Insight of Croatian Open Data Portals Functionalities According to TODO Interdisciplinary Assessment Framework v2.0

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Abstract. *It is reported that open data (OD) leads to transparency, citizen participation, cooperation, growth of the economy and public service. The open data ecosystem is described as a network of interactions between stakeholders involved in data processing, application development, privacy protection, security, and usage. The paper's main objective is to examine Croatia's open data ecosystem, where following sub-objectives are proposed: (i) to define a level of the OD ecosystem of Croatia that will be analyzed; (ii) to determine the most developed OD portal based on number of published datasets (iii); to analyze the current state of a selected OD portal.*

Keywords. Open data ecosystem, open government data, open data maturity model, assessment framework, case study

1 Introduction

The research on open data (OD) in Croatia is in its infancy. The project Twinning Open Data Operational [Grant Agreement Number 857592] (*Twinning Open Data Operational*, 2019) is an initiative of the academic community of University of Zagreb with the aim to increase the research potential and activities in the field of open data. One of the capacity building activities within the project is an online training, led by the foreign expert partners, which is aimed to create a common understanding of the different disciplinary approaches and perspectives and will be used as the starting point for identifying interdisciplinary and multi-domain research challenges dealing with one or multiple stages of the open data life cycle. The open data lifecycle involves different steps addressing the related and specific capabilities of open data, where different roles in the system participate in internal and external cycles, together making a broader lifecycle model that provides an ecosystem overview to achieve all the benefits of opening different types of data (Charalabidis et al., 2018).

The online training consisted of 3 modules. Within the second module, a first version of an open data assessment framework was developed, which was adapted and tailored to the needs of the Croatian ecosystem within the third module. The open data assessment framework consists of 4 categories of key performance indicators (KPIs) identified within modules. To make the adjustment of the framework and identified KPIs, the case study assessment was performed. The draft results of assessment were presented at the TODO Summer school, one activity of the project, where different aspects of the assessment framework were discussed and elaborated. The final assessment results are presented within this paper.

In general, the open data assessment framework seeks to assess the state of the open data initiative in relevant areas (Neves et al., 2020) where datasets should be published in a quality manner. When we talk about data quality, it can be measured by (Vetro et al., 2016): (i) data availability (e.g. the number of datasets and metadata available on a portal); (ii) demand for such available data (e.g. number of data views); (iii) data reuse (in different research areas). The open data assessment framework could help to understand the various guidelines focused on open data initiative (Sandoval Almazan, 2011).

The main objective of the paper is to determine maturity level of Croatian open data portals based on the developed assessment framework. In order to achieve the main objective of the research, it is further decomposed to following sub-objectives: (i) to define a level of the open data ecosystem of Croatia that will be analyzed (e.g. national level, local level, domain-specific, institutional); (ii) to determine the most developed OD portal based on the number of published datasets (iii); to analyze the current state of a selected OD portal by experts using a part of the previously

developed questionnaire that is focused on assessment of portal functionalities.

The paper is structured as follows. Firstly, the literature review is proposed. Secondly, the research methodology is described. Thirdly, the results of the conducted analysis are presented and discussed. At the end of the paper the results of the analysis are summarized.

2 Literature review

In the last several years, the development perspective of countries has been focused on the establishment of e-government. Ten years ago, initiatives of open data concepts and launching national open data portals have been aimed at contributing to greater democratic accountability and transparency, the efficiency of government activities, citizen participation and entrepreneurship (Jetzek, 2012). The European Open Data Portal was launched in 2011, and most European countries have followed the same path with the establishment of national open data portals, recognizing open data as a strategically important field (Salas et al., 2020), (Ruijer et al., 2020). In recent years, various open data portals and infrastructures have been developed for access, explore and exploit the potential of open data, so it is important to place emphasis on the open data ecosystem where collaboration and usage of open data are the goals (Zuiderwijk et al., 2014).

