The Impact of Enterprises Open Data Maturity Level on the Attainment of Sustainable Development Goals - Theme Analysis

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Over the past two decades, open data has become a key element of digital transformation and innovation in enterprises. The Open data in enterprises enables them to grow economically, enhance social responsibility, and engage in environmental sustainability programs. The effective use of open data within organizations enables improved decision-making processes, business optimization, and thus creation of added value. However, a question arises: how does the maturity level of organizations for the use of open data influence the attainment of Sustainable Development Goals (SDGs). This paper provides a comprehensive definition of the problem. With the use of Soft Systems Methodology it analyzes the process, from publishing the open data to its use, for the attainment of SDGs and the various stakeholders involved. This establishes a foundation for further research on how an enterprise's maturity to use open data impacts the attainment of SDGs.

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1 Introduction

Open data have in the last two decades become one of the key elements of digital transformation and innovation. Organizations that know how to effectively use open data, have the possibility to create new opportunities for economic growth, social responsibility and environmental sustainability. However, a question remains whether higher maturity level for the use of open data in organizations facilitates the achievement of sustainable development goals.

Despite the many advantages reported by academic society regarding the use of open data, ranging from product to organizational innovations (Apanasevic, 2021; Chang et al., 2022; Fasli et al., 2023; Janssen et al., 2012; Kitsios et al., 2017; Wieczorkowski, 2019) very little is known about its use in enterprises (Koski, 2015; Zuiderwijk et al., 2015) and the use for the purpose of attaining sustainable development goals (Fasli et al., 2023). The governments are investing into opening its data in a way that the data will be as useful as possible to as many stakeholders as possible (Attard et al., 2016; Fleiner, 2018; Jetzek et al., 2014). However, measuring the impact of open data is challenging due to many reasons: the use of open data does not have to be reported; the impacts cannot be expressed in tangible benefits and there are no standardized metrics to evaluate the impact of open data (Koski, 2015; Welle Donker, 2018). This highlights the first problem, which is the insufficient knowledge about the actual use of open data among enterprises, including whether enterprises use open data and the reasons for their potential non-use. To address this we need to determine whether the enterprises possess the capabilities to use open data for various purposes.

One of the desired uses of open data is to help enterprises to achieve sustainable development goals (SDGs). The SDGs are defined by the United Nations and include the eradication of poverty, reducing inequalities, addressing climate change and other social, environmental and economic difficulties while stimulating economic growth (United Nations, 2025). Large and listed enterprises are required to report about their environmental, social and governance (ESG) practices in corporate sustainability reports. These reports are mandated by corporate sustainability reporting directive (CSRD) (European Commission, 2022). The CSRD provides a framework in accordance with European sustainability reporting standards (ESRS) to facilitate enterprise reporting. CSRD framework demands

enterprises to define their corporate actions based on their impact on environment, social life and governing structure (European Commission, 2022). Enterprises are being called upon; to act sustainable and through the CSRD reporting they can align their activities with the SDGs. This leads us to the identification of the second problem, which is: how can enterprises ease themselves to achieve the SDGs?

By integrating the two identified problems we define the issue addressed in this study: How enterprises maturity to use open data impacts the attainment of SDGs? To explore this, we will apply the soft system methodology to clarify the root definitions – the process, the actors involved in the process, and the environment in which the enterprises operate. This will help understand the depth of the problem and lay foundations to further research of the topic.

The structure of this paper is organized as follows. In section two we will outline the methodology selected to address the problem. In section three we will apply the chosen methodology to our problem and present the results. After that a discussion about the results and conclusions derived will be described.

2 Methodology

The chosen methodology for establishing the current state of the problem is soft system methodology (SSM). This methodology presents "an approach for tackling problematical, messy situations of all kinds. It is an action oriented process of inquiry into problematic situations in which users learn their way from finding out about the situation, to taking action to improve it." (Checkland & Poulter, p. 201, 2020) The methodology was designed as a learning system, where "the learning is about a complex problematical human situation, and leads to taking purposeful action in the situation aimed at improvement, action which seems sensible to those concerned" (P. B. Checkland, p. 278, 1989).

