

Assessing Information and System Quality of Open Government Data Portals in Croatia

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Open government data (OGD) paradigm gained momentum in the recent years resulting in numerous OGD initiatives. These initiatives assured reliable and faster development of open data ecosystem on different administration levels. Diversity of government organizations dealing with different kinds of data, however, resulted in a variety of OGD initiatives. As a direct result, OGD portals developed through these initiatives show different functionalities, characteristics, and quality of provided data and services. This paper therefore aims to provide a better insight into the similarities and differences of data portals by analyzing their characteristics from thematical, semantical, functional, and technological perspective. The methodology used relies on the framework previously developed and implemented in Greece in 2015, consisting of multiple indicators assessing different characteristics of portals, in each of four perspectives. Results of the assessment show Croatian