cover the costs of providing open data through non-open data or value-added products and services they provide. For example, the Dutch National Transport Agency (RDW) offers general vehicle and parking data as open data. RDW bears the cost of providing those open data from the revenue it gains from vehicle registration charges and annual vehicle tests. The agency also obtains income by offering fee-based web services (including near real-time and additional historical data) (Welle Donker & van Loenen, 2016). Additionally, by publishing open data, some government agencies, including RDW, capture financial value through transaction costs saving (Welle Donker & van Loenen, 2016). The transaction costs were previously incurred to maintain the payment systems for selling data. By making data open, these systems no longer need to be in place. There are also government agencies that serve both as open data providers and intermediaries and, in turn, generate revenue from their open data intermediation products and services. For instance, while being compensated by the treasury for the open data it provides, the Dutch Cadastre, Land Registry and Mapping Agency (Kadaster) also manages PDOK (the open national geographic information platform). Other government agencies pay Kadaster to host their data in PDOK (Welle Donker & van Loenen, 2016). Besides, Kadaster also offers paid data products as a source of revenue.

As open data providers or intermediaries, government agencies offer cost savings to open data users, including other government agencies, as they could avoid purchasing or collecting data themselves (Hartog et al., 2014; Janssen et al., 2012). Additionally, government agencies that serve as open data intermediaries also offer cost savings to open data providers as the latter do not have to individually develop and maintain their own platforms to disseminate open data.

4.2.2 Companies

Companies contribute as funders to open data initiatives (either in the supply, intermediation, or use of open data) in multiple ways. For example, companies such as TomTom, Microsoft, Meta, Esri, and Grab contribute to the OpenStreetMap (OSM) project by being corporate members at the OpenStreetMap Foundation (OSMF), with annual membership fees ranging from €750 to €30,000, depending on the tier. OSM is a global open geographic data crowdsourcing project maintained by a community of volunteers, and the OSMF is the non-profit organization that supports the project by means of giving its legal representation, infrastructure hosting, fundraising, and supporting the project growth.

Companies may also contribute financially to open data initiatives on a project basis. For example, AWS, Meta, Microsoft, and TomTom collaboratively initiated the Overture Maps Foundation (Overture), which aims at creating high-quality and interoperable open map data (Overture Maps Foundation, 2024). Overture leverages OSM data as one of the primary sources aside from data provided by its members.

Companies benefit financially from contributing to OSM and Overture projects as they (or their platform partners and vendors) can use open data from these projects themselves. These companies do not need to purchase or collect data on their own. Instead, they can leverage crowdsourced or collaborative open databases they support financially. They can also contribute to these projects as open data providers by contributing the data they collect to the open database. Both types of contributions – as a funder or open data provider – can result in cost savings (or, rather, cost sharing with others) for these companies.

Companies may also benefit from tax deductions by financially contributing to open data initiatives, such as the case of the Wikimedia Foundation and OpenStreetMap Foundation. However, this depends on whether the non-profit organisation is granted a tax-deductible status according to local laws.

Companies that use or intermediate open data generate profits from products and services enabled or enhanced by open data. They also benefit from cost savings as they do not have to purchase or collect data independently. In turn, they contribute tax revenue from their generated profits (European Commission, 2000; Onsrud, 1992; Vickery, 2011; Welle Donker & van Loenen, 2016). In theory, (a portion of) the tax revenue would flow back to government open data providers to support the operational and developmental costs of publishing open data.

4.2.3   Non-profit organisations
Non-profit organisations can be funders of open data initiatives. For example, the Humanitarian OpenStreetMap Team (HOT) is a non-profit organisation (separate from the OSMF). HOT is also a corporate member of the OSMF, contributing annual membership fees to support the OSM project. HOT also contributes open data from mapping projects they conduct to the OSM database. By being a funder and an open data provider, HOT can simultaneously leverage the OSM database, which other OSM community volunteers contribute, for their projects, saving the organisation costs.

Even though non-profit organisations' (NPOs) goal is not to generate profit, financial value is still essential for the operation and growth of these organisations. There are non-profit organisations that are original open data providers, i.e., they collect and disseminate the open data themselves, such as Human Rights Data Analysis Group (HRDAG), and those that serve as open data intermediaries, such as Global Forest Watch, and International Aid Transparency Initiative (IATI). In both roles (as open data providers and intermediaries), non-profit organisations often gain funding through donations or voluntary contributions (e.g., membership fees). There are also non-profit organisations that are end-users of open data, such as the Red Cross, which uses open data in humanitarian responses. These organisations benefit financially from not having to purchase or collect data themselves for their work.

4.2.4   Citizens
Citizens can contribute financially to open data initiatives. Like companies, they can do so through donations or voluntary contributions (e.g., membership fees). For some organisations, that carry out open data initiatives in some countries such as Wikimedia Foundation and OpenStreetMap Foundation, citizens can receive tax deductions by contributing to those organisations. Citizens can also voluntarily contribute as open data providers in open data crowdsourcing projects, as OSM community members do. As end-users, citizens can use open data for free for their individual or household activities, such as to check registration of addresses and buildings, or research and hobby activities.

4.3   Discussion

The previous section showed various ways that actors in the open data ecosystem (can) both provide and capture financial value in different roles. It is difficult to establish whether the exchanges of financial value between actors in the ecosystem are balanced or equitable. To begin with, what would a balanced (or fair) distribution of financial value should look like? For example, does it mean that open data providers have to be compensated exactly the amount they spent (in euro terms) on providing open data? Similarly, how much should a data user or intermediary provide financial value back to the ecosystem relative to the profits they earn that were enabled or enhanced by open data?