The open data ecosystem is characterized by interdependent socio-technical levels, dimensions, actors, elements and components, and addresses challenges such as licensing, technology, funding, organization, culture and legal framework, and infrastructure (Zuiderwijk et al., 2014). The key to a successful and sustainable open data ecosystem is the establishment and availability of a technical, legal, and organizational perspective, so it is important to create policies that define the legal context, standards that facilitate data interoperability, and a stimulating and useful network for data users (Welle Donker & Loenen, 2016). The OD ecosystem can be used as a tool for decision making and planning and can contribute to the development and creation of a technology-conscious, information-intensive social system, not only at the national but also at the local level (Zuiderwijk et al., 2014). Governments around the world are developing open data platforms with different functionalities to facilitate access to data collected by different stakeholders for the exchange, and reuse of open data.

In recent years, several international assessment frameworks for open data and open data portals have been developed (Welle Donker & Loenen, 2016), but the assessment of open data portals on the national, but also local level has been omitted. The practice of publishing open data at the local level is not widely accepted, especially in Croatia. In many countries, governments encourage local authorities or urban areas to apply open data policies and to publish data as open data. Open data portals of the local level often lack insight into residents' perspectives on the data required and do not know how to take relevant community data into account when developing their open data policies. Research conducted in the Netherlands has shown that all residents at the local level considered transparency important for the quality of public administration and that local transparency is currently lacking (Zuiderwijk et al., 2019). Also, the current literature highlights the possibilities for significant improvement of open data portals at the local level, especially in terms of data publication, portal functionality, customer support, and design and usability of data (Zuiderwijk et al., 2019).

In this paper, an assessment of the open data ecosystem at the local level will be performed. A similar study was conducted in Spain where an analysis was made into four main categories, they were data catalog, portal content, accessibility and visualization, and citizen participation. The results showed that there is a lot of scope for improvement because there were only 40% of the analyzed cities have an open data portal, and the average score of the analyzed sample does not reach 50%. Also, most portals are mostly data repositories, neglecting aspects such as public use of data, accountability, citizen engagement, and data quality (Royo-Montañés & Benítez-Gómez, 2019), and local authorities act seemingly transparently, without disclosing significant data (García-García & Curto-Rodríguez, 2018), (Young, 2020). A similar study was conducted in Canada where Gill and Corbett designed an open data portal assessment tool to look at aspects of portal design usability and accessibility features of open data, as portal design barriers can limit access and use of open data. Research has shown that improvements are needed to open data portals at the local level, especially in terms of portal design, data usability, ie diverse data supply, and portal maintenance (Gill & Corbett, 2017). In Australia, an assessment of the portal was made for about twenty cities, where the adoption of open data policy, the number of data sets published on the portal, the provision of open data in a machine-readable format, and the provision of entrepreneurial data services were analyzed. The key findings of this research point out that local governments should develop and increase the intensity of open data policies and generally publish more datasets, invest more in open data portals and be proactive in sharing public data through their own open government data portals (Chatfield & Reddick, 2017).

Initiatives to launch open data portals by local governments and the use of open data from local government portals can encourage citizens to participate in decision-making by exploiting collective opinions and knowledge about local issues (Lnenicka & Nikiforova, 2021) and can transform traditional channels of communication between citizens and local governments (Zuiderwijk et al., 2019). The growing scope and diversity of data produced in the urban

ecosystem are crucial for the development of solutions for smarter and more sustainable urban development. Establishing a quality open data ecosystem at the local level and its key role in generating and analyzing contextual and effective data (Mcbride et al., 2020) aimed at understanding, managing, and planning the city is crucial for the sustainable development of smart cities (Neves et al., 2020), (Kitchin & Moore-Cherry, 2020).