How mature is an organization to use open data depends on various factors ranging from its ability to establish an organizational culture that supports and rewards employee initiative for the implementation and use of new technologies, to its infrastructural capabilities. Another issue highlighted in this study is how to ease the enterprises to attain SDGs? Combining these two questions gives us a "messy", complex, problematical real-world situation: How does the enterprises maturity to

use open data impact the attainment of sustainable development goals? To this research question one simple solution cannot be given but a learning process is needed to gain insight into different situations addressing different stakeholders needs. Therefore, the optimal methodology for addressing our problem is the SSM by Peter Checkland (1989).

The soft system methodology learning cycle follows a sequence of seven stages, shown on figure 1.

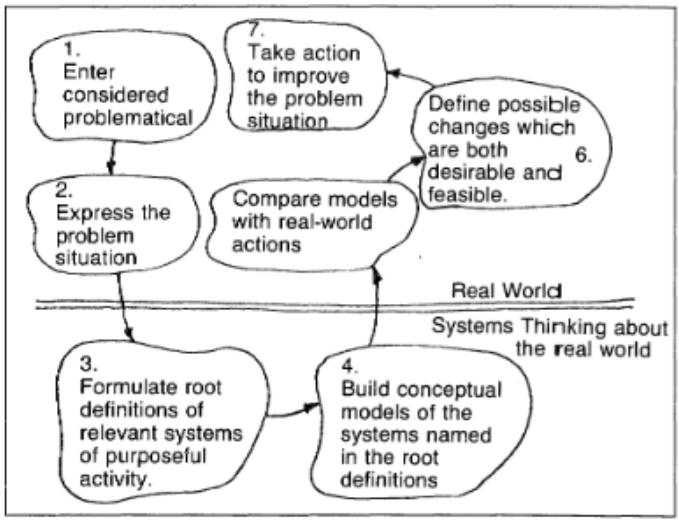

Figure 1: The learning cycle of SSM
Source: P. B. Checkland, P. 281, 1989

The first two stages present the phase of *finding out*. In this phase pictures of the situation in question are assembled by recording elements of *structure* and *processes* and forming a view of how the two relate to each other in creating the *climate* of the situation (P. B. Checkland, p. 281, 1989). An abstraction of the situation can be shown on a "rich picture", that represents the climate of the problematical situation. For this phase more elaborate guidelines include three analyses:

- the first analysis identifies the clients and problem-solver(s). The problem-solver lists potential "problem owners" including the clients and others affected by the situation

- the second analysis examines the situation as a social system and though highlights the cultural context of the problem,
- the third analysis examines the situation politically, analysing the distribution of power in the situation (P. B. Checkland, 1989).

The answers to these three analyses provide us the elements Customers, Actors, Transformation, Weltanschauung, Owners and the Environment, shortly named the CATWOE elements, which are explained in figure 2.

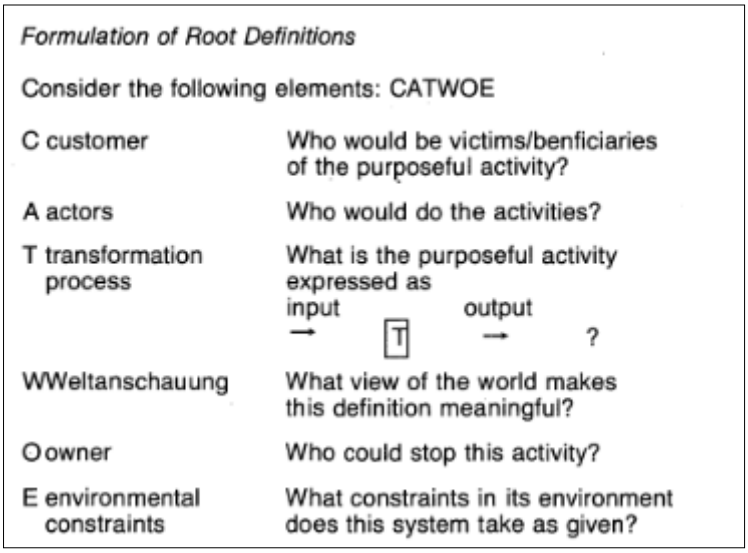

Figure 2: Formulation of Root Definitions
Source: P. B. Checkland, p. 283, 1989

During stage three so called Root definitions are established. Root definition represents the name of the system and is supposed to be constructed by consciously considering the elements of the CATWOE (P. B. Checkland, 1989). The core of the Root definition represents the T – transformation process which changes input into output.

Stage four of the methodology focuses on constructing conceptual models. In this phase, all the activities within the system are identified and clearly verbalised. These activities are then assembled into a system structure and hierarchically organized.