Besides, it is also worth questioning whether the circulation of financial value has to be 'balanced' by itself in the ecosystem, or rather, other types of value can (or already are) compensate for the financial value provided by certain actors. For instance, in the case of BAG data provided by Dutch Kadaster, the agency spent money to continue providing the data. The data is then used by various companies, allowing them to generate profits through the internal use of the data or the sale of value-added products and services. Besides providing tax revenue to the government, which was then used to fund Kadaster providing BAG data, these companies, as well as other types of actors such as universities, may also contribute value back to the ecosystem by providing feedback regarding the data to Kadaster or creating derivate products (such as TU Delft's 3D BAG) that are useful to others, including Kadaster. The latter kinds of values are not financial value but are still valuable to the data provider, i.e., Kadaster.

Having said that, a few aspects can be considered to improve (or 'balance') the distribution of financial value in the open data ecosystem to ensure that all actors can continue to be actively involved in the ecosystem.

- Commitments to provide continuous and adequate funding for maintaining and developing open data infrastructure and support ought to be institutionalized, for example, through supranational, national, or local laws. Conversely, open data has to be considered as an infrastructure (like roads, clean water, etc.) and be accounted for in the tax policy design that, at the same time, does not disincentivize companies from continuing using open data. Hence, further research in this regard may be worth it.
- Some restructuring, streamlining, and coordination of open data management and provision may be necessary within and across government agencies to save (transaction) costs as open data providers further. At the same time, it may also be worth coordinating with other agencies that are not necessarily open data providers to implement contractual obligations with third-party vendors that collect data through their government-funded projects/undertakings to give such data to the government free of charge (including augmented data on top of initially open government data), so that (some of) the data can then be provided as open data. This saves the government from (re)collecting the data.
- One possible way to recuperate some of the costs of providing open data is for government agencies to also provide value-added services based on open data at fees. This involves revisiting, clarifying, and potentially amending existing laws related to government-market roles and competition.
- Government agencies should be obligated to use open data whenever it is available and to inform open data providers of any errors in the data. This saves costs for them as open data users as well as to open data providers in ensuring data quality.
- Tax incentives may be worth considering enticing companies and citizens to contribute to open data initiatives as funders or data providers. The case of the Wikimedia Foundation and OpenStreetMap Foundation being granted tax-deductible status in some countries, where companies and citizens who donate to these organizations can claim tax deductions, is a good example to consider for other open data initiatives.

- Governments should recognize that they are no longer the only open data providers. Hence, they should consider supporting citizen-generated or crowdsourced open data projects, such as OpenStreetMap, by financially supporting or contributing their own data to these projects. At the same time, governments can also leverage open data from these projects as one of their data sources. This may lead to more cost-sharing in open data initiatives within the ecosystem.

4.4 Conclusion

This chapter highlighted the roles undertaken by the different actors in the open data ecosystem regarding the financial value provided and gained. We found that actors can play the roles of funders, open data providers, open data intermediaries, and open data end-users, and that depending on the type of actor and role undertaken, the financial value changed. For instance, companies can prioritize cost savings and product enhancement, using open data to reduce expenses on data collection while adding value to their services. Government agencies, on the other hand, often view open data as a means to stimulate economic activity and drive indirect financial returns, such as tax revenue and efficiency gains in public services. Non-profits benefit financially by accessing data at no cost, which supports their mission-driven work without extensive investment in data resources, and citizens gain value through free access to information for personal or community use. The examples show that open data ecosystems can, therefore, offer various means to provide and capture financial values, adapted to each actor's goals and needs. In the next chapter of this deliverable, we will explain how value in open data ecosystems goes beyond financial value, and also includes social value.

5 Social (use) value in open data ecosystems

5.1 Introduction

The academic literature on open government data (OGD) widely asserts that OGD has no intrinsic value on its own. Instead, its value emerges when it is actively utilized (Attard et al., 2016; Hossain et al., 2016; Onsrud & Rushton, 1995; Tai, 2021; Virkar & Viale Pereira, 2018). Despite the significant attention given to OGD and the value created, a notable gap in the literature is the lack of understanding from the user's perspective, which has led to discrepancies between the promises of OGD and the (use) value distribution in open data ecosystems (ODEs) and how different components interact to shape these distributions.

Value conceptualization in OGD has often assumed a direct relationship between data usage and its outcomes (ODECO D3.1). However, as highlighted by Zuiderwijk et al. (2019), there is a misalignment between the goals and outcomes of OGD initiatives. This gap necessitates a deeper exploration into the causal relationships between open data utilization and its societal or individual benefits. Our literature review reveals that multiple factors—technological infrastructure, tasks and activities, guidelines, and long-term plans—interact in complex ways to influence the distribution of value within ODEs. The growing need for empirical studies on the user perspectives of open data is crucial to bridging the gap between theoretical frameworks and real-world applications (Janssen et al., 2012). Understanding these dynamics helps contextualize how social, cultural, and political factors affect value distribution and challenges the direct, linear assumptions of open data's impact.

5.2 The concept of social value

The understanding of OGD value is fundamentally tied to the classical concept of "use value," which refers to how individuals perceive the utility of goods and services (Bowman & Ambrosini, 2000). In the context of OGD, use value aligns with user-centered design theories, which emphasize that products and systems must be designed to meet users' needs (Norman, 2002). However, this creates a challenge because of the ambiguity between usefulness (object-centric) and utility (user-centric) which can complicate the design of systems that cater to diverse user needs (Seffah & Metzker, 2004). For example, when a government agency releases open data on public transportation schedules, its usefulness might be measured by completeness, accuracy, and format. However, from a user-centric view, utility depends on how well it meets users' needs. Commuters, for example, find valuable data, if it is easily accessible through a mobile app, for real-time information to plan routes. Thus, utility is tied to user satisfaction and the data's applicability in daily routines.