In order to gain insight into the developments achieved in the field of open data in Europe, the European Union has published a study on the maturity of open data (European Commission, 2020). The study assesses the level of maturity based on four dimensions: policy, portals, impact, and quality. According to the achieved results by dimensions, each country is classified into four different groups: trend-setter, fast-tracker, follower, and beginner. If we look at the results achieved by Croatia in 2020, the study classifies it as a country that quickly follows trends and the same results was achieved by Slovenia. Looking at other ex-YU countries, they lag behind in the implementation of open data policies. For example, if we compare the public sector and the number of published datasets on national portals, Croatia has 1169 published datasets, while Slovenia has 1146. The open data portal of Bosnia and Herzegovina has a total of 143 datasets, and in most cases, only datasets about local budgets were published. A small number of datasets were published on the portal of Serbia (196 with reference to the public sector), but also on the portal of Montenegro (a total of 122 datasets, of which 12 are referenced to public administration). Kosovo has 205 datasets related to the government and the public sector, and North Macedonia has published a total of 281 datasets.

3 Research methodology

The initial literature review and open data assessment framework (only the KPI category Portals) were the basis for defining research problems, research questions as well as research objectives related to open data ecosystem of Croatia. The empirical part of the research is predominantly qualitative. The initial step was to define a level of assessment since the research idea was to apply the developed assessment framework and use it to evaluate the portals. There are few levels that can be assessed by the framework and it is on the evaluator(s) to define the level of assessment. OD portals according to questionnaire can be evaluated on a national or local level (e.g. open government data portal of a country, open government data portal of a city), a domain-specific level (e.g. Croatian genetic resources database, National spatial data infrastructure) or institutional level (e.g. Croatian financial services supervisory agency). Portal selection criteria on the selected level was the number of published datasets. Therefore, the OD portal with the most published datasets is selected for further analysis. Questions within questionnaire are grouped into following 4 categories which represent KPIs: Governance, Availability, Portals, and Impact. Category Portal is directly focused on portal functionalities. Hence, only this category and its related questions are used for evaluation of the portals. Questions related to the evaluation of the category Portals strive to assess how open data is published on the open data portal. Also, from the perspective of organizations that use open data we can assess their capability to include open data in their business processes and innovate business models.

For this assessment, the initial proposal of the open data maturity model is defined, and its main dimensions are outlined in Fig 1. The theoretical basis for the development of the initial proposal of the open data maturity model was the Open data maturity model (Open Data Institute, 2015) and The European Data Strategy (European Commission, 2020) which warns of the importance of data sharing in the for-profit sector in order to develop artificial intelligence. Furthermore, the dimensions of proposal are created based on the knowledge gained from the project Share Public Sector Information (*The Share-PSI 2.0 Thematic Network*, 2014-2016). The novelty within the proposed open data model is not only on the public sector as was case in the Share-PSI 2.0, but also on the private sector. In addition to all the above, the proposed dimensions are the result of discussions with experts and work in expert groups.

Fig. 1 shows that strategy, organizational culture, ecosystem, products and services, technology, organization and business processes, as well as an information system, have been identified as the main proposed dimensions of organizations' maturity models for incorporating open data into their business models and processes. Within each dimension, the key areas have been identified that indicate the ability to include open data in the business of organizations. For example, if we look at the organization and business processes dimension, the maturity for the adoption of OD can be seen through knowledge management, agility, and experimentation. Organizations capable of including open data in their own processes that can also reach a certain level of maturity, are flexible and measure their own organizational performance.