The completed assembly describes the transformational process named in the Root definitions. This is followed by stage five, which includes comparing the created model with real-world situation. This comparison serves as a basis for discussions aimed at improving the problem situation. Often, this stage prompts the problem-solvers to repeat earlier stages in the methodology. The learning process – the main objective of the methodology – is achieved through the comparisons of the models and the actual situation. In the next stage the participants focus on identifying the most suitable changes to address the problem situation. The evaluation of possible improvements has to satisfy two distinct criteria. Firstly, the comparison of desired reality to identified models will generate ideas for change. However, this logic is not enough, because people are not always motivated to implement changes even though these are systematically justified. Therefore, the second criteria includes identifying ideas that are also culturally acceptable. That is also the reason why it is important to carefully consider the W (weltanschauung) of the CATWOE for each model. The last, seventh, stage proposes acting. Once desirable and feasible changes have been identified, this stage involves implementing those changes and completing the SSM process (P. B. Checkland, 1989).

The scope of this paper includes the first three stages of the methodology: the identification of the problem, and formulation of root definitions to enable purposeful further activities. This will provide a foundation for understanding the problem and its complexity.

3 Results

Following the soft system methodology enables us to structure the complex problem within its environment and present it in a way that will be understood by everyone involved as coherent as possible. The problem that we identified is that we do not know how the maturity level of an enterprise to use open data impacts its possibility to attain sustainable development goals. From that a root definition is derived: **Large enterprises use open data to enhance their sustainability practices**. The input of the system are therefore the open data, that enterprises can use, and the output is the enhancement of an enterprises sustainable practices. In our study we argue that higher levels of maturity make it easier for enterprises to achieve higher levels of sustainability.

The third phase includes three analyses, the first one being the identification of all the actors in the process, from problem owners to problem solvers and everyone in between. In the CATWOE analysis these would represent the C – Clients, A – Actors, and O – Owners of the problem.

- The clients in our transformation are the organizations that conduct their business in Slovenia and have a legal obligation to attain some aspects of the SDGs and report about its achievement through CSRD reporting. In the scope of our study, we will focus on large enterprises.
- The problem owner is the Slovenian government that has the obligation to implement international law and EU directives in the national legislation. On the one side it is obliged by the EU directive 2019/1024 (European Commission, 2019) to open its data to the public for any purpose and monitor it's use. And on the other side it enforces large and listed organizations to report about their sustainability practices. This reporting must include information on environmental, social and governance (ESG) impacts, risks, opportunities and strategies aligning with EU sustainability standards (European Commission, 2022).
- The actors in this transformation is a vast multitude of organizations, ranging from supra governmental like the United Nations Organization and the European Union; to governmental organizations like the legislative body and public sector organizations that have the obligation to publish their data according to open standards; as well as the non-governmental organizations, the media and the civil society that conduct the monitoring of the realisation of the directives and the veracity of corporate reports.

The second analysis includes the identification of the cultural surroundings of the problem and the definition of what the process under consideration represents to each of the participating entities. With that the W (weltanschauung) of the CATWOE analysis is identified. In the process of using open data in large organizations to enhance its corporate sustainability practices there are many stakeholders. The first to mention is the United Nations Organization (UN) which includes 193 states around the world. Their mission is to preserve international peace and security, protect human rights, deliver humanitarian aid, promote sustainable development, and uphold international law (United Nations, 2025). To achieve this the 17 Sustainable Development Goals have been introduced that represents a global

call to action to promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection (United Nations, 2025).

The European Union as a leading global partner for the SDGs has committed to implement them into all the policies and encourage EU member states to the same (European Commision, 2025). To encourage large and listed enterprises to consider its impact in their immediate and far-reaching communities it presented the Corporate Sustainability reporting directive (CSRD) (European Commission, 2022). Along with that the EU has another agenda relevant to our problem. It introduced the Open data directive (European Commission, 2003, 2019) that mandates the public sector information to be published in an open and machine readable format for everyone to use for any purpose, including its use for profit. The Directive obliges public sector organizations to publish the data and encourages private sector enterprises to do the same. The use of open data for enterprises is optional, however it is promoted in numerous ways. Open data has the potential to be used for various purposes, in our study we only intend to explore its use to attain the SDGs.