Further complicating the value dynamics in open data ecosystems is the non-rivalrous nature of digital goods, such as open data, further complicates the value dynamics in open data ecosystems. Many can use digital goods simultaneously without diminishing their availability, thus shifting value dynamics from individual utility to broader platform utility (Jetzek et al., 2019). This shift raises concerns about exploitation and power dynamics, as users often become part of the value creation process, sometimes inadvertently contributing to the generation of value for external parties (Zuboff, 2019). For example, in open data platforms, users are expected to provide feedback and share data actively (Charalabidis et al., 2018). This participatory culture, described by (Toffler, 1990) (p.27) as "prosumer," challenges the traditional understanding of use-value as separate from production.

The value of OGD extends beyond individual use, contributing to societal outcomes, such as enhancing transparency, improving public services, and addressing public emergencies (Data Act, 2023). This perspective shifts the focus of value assessment from individual utility to the role of data in achieving broader, community-oriented outcomes (Tomlins, 2017). These dimensions often

influence how open data is perceived and utilized, leading to varied distributions of benefits across different user groups and stakeholders. Social value, as Jain et al. (2020) describe, refers to long-term outcomes benefiting multiple stakeholders, including underrepresented communities, which adds complexity to the value dynamics in ODEs.

5.3   Research methodology

This chapter employs a literature review approach to examine the dynamics influencing social value distribution in Open Data Ecosystems (ODEs), specifically focusing on Open Government Data (OGD) that, by definition, can be understood as open data. OGD is emphasized due to its significant presence in existing literature, as it falls under the broader category of open data. Terms like impact, value, effects, and benefits are often used interchangeably in this field, so these were included in the search for relevant studies.

The review includes peer-reviewed research published between 2013 and 2023, chosen for its relevance and to provide insights since a key review on OGD benefits from 2012 (Janssen et al., 2012). The aim is to reflect the current understanding of the role of OGD in value creation. Only studies that clearly describe the impacts and benefits of OGD usage were included, particularly those that discuss the interdependent nature of ODEs involving diverse network of stakeholders. These studies highlight local contexts and the collaboration of communities with shared goals. A thematic analysis was performed on the selected studies to identify patterns and concepts within the literature. This analysis helps to categorize factors influencing value distribution and understand how these dynamics facilitate value creation in ODEs.

5.4   Dynamics influencing social value distribution

Our literature analysis reveals four primary themes when analysing the dynamics influencing social value distribution within ODEs: technologies, tasks, guidelines, and plans. Each theme represents a set of interdependencies that shape how social value is distributed among different actors in an open data ecosystem.

Technologies: This theme involves the technological infrastructure needed for effective OGD usage. Robust IT infrastructures, including cloud computing, standardized data exchange formats, and data analysis tools like machine learning, play a key role in shaping the accessibility and usability of open data. These technologies enable meaningful interactions with data, thus influencing the value derived from its use. Technologies such as metadata management and data quality control also affect how value is perceived and realized by users (Gao & Janssen, 2022; Runeson et al., 2021).

Tasks: This theme encompasses the activities required to facilitate meaningful open data use, such as data collection, quality assurance, publishing, and monitoring. Collaborative platforms like GitHub or ArcGIS and data analysis methods, such as machine learning, contribute to the iterative processes of refining and disseminating data for use. These tasks help ensure data is accessible, usable, and reliable, which directly influences the distribution of social value across user groups (Wilson & Cong, 2021).

Guidelines: This theme refers to the frameworks and regulations that govern the interactions among agents in the ecosystem. Guidelines may include ethical practices, compensation models, training programs, and regulatory measures that control the flow of open data. These guidelines ensure that open data usage aligns with societal values and that the distribution of data benefits is equitable (Smith & Sandberg, 2018; Zhang et al., 2021). They foster collaborative decision-making and promote inclusive design, ensuring that open data initiatives reflect both local needs and global goals.

Plans: Plans and processes are long-term strategies guiding the evolution of open data ecosystems. Vision-setting, cultural change, public funding, and project planning are integral to ensuring that open data initiatives are sustainable. Effective planning supports collaborative ventures and drives innovation while maintaining focus on societal goals such as environmental sustainability or public health (Runeson et al., 2021; Najafabadi & Cronemberger, 2022).

These four themes illustrate the interdependencies that define the dynamics of value distribution within ODEs. Technologies provide the foundation for open data interactions, while tasks ensure its effective use. Guidelines ensure ethical and organizational coherence, and plans set the direction for long-term sustainability.

5.5 Purpose-driven approaches in open data ecosystems

The dynamics influencing value distribution in ODEs are complex and require a holistic, context-sensitive approach that considers both the local needs of users and the broader social, ethical, and political implications of open data usage. Open data ecosystems are inherently interdependent, and the value generated from these systems depends on the collaborative decisions made by all participants. The dynamics emerging from the technologies, tasks, guidelines, and plans are critical in shaping the temporal dynamics of open data value, ensuring that its use evolves in response to changing technologies, societal and community needs, and ethical considerations (López-Reyes et al., 2024).

Furthermore, a purpose-driven approach, as opposed to a user-driven one, can enhance open data ecosystems by better reflecting the understanding of social value. While user-driven models primarily focus on satisfying individual needs and demands, purpose-driven models prioritize well-defined societal goals. These goals typically aim to promoting responsible data usage while advancing societal benefits, such as improved healthcare and environmental sustainability. This balancing act between fulfilling individual user demands and ensuring that data governance aligns with social welfare and ethical standards is challenging but essential (Verhulst et al., 2020).