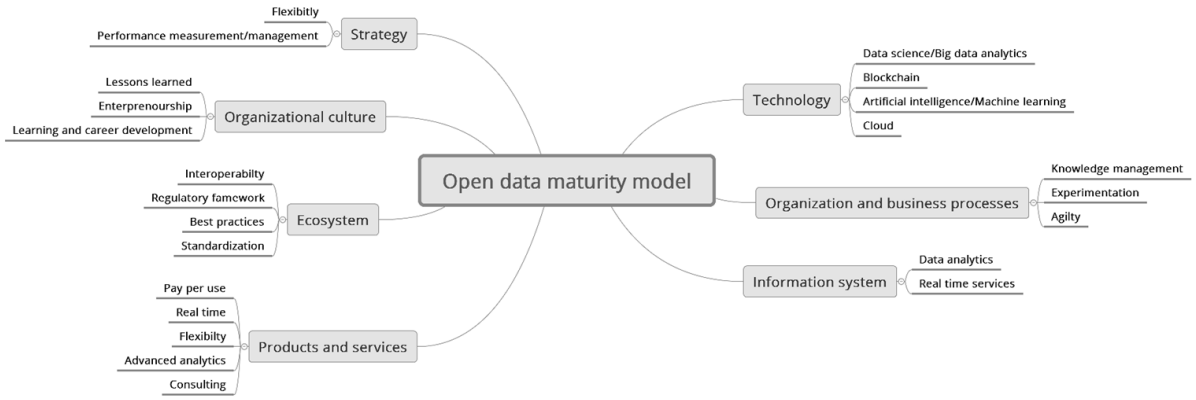

Figure 1. Proposal of an open data maturity model

4 Research results

The level of the Croatian OD ecosystem for the examination is selected due to the lack of studies that evaluate OD portal functionalities on a local level. To identify existing Croatian local OD portals, the national portal of Croatia is searched. Based on the data publisher list, a total of 33 local portals were identified.

Visual interpretation of portals with respect to the number of published datasets is shown in Fig. 2. The x-axis represents Croatian local open data portals, or rather, their names, while the y-axis represents the number of published datasets per portal. The graph in Fig. 2 portrays that most portals have published a small number of datasets. Out of a total of 33 portals, 31 of them have 15 or fewer datasets published, most of which have only one or two datasets published. One portal, The OD Portal of the City of Zagreb, has published 72 datasets, which is a significant number of published datasets in the observed set of portals. According to the collected data, the largest number of published datasets per portal have The OD Portal of the City of Rijeka (a total of 164 datasets).

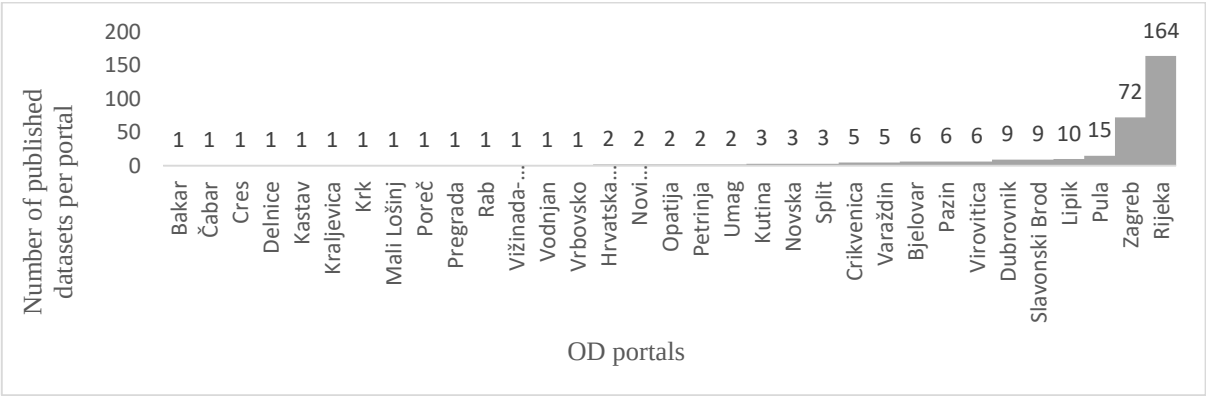

Figure 2. The frequency of the portal with respect to the number of published open datasets

For further analysis of a portal on a local level, The OD Portal of the City of Rijeka (City of Rijeka, 2021) is chosen since it has the largest number of available datasets. As mentioned before, the category Portals was selected for further analysis. It consists of 17 relevant assessment questions. The questions strive to determine how open data are published in The OD Portal of the City of Rijeka.