Next stakeholders in the process of enterprises use of open data to attain the SDGs are member state governments. The governments are responsible for incorporating EU directives into national legislation. With that it must provide financial, human, and other resources to enable its implementation and monitor its application. Furthermore, it must empower them to introduce changes in the event of deviations from the expected outcomes.

Supranational and governmental stakeholders are followed by non-governmental organizations, who have a wide range of responsibilities to fulfill. They have to function as an intermediary balancing multiple responsibilities. On one side, they oversee the use of public funds. On another, they monitor the actions of enterprises and the veracity of their reporting. Finally, they are responsible to the public and their wellbeing as one of their main objectives. To achieve their function non-governmental organizations to the greatest extent possible they cooperate with the media to disseminate their findings. In the studied process the media serves as a

bridge between the enterprises and their environment. It has an obligation to objectively report on the enterprises' efforts to attain SDGs as well as their failures.

The owner of the process is the government. It has an obligation to adopt EU directives into national legislation and allocate resources for its implementation. Furthermore, it has the potential to promote the use of technologies, such as open data, and facilitate conditions for large enterprises to evolve to higher levels of maturity to use open data and to use those data to enhance its sustainable practices. The government is also responsible for the monitoring of implementation of legislation. In the studied process this means that the government plays a crucial role in promoting the use of open data to enhance corporate sustainability practices.

The minimum requirements to which the clients in the defined process – large enterprises – must conform are set in legislation. However, they have the possibility to exceed legal requirements. This gives them a unique opportunity to create economic profit through using open data, create jobs and provide innovative services that increase their beneficiaries' quality of life (Attard et al., 2016). In future studies, the answer to our research question – How enterprises maturity to use open data impacts the attainment of SDGs? – will represent the enterprises with an easy-to-understand answer to:

- why investments in increasing the maturity level to use open data are reasonable, and
- how the use of open data may help them to achieve higher levels of sustainability.

The last stakeholders involved in the process is the civic society, that possesses the fundamental right to live in peace and prosperity in an environment with no political or physical deprivations and provides conditions that improve health and education, reduces inequalities and spurs economic growth (United Nations, 2025). This gives the civic society the right to be informed of enterprises sustainable practices and empowers them to hold them accountable for their environmental and social impact. It also gives them the responsibility to demand a healthy environment for their well-being as well as for the benefit of future generations. With ensuring transparency and public inclusion enterprises can promote themselves as responsible and long-term sustainable partners in the environment in which they operate.

Table 1: Defining the CATWOE elements

CATWOE	Participants	Elements in defined problem
Clients		Organizations that are at different levels of maturity to use open data and have to comply with legislation regarding corporate sustainable reporting
Actors		A multitude of organizations from non-governmental, governmental and private to civic society
Transformation		Use of open data to attain sustainable development goals
Weltanschauung	United nations	Wishes to enable a future for all living things on our planet. Therefore, it presented the 17 SDGs that tackle different aspects of life.
	European commission	To enforce the implementation of SDGs into enterprises the EU has introduced the CSR directive, that mandates reporting of enterprises sustainable practices. Through the open data directive mandates that all the data, produced by the public sector has to be openly available for any purpose.
	Government	The national governments of the EU states, including Slovenia, have to introduce the EU mandated directives into their legislation and monitor its performance.
	Public sector organizations	Public sector organizations have to publish their data according to the open data legislation in non-proprietary, non-discriminatory, machine-readable formats, with corresponding open licences.
	Non-governmental organizations	Non-governmental organizations oversee the sustainable practices of enterprises and compare the reports with actual situation. They have the power (and often state provided means) to disclose good practices or non-compliances.
	Private sector large enterprises	Have the obligation to comply with the legislation. While the legislation for open data use is not binding for them, it is assumed that they may benefit form it. The legislation regarding CSR reporting is binding and they have to report of their actions and future plans to meet the SDGs.
	The media	Act as a link between the enterprises and their environment. The media has the obligation to objectively report of the enterprises efforts to attain SDGs al well as its failures.
	Civic society	Has the fundamental right to live in a healthy environment and demand the enterprises to act in a sustainable manner, so that the planet will be able to support future generations.
Owners		Government
Environment		European Union legislation, United nations recommendations, Slovenian legislation, European social security legacy – civic pressure

Source: Own

In the third analysis the environment of the transformation is determined. In our study we will focus on enterprises that conduct their business in Slovenia and the EU. The EU is historically prone to protect social security systems including comprehensive, adequate protection against common life cycle and labour market risks. The protection of individuals over the life course enables social security systems to play a key role in ensuring economic and social stability (International Social Security Association, 2024). The directives of the EU mandate the states to adapt their legislation to meet the requirements on open data and corporate sustainability reporting. Not only the EU, also the civil society is more and more aware and conscious of the sustainable practices of organizations.