In a "publish with purpose" model, open data initiatives are motivated by specific social outcomes rather than simply the volume of data made available to share data openly. This model aims for impactful reuse by aligning data publication with societal needs. Such an approach promises to foster public trust and engagement, as it goes It encourages practitioners to understand and assess the specific data needs of various user communities, ensuring that the data meets relevant social and economic objectives (Verhulst et al., 2020). For instance, purpose-driven open data can support the formation of data collaboratives that combine resources and expertise to address urgent global challenges such as humanitarian action, environment, economic development, transportation, healthcare, crisis response, and others (Susha et al., 2017).

Share purpose-driven initiatives not only ensure data accessibility but also make it actionable, catering to the specific needs of communities while respecting their cultural and local contexts (López-Reyes et al., 2024). Moreover, aligning data governance with well-defined goals promotes transparency and trust, both of which are essential for maintaining long-term engagement from users, data providers, and policymakers (Marcucci et al., 2023). By engaging with these communities, through building partnerships or even encouraging co-ownership, open data initiatives can be better tailored to serve the co-created value, maximizing its utility and usability.

However, implementing purpose-driven community-centric open data ecosystems comes with considerable challenges. One major hurdle is balancing competing priorities among stakeholders. Some data providers may focus on profitability or proprietary rights and restrict the access or re-use of their data, while public entities and civil society groups may prioritize accessibility and equity (Attard et al., 2015). Ensuring that data usage adheres to ethical standards and community

rights requires robust governance frameworks, which can be resource-intensive to develop and enforce (Rocha de Siqueira & Ramalho, 2024). Additionally, data asymmetries exist, as larger institutions often have greater access and capacity to utilize data than smaller or marginalized groups. Without proactive measures to level the playing field, purpose-driven initiatives may inadvertently reinforce existing inequalities (Verhulst et al., 2020). There is also a risk of "purpose drift," where the original societal aims of open data projects become overshadowed by secondary priorities, such as commercial or political interests (Zuiderwijk et al., 2019).

To address these challenges, open data ecosystems must incorporate critical design practices that encourage active participation from a wide range of stakeholders, including underrepresented communities, who are often most affected by data-driven decisions but frequently excluded from these discussions (see ODECO D2.3). Investments in data literacy and capacity-building initiatives are essential to empower users and organizations to derive maximum value from open data (see ODECO D4.3). Additionally, advancing technological solutions such as privacy-preserving analytics and secure data-sharing frameworks could also help mitigate risks, ensuring that the social value of open data remains aligned with its intended objectives (Attard et al., 2015). By navigating these opportunities and challenges, purpose-driven approaches can play a transformative role in maximizing the societal value of open data ecosystems.

These efforts highlight the interactions between technological infrastructure, tasks, guidelines, and plans in purpose-driven open data ecosystems. While technological infrastructure provides the foundational tools for accessing and using open data, the tasks involved in data management and usage ensure that the data is reliable, accessible, and actionable. Meanwhile, guidelines ensure that data governance aligns with ethical standards and social equity, and plans facilitate the long-term sustainability and alignment of open data initiatives with public welfare goals. The challenge lies in navigating these dynamics to ensure that open data initiatives do not merely cater to individual user demands but are strategically aligned with broader social, ethical, and environmental objectives. By prioritizing clear public interest goals where the purpose is co-created by involving the beneficiaries as well as the affected communities and considering power dynamics, purpose-driven models could transform open data ecosystems into catalysts for the public good, fostering cross-sectoral collaboration and promoting sustainable development (López-Reyes et al., 2024).

5.6   Conclusion

This chapter has examined the dynamics in the use of OGD by considering that the value of open data ecosystems extends beyond traditional ideas of individual benefits to encompass broader societal outcomes. While the notion of use value highlights the direct advantages for users, social value emphasizes long-term impacts of open data on communities. By considering the emerging dynamics regarding technologies, tasks, guidelines, and plans within user communities aligned a shared purpose and observe them over time, it might be possible to align them with ethical standards and societal needs, fostering trust, inclusivity, and sustainable value creation.

Even when promoting and introducing purpose-driven open data ecosystems, the key challenge will be to align competing values between stakeholders, as some stakeholders will be driven by the use value of open data, and data asymmetries will exist. In this chapter, we introduced different pathways towards the successful implementation of purpose-driven open data ecosystems, such as critical design approaches and practices, capacity-building and data literacy initiatives but also technological solutions. Future research should not only focus on operationalizing social value across diverse contexts and developing metrics to evaluate the multifaceted impacts of open data initiatives, but also on how to effectively implement purpose-driven and community-centric open data ecosystems. Ultimately, the success of open data ecosystems hinges on their ability to connect individual use with collective well-being.

6 Exploring conflicting values in ODEs and legal pathways to address them

6.1 Introduction

While the previous two chapters each focused on a particular type or category of value (financial value versus social value), in this chapter we will explore how there can be conflicts between these different types of value in open data ecosystems.

The literature on open data has evolved significantly over the past decade, reflecting the increasing complexity and scope of open data practices (see for e.g., Davies et al., 2019). We can identify different phases of scholarly work with regard to open data (Van Maanen, 2023) - Research primarily focused on the technical and procedural aspects of *open data release*—the mechanisms by which governments and institutions made datasets publicly available, with the goal of overcoming 'barriers' that prevented open data flows (Janssen et al., 2012), including legal barriers (Dulong de Rosnay and Janssen, 2014) thus implying that open data are beneficial (Van Maanen, 2023). While this literature was not blind to the negative aspect of open data (Zuiderwijk & Janssen, 2014), this early wave of research had the tendency of emphasize the benefits of open data for enhancing public services, promoting citizen engagement, and driving economic development (Van Maanen, 2023).