In order to execute the assessment, it is necessary to answer a total of 17 questions (from question number 25 to question number 41). The questions cover following topics: KPI1 - the level of deployment according to Tim Berners-Lee's 5-star deployment scheme, KPI2 - search functionality options of the open data portal, KPI3 - available types of services on the platform to make datasets available, KPI4 - available preview function, KPI5 - download options for datasets, KPI6 - metadata documented according to recognized standard(s), KPI7 - metadata language, KPI8 - metadata completeness, KPI9 - information about data provenance or data source(s), KPI10 - frequency of update of datasets, KPI11 - the actuality of the version of the published datasets if a dataset is a static, KPI12 - the actuality of the version of the published datasets if a dataset is a dynamic dataset, KPI13 - showcases of most popular datasets and their applications, KPI14 - availability of feedback on published datasets, KPI15 - option to upload datasets,

KPI16 - data about web statistics on the open data portal, KPI17 - user-friendliness of the OD portal. To determine the current state of functionalities development of The OD portal of the City of Rijeka all questions within category Portals of the developed framework were answered.

Results of the analysis are displayed in Table 1 (the first column presents the KPIs, while others show the maturity levels of KPIs). The maturity levels are described according to possible answers to the assessment framework questions for the current case study portal.

Table 1. Portal KPIs – The OD Portal of the City of Rijeka

KPI / Level	0	1	2	3
KPI1		a mix of star levels, mostly 2 to 3 stars		
KPI2				filter option for data format; search per domain or theme; most popular datasets; most recently added / updated datasets; licences; tags; per publisher, or rather, organization
KPI3		via download service; via an API		
KPI4				preview option is implemented properly
KPI5			I can select file format, e.g. open format and proprietary format	
KPI6				yes, metadata is documented adhering to a metadata standard (e.g. ISO 19115, DCAT)
KPI7		in national language only		
KPI8		there are missing metadata fields and important data are missing		
KPI9				yes, clearly listed in metadata
KPI10			yes, but only actual version according to update date is listed in metadata / documentation	
KPI11		only most actual version according to update date is available		
KPI12	with a significant delay, rendering the dataset only useful for historical research / trend analyses			
KPI13	no showcases			
KPI14	link to social media; additional number of data followers per dataset			
KPI15			yes, but not directly; only after a request has been submitted	
KPI16	total number of published datasets; total number of organizations; total number of theme			
KPI17	from 1 to 10 score is = 2			

According to the carried analysis, which results are shown on Table 1, it could be seen that The Open Data Portal of the City of Rijeka has mixed results in open data maturity assessment. Results are volatile from level 0 to level 3 which indicates that some functionalities are more developed than others. Altogether, since a lot of assessments are in middle (from level 1 to level 2) final results could not be better than estimation of overall level 1 with tendency to level 2, if some level 0 problems would be solved in the future.

5 Conclusion

As experience with open data has grown, practitioners and researchers have acknowledged that open data is not achieved in a vacuum. The open data ecosystem is used to express the dynamic interdependencies between actors responsible for generating data within and between different organizational contexts, establishing the conditions under which data can be shared and, ultimately, using government data to generate value for the public.

In this paper, the main objective was to determine the maturity level of one Croatian open data portal based on the developed assessment framework using several defined research sub-objectives. For this purpose, the proposal of open data maturity model is outlined with the aim of determining the readiness of including open data in the business of organizations. The open data maturity model consists of several dimensions, which overview was given earlier in this paper. In order to assess the maturity in launching the open data initiative, an open data assessment framework was used with an emphasis only on one part of the framework - Portals. The evaluation was focused on OD portal functionalities on the local level, and it was performed as a case study of The OD Portal of the City of Rijeka.

The analysis showed that the maturity of the portal, measured by defined KPIs within the assessment framework, is at level 1. In accordance with the authors assessment, there are certain tendencies towards level 2 (maturity measurement scale from 0-4). It can be concluded that The OD Portal of the City of Rijeka is taking initiatives related to managing and publishing open data and thus allows data reuse. Research results shows that there is a need to Portal strengthen activities related to the managing open data, with the aim to gain an appropriate level of maturity.

As a future research, the verification of the initially set dimensions of maturity will be made, as a basis for the elaboration and development of the maturity model of open data. Also, the results of this paper can be used in a longitudinal study of monitoring further development of portal functionalities of The OD Portal of the City of Rijeka.

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