Figure 3 presents a rich picture of interconnections between the CATWOE analysis elements. The W is not included in the picture to maintain clarity of links between the elements.

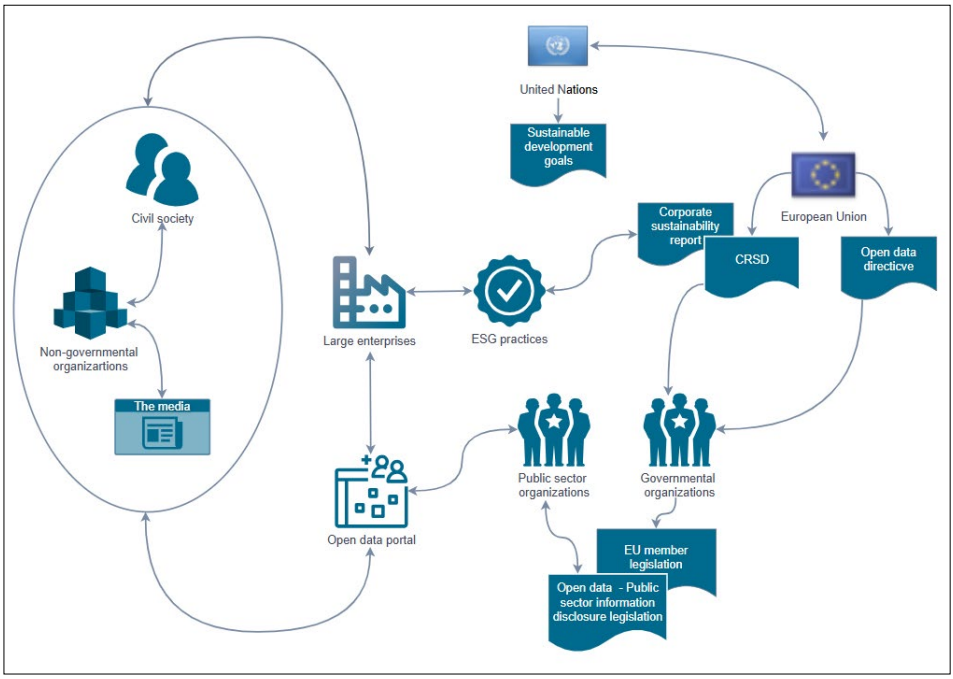

Figure 3: Using open data in enterprises to attain SDGs
Source: Own

4 Discussion

The Soft Systems Methodology (SSM) provides a structured approach to analysing the complex relationship between the maturity of an enterprise to use open data and its ability to attain SDGs. Using this methodology, we comprehensively defined the problem within its environment, identified the stakeholders involved, and assessed their role in it.

In our study we identified the problem that we don't know how the maturity level of an enterprise to use open data impacts its possibility to attain SDGs. The inputs of this system are the open data and the outputs: the enhancement of enterprises sustainability practices. From this a root definition was formulated as: large enterprises use open data to enhance their sustainability practices. After that the actors in the process were identified, that being: large enterprises as the clients of the system, the government as the owner, and other participants in the process: the UN, the EU, the public sector organizations, the non-governmental organizations, the media and the civic society. Each of the participants plays an important role in the system from providing quality material – the open data, through the process of its use to enable large enterprises to provide the wanted output – enhanced sustainable practices.

Enterprises in the EU function in a specific environment, where the rights of citizens that guarantee a high quality of life and social security, are at the top of the agenda of institutions such as the European Commission (von der Leyen, 2024). The enterprises must comply with restrictive legislation to ensure that the high standards are met. On the other hand, the institutions that restrict the un-sustainable practices are also the institutions that through its directives facilitate conditions for enterprises to move to a new, sustainable way of conducting business. One of the ways to achieve that is by requiring of the publication of high-quality open data.

By applying soft system methodology, we have identified the process and its key actors, the environment, and systemic interactions between them that impact enterprises use of open data to attain sustainable development goals. Future research should focus on measuring the actual maturity of enterprises to use open data and assess the impact of that to their ability to attain sustainable development goals.

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