As the field matured, attention began to shift towards the broader concept of open data ecosystems (Zuiderwijk et al., 2014; Pollock, 2011). These ecosystems are characterized by the interactions among a diverse set of actors, including government, companies, non-profit organizations, citizens, intermediaries, journalists, and schools (Van Loenen et al., 2021). Rather than focusing solely on data release, this strand of literature examines how these different actors collaborate, exchange data, and create value collectively (ibid). However, it also highlights the challenges inherent in these ecosystems, as actors can be motivated by different—and sometimes conflicting—reasons to both contribute to and engage with open data initiatives (Magnussen et al., 2024). Governments may prioritize transparency and service improvement, while private sector participants may seek to derive commercial benefits, and civil society actors may focus on issues of accountability and social justice (ibid). Another strand of literature started focusing on open data in practice, or 'at work', with a focus on open data practices that go in the direction of inclusion, social equity, and the achievement of democratic values (Ruijer et al., 2017, 2024).

In this chapter, we aim to explore the conflicts in values that arise within open data ecosystems, particularly from the perspective of government actors with a focus on fairness and (social) equity considerations. Drawing from the fields of critical data studies (Kitchin, 2021; Milan, 2024a) and public administration (Ruijer & Pietrowski, 2022), we seek to understand how competing values—such as efficiency, equity, privacy, and public accountability—manifest in the management and governance of open data. With increasing focus on Linked Open Data initiatives, use of big data analytics to combine and generate insights out of open datasets and collective dimensions of privacy, there are emerging concerns relating to the inclusion of and inference of personal data from open datasets. (Dalla Corte 2018; Scassa 2019; Botero Arcila 2023). Indeed, critical data studies, which interrogate power dynamics and inequalities in data practices (Iliadis & Russo, 2016) and public administration, which focuses on the design and implementation of government policies (Ruijer et al., 2022), provide valuable frameworks for analysing these tensions.

After the introduction, we present the research methodology in section 2, followed by a critical review of values in open data ecosystems in section 3. In section four we present the legal/governance pathways to overcome criticalities. In the final section, we present the conclusions, and we review the limitations of our analysis.

6.2   Research methodology

This chapter is built as an interdisciplinary narrative literature review, bringing together literature from legal, social science and public administration with the aim to identify key themes and debates surrounding conflicting values in open data ecosystems. This analysis is not exhaustive but aims to highlight the most pertinent contributions in the field that address value-driven conflicts. These themes offer insight into the power imbalances, ethical considerations, and governance challenges that arise when different actors interact in open data environments.

Based on the body of literature that we reference in this chapter; we offer a non-comprehensive list of *governance and legal pathways* that can be pursued to address the critical issues related to value distribution in open data ecosystems. These pathways offer potential strategies to mitigate conflicts, promote more equitable data practices, and ensure that the value generated by open data is distributed more fairly across all actors involved. Equitable data practices generally refer to principles and actions aimed at ensuring fairness, inclusivity, and justice in how data is collected, managed, analysed, and used. These practices prioritize the needs and rights of all individuals, especially marginalized or underrepresented groups, to prevent harm and promote equitable outcomes. This also entails a more fairly balanced distribution of the value generated by open data.

It is important to emphasize that while our review is not comprehensive, it remains highly relevant for several reasons. First, the rapidly evolving nature of open data ecosystems means that a complete review may be impractical or even impossible at any given time; new studies, frameworks, and case studies continuously emerge. Second, the focus of this review is to illuminate key themes and tensions within the literature that are central to understanding the dynamics of data justice and equity. These themes help identify actionable governance strategies, even if not all studies are considered. Lastly, our selective approach allows for a more nuanced discussion of the most impactful contributions to the field, thereby fostering deeper insights into the legal and ethical implications of open data practices. In this way, our review offers a critical foundation for further research and policy development, despite its limitations.

6.3   A critical review of conflicting values in open data ecosystems

Over the years, research on open data has identified a set of critical challenges that highlight contrasting values in open data ecosystems. In this analysis, we focus exclusively on justice, fairness, and equity, and how these values can come into conflict with more traditional or typical values of open data, such as efficiency, economy, and effectiveness. We divide these contrasts thematically into three main categories.

First, we address the question: "*What open data? Understanding open data production*", exploring the complexities of how open data is produced and made available. Next, we examine the governance of open data through the lens of accountability in "*The governance of open data: Who is accountable?*". This section focuses on how data is managed and who holds responsibility for its use. Finally, we shift our attention to the impact of open data in "*From open data to benefits: What do we need open data for?*", analysing how open data translates into real-world benefits and whether it fulfils its intended goals.

What open data? Understanding open data production

The value in open data ecosystems is primarily a result of data production, as data are not neutral; they are inherently political (Kitchin, 2021). This idea has been explored in the field of information justice, particularly within data justice, which examines how data can be considered beneficial when separated from the value generated during their production (Johnson, 2014). The first logical step in assessing value within open data ecosystems is, therefore, to analyse the value embedded in data production. Connected to the production of data is the assessment of which data are

missing (e.g., data regarding vulnerable groups) (Giest & Samuels, 2020). This step is crucial for understanding the dynamic nature of value in open data, especially as we encounter phenomena like "data creep," where data spill over into uses for which they were not originally intended (Ruijer et al., 2022) and lack of data on some social issues can then reflect in invisibility (Milan & Trere, 2021).

However, recent literature suggests that tracing the origins and intended purposes of data is becoming increasingly difficult due to the rise of AI technologies (Alegre, 2024) and the growing role of data infrastructures (Milan, 2024b). As the original reasons behind data production become harder to discern, our ability to evaluate the value of that data weakens, diluting power and agency. Data, in turn, become a conglomerate repurposed for various objectives, complicating any assessment of their value since, often, data inputs are invisible (Busuioc et al., 2023). Nevertheless, it remains essential to continue this evaluative exercise in order to capture the value of open data within a complex and evolving ecosystem. This is relevant in two contexts – *one*, in the generation of open government datasets (where concerns about representation of marginalised communities for instance need to be addressed), and *two*, in the reuse and repurposing of other data for data-driven decision making, such as the combination of administrative data with big data (where it is important but difficult to trace the origins of the data used for decision-making).

The governance of open data. Who is accountable for them?

Next to the question of data production is the issue of who influences value in the open data ecosystem. Contribution to this ecosystem is often obscured by the infusion of values from various actors, frequently hidden within opaque partnerships. For example, data production can result from partnerships between the private and public sectors, facilitated through procurement processes and the creation of data infrastructures (Gurin, Bonina and Verhulst 2019). Consequently, accountability becomes dispersed and invisible, leaving those affected by data decisions without agency. This lack of transparency makes it challenging to trace how data moves across borders and sectors, further complicating questions around who bears responsibility for the integrity, privacy, and security of the data. A notable example of these concerns is the case of open science data collected in the U.S. being used to train facial recognition technology in China (Taylor et al., 2022).

From open data to benefits, what do we need open data for?

Not all actors in the data ecosystem have the same power. Power dynamics can lead to what can be termed as *selective openness*, where only certain data is shared, accessible or reusable, often benefiting dominant actors (Gurnstein 2011). While open data ecosystems emphasize the collective benefits of sharing open data, the distribution of value still can be uneven in practice. Larger corporations or well-resourced organizations tend to capture more value from open data than smaller entities or individuals (Bates, 2011; Broomfield, 2023; Chandrasekhar, 2024). As such, the literature suggests that this dynamic could exacerbate existing economic and social inequalities, as the capacity to utilize open data is often tied to access to advanced tools and expertise. This calls for the assessment of value in open data ecosystems in connection to who is likely to benefit from it.

6.4 From conflicting values to legal and governance pathways that account for criticalities

This section proposes some legal and governance strategies in response to one of the research questions of this deliverable - strategies to design open data ecosystems that balance competing values while ensuring inclusive and sustainable value distribution. Legal avenues for redistributing value in the open data ecosystem need to account for the current inequities in open data initiatives. On the one hand, existing approaches like the 'FAIR' (Findable, Accessible, Interoperable and Reusable) data principles do bring focus to issues of data quality, accuracy and

representativeness in open – research - datasets. However, these principles start from the premise that datasets are neutral purely technological artefacts.

But, as discussed in this section but also elsewhere in this deliverable, the production of open datasets is inherently political. "Missing data" affects not only the representational quality of an open dataset, but it also means that *someone is missed out* when this dataset is relied on by public administration for decision-making (Kim et al., 2024). For example, at the beginning of the Covid-19 pandemic, more "data-rich" countries from the Global North were able to create larger datasets of Covid-19 cases and deaths compared to countries in the Global South, which in turn lead to global health policy being created from datasets that did not fully represent the situation in Global South countries (Milan & Treré, 2020). Going one step further, scholars also highlight the lack of data collection about covid-19 experiences among indigenous communities in Global North countries - owing to lack of infrastructure as well as systemic distrust by these communities in data-driven policy making (Carroll et al., 2021). And at an even more micro-level, as Santoro (2024) argues in the context of open datasets on daycare availability in Brussels, these open datasets are not well-integrated with mobility data for instance, and as a result do not offer much information on accessibility of each daycare centre - which is an important factor for parents seeking daycare services. These examples at various levels clearly highlight the imbalances present in the collection of data, which extend to imbalances in the value of data.

As a result, legal and governance avenues for redistributing value need to recognise and account for the politics of open data production and re-use. Normatively, this can be achieved through an orientation towards 'data justice' (Taylor, 2017). In terms of practical implementation, legal and governance frameworks for open data initiatives could refer to Collective Benefit, Authority to Control, Responsibility, Ethics (CARE) principles in addition to the FAIR principles for data quality management (ODECO, 2023). These CARE Principles do not focus only on inherent qualities of data that enable more sharing and re-use, but also focus on power differentials. As a result, CARE Principles also focus on realising collective benefit from open datasets, as well as ensuring commitment to ethics. (Carroll et al., 2020). There are examples of CARE principles being translated into the design and implementation of open data initiatives - such as the Open Data Mekong project (Chung & Chung, 2019; DCPC, 2024).

6.5   Some conceptual legal avenues oriented towards data justice
In this section, we offer some suggestions for legal policy and implementation, drawing from recent initiatives that adopt a critical perspective to legal interventions.

First, existing legal frameworks such as the Implementing Regulation on High-Value Datasets (2023/138), applicable to the European Union (EU) should be implemented in more equitable ways. This regulation, introduced as part of the 2019 Open Data Directive in the EU, mandates that certain public sector data deemed to have high socio-economic, environmental, and scientific value be made freely accessible and reusable across the EU. This regulation targets specific categories of data that can drive innovation and economic development, such as data related to geospatial information, environmental data, meteorology, statistics, companies, and mobility. The choice of these datasets reveals an implicit hierarchisation of value - where economic value of open data is prioritized over, for instance, citizen participation. (Broomfield, 2023). As Balvert and van Maanen (2019) note, "*[t]he communication of data by government is an inherently political process that can and should not be reduced to the productivity and efficiency of market actors. Efficiency as a morale for data dissemination has the tendency to lead to a nullification of primary rights of citizens to governmental services.*" To this extent, Chandrasekhar (2024) has argued that the EU could borrow from India in either altering or expanding the categories of high-value datasets to include social data - such as data on poverty alleviation and other socio-economic indicators. Similarly, the Understanding Glasgow project - a collaboration between the Glasgow

Centre for Population Health, local and national organizations, researchers, and communities - created open datasets and visualisations on life and well-being in Glasgow, including indicators on health, education, income, environment, housing, and social capital DCPC 2024, Understanding Glasgow 2024).

Second, legal institutions should also pay more attention to the involvement of commercial actors in open data initiatives. While commercial actors, particularly open data intermediaries, do bring significant benefits to the open data ecosystem (Shaharudin et al., 2023), there is also a real risk of commercial actors acquiring a stronger voice than public administrations as well as citizens in the governance of open data. Courts can play a particularly useful role in laying down rules about the conduct of open data intermediaries, to ensure they act in public interest. For instance, the European Court of Human Rights (ECHR) has created a body of jurisprudence on intermediaries and the fundamental right to receive information (van Maanen & Balvert, 2019). This case, therefore, holds some insights on what kinds of objectives open data intermediaries should valorise. Further, to the extent commercial actors are involved in providing public services - such as information and communication services for a municipality or a city - legal frameworks for public procurement can also be modified to ensure these private actors act in public interest. One way to achieve this, is by following the example of the City of Barcelona and introducing 'data sovereignty clauses' in public procurement contracts, which require commercial actors to share all data generated in the course of providing the public service in an open machine-readable format with the public administration, so that this data can be released as open government data (Monge et al., 2022). A similar example exists in the Netherlands, in public procurements contracts between the public agency Rijkswaterstaat and private contractors for water infrastructure projects.

Third, and finally, legal instruments in the realm of private law can also aid in equitable value creation and distribution in the open data ecosystem. Central to the open data movement is the use of free and open licenses - such as Creative Commons for creative works, as well as the Open Data Commons Open Database License and Community Data License agreement for datasets. Since the background cultural context of the open data movement was intellectual property - specifically copyright - these licenses were legal tools by which the logic of copyright was 'inverted' to enable greater access and re-use of data, information and knowledge to create a vibrant digital commons. (Giannopoulou, 2018). However, re-use of data is now impacted not only by copyright, but also by data protection and privacy concerns as well as competition and liability concerns (Dalla Corte, 2018; Dulong de Rosnay & Janssen, 2014). And as mentioned above, given unequal power distribution in the generation and re-use of data, there is also growing data extractivism and data colonialism - where data generated by and relating to communities in the Global South are captured and re-used by actors in the Global North, with little to no value – i.e. neither financial nor social value - flowing back to Global South actors. (Ávila, 2023). In this content, open data and content licenses can be reimagined, to inculcate new sets of values and ethics in data sharing and re-use. (Benhamou & Dulong de Rosnay, 2023). For instance, the Data Science Law Lab in the University of Pretoria has developed a new data license for African language datasets, that requires re-users from developed countries to commit to stronger share-alike and openness obligations - as a way to respond to data colonialism (Data Science Law Lab, 2024).

6.6   Conclusion

In this chapter, we brought together elements from law, social science and public administration literature to illustrate the tensions and conflicts between different values in open data ecosystems. We focused on three aspects - the production of open data, the responsibility of public administrations, and the impact of open data. By reviewing critical literature on these topics, we distilled a set of observations on the tensions between realisation of economic and social value from open data. We argue that the political decisions underpinning the production of open data

as well as the infrastructures and skills required to re-use open data means that there are stark power differentials between different types of actors who can realise value out of data. Although its not always easy to clearly distinguish between these different types, in certain cases commercial actors are clearly privileged over citizens and public administrations.

Further, we argued that legal avenues for redistributing value in open data ecosystems should take into account these power differentials, to ensure that all open data actors are given proportional voice in governance of open data. We argued that normatively, legal interventions should be oriented towards data justice, to enable equitable generation and use of open data. We then outlined some conceptual legal avenues for implementing such an orientation towards data justice. We offered suggestions with regard to the implementation of regulatory frameworks such as the Open Data Directive in the EU, modifying public procurement processes to ensure private sector vendors act in public interest, t, and upgrading tools of private legal ordering such as open data and open content licenses. Other suggestions could also include release of open government datasets under open licenses with "share alike" requirements, to ensure that re-use and derivatives are also released as open data, and potentially contributing to an open data ecosystem.

While these suggestions are well-suited for adopting a critical approach to open data governance, we recognise certain limitations as well. As mentioned in Section 2 above, the suggestions offered in this chapter do not result from a systematic literature review of values in open data ecosystems. However, as argued above, such systematic literature review is often impossible, given the constantly evolving nature of open data ecosystems as well as the publication of many new laws and policies on data sharing and re-use. Further, the conceptual legal suggestions offered here are not intended to serve as prescriptions, but as illustrations of approaches adopted in some countries that could inform law and policymaking in other countries. Legal systems vary across jurisdictions - for example between constitutional and common law systems - which, in turn, impacts the replicability of the legal avenues discussed in this chapter. Nonetheless, these legal suggestions represent recent impactful contributions to the field, and are therefore relevant from the perspective of policymakers.

7 Conclusion: Balancing and Distributing Value in Open Data Ecosystems

The exploration of values in open data ecosystems has highlighted their multifaceted nature, revealing both opportunities and tensions. Across this deliverable, each chapter has unpacked different dimensions of value - conceptual, financial, social, and legal - bringing clarity to their interactions, interdependencies, and conflicts. This conclusion synthesizes the insights from these chapters, discussing the broader implications for balancing and distributing value in open data ecosystems and providing an integrated answer to the two central research questions:
1. What types of value are prioritized in open data ecosystems and how do different types of value interact with each other?
2. What strategies can be employed to design open data ecosystems that balance values while ensuring inclusive and sustainable value distribution?

7.1 Conceptualizing value: A multifaceted approach

Regarding the first research question, the deliverable began by emphasizing the centrality of 'value' in open data ecosystems, framing it as not merely economic but encompassing social, ethical, and functional dimensions. The shift from unidirectional models of value generation (data release by governments) to circular models of co-creation has underscored the need for inclusivity and mutual interdependence. These conceptualizations foregrounded the challenges of defining and measuring value when multiple stakeholders—government agencies, private companies, NGOs, and citizens—participate with diverse motivations and capacities.

The chapter on financial value delved into the monetization potential within ODEs, exploring how various actors capture and provide financial value. It revealed stark inequalities: larger corporations, endowed with resources and technical expertise, are better positioned to extract financial gains, while smaller actors, such as NGOs and local governments, often struggle to participate meaningfully. This "data divide" undermines the broader objective of equitable value distribution, even when only looking at the financial value of open data.

Chapter 5 shifted the focus to social value, emphasizing that the utility of open data extends beyond financial metrics. Social value encompasses public trust, civic engagement, and societal benefits, such as transparency, accountability, and improved public services. However, the realization of social value in open data ecosystems nowadays faces significant barriers, including technical limitations, data asymmetries, and a lack of contextual understanding. The absence of marginalized voices in the design and governance of ODEs perpetuates these issues, limiting the transformative potential of open data to address pressing societal challenges.

Chapter 6 further explored the inherent conflicts between different types of value in ODEs, particularly between efficiency, equity, and privacy. These conflicts - again - stem from power asymmetries, where dominant actors prioritize their goals—such as profit generation or operational efficiency—over broader societal benefits.

7.2 Towards a balanced ecosystem: some recommendations

Regarding the second research question, each of the chapters in this deliverable proposed strategies for a more balanced distribution of value in open data ecosystems.

The inclusive perspective in Chapter 3 advocated for an alignment of economic gains with societal benefits. Recognizing value as a collaborative construct rather than a zero-sum resource is foundational to fostering sustainable ecosystems. This inclusivity requires deliberate governance mechanisms to ensure equitable participation, particularly for marginalized stakeholders.

Strategies proposed in chapter four to mitigate the imbalanced distribution of financial value include tax incentives for contributions to ODEs, the provision of shared infrastructures, and enabling value-added services by government agencies to offset costs. These initiatives point toward the need for redistributive mechanisms that counterbalance the financial dominance of well-resourced actors and foster a more equitable ecosystem.

In chapter six legal and governance pathways were provided as potential solutions for tensions between different values. Normative frameworks such as the CARE principles should complement existing FAIR principles by addressing issues of equity, ethics, and accountability. However, implementing such frameworks requires a shift from technocratic governance models to participatory approaches that prioritize data justice and inclusivity.

The different chapters of this deliverable clearly show that the overarching challenge for ODEs lies in balancing diverse and often conflicting values while ensuring their sustainability. Based on the results and findings of the different chapters, several strategies pathways can be proposed for addressing these challenges.

- **Governance Reform**: Decentralized and participatory governance models are essential for addressing power imbalances and fostering trust among stakeholders. Transparent mechanisms for open data sharing and accountability must be prioritized.
- **Capacity Building**: Smaller actors, such as NGOs and local governments, require support in terms of technical expertise, infrastructure, and financial resources to engage effectively with ODEs.
- **Innovative Incentives**: Tax breaks, subsidies, and public-private partnerships can incentivize broader participation and redistribute the benefits of open data more equitably.
- **Purpose-Driven Data Initiatives**: Aligning data release and usage with societal goals, such as addressing climate change or improving healthcare, can maximize both social and economic value.
- **Ongoing Research and Collaboration**: The dynamic nature of open data ecosystems demands continuous exploration of emerging challenges and the co-creation of solutions by diverse stakeholders.

7.3   Concluding remarks

The ODECO research demonstrates that open data ecosystems hold a significant potential for economic and societal impact, but still are constrained by systemic inequities and governance gaps. Larger organizations dominate, capturing most value, while smaller players like NGOs and underfunded groups often lack the resources to participate meaningfully. To address these power imbalances, more practical solutions such resource-sharing initiatives, capacity-building programs, or tax incentives could help smaller actors in engaging more effectively. Such measures and solutions however should be designed carefully, to avoid unintentionally reinforcing existing power hierarchies.

Some conflicts between priorities and values often remain unresolved. Tensions between individual 'use' values and collective 'purpose' values can be difficult to address or solve. Current governance models still seem to favor dominant actors and their priorities, limiting inclusivity and creating barriers for equitable participants. The incorporation of CARE principles alongside technical standards might help address these conflicts, but this approach needs further exploration. Important to realize is that new technologies (such as AI and IoT) also bring new challenges and risks which also need to be addressed.

Looking ahead it can be stated that significant efforts are needed to balance and distribute value in open data ecosystems, and without deliberate action, open data ecosystems risk perpetuating existing inequities rather than addressing them. The success and sustainability of open data

ecosystems will depend on balancing competing values and ensuring they serve diverse societal needs fairly and effectively.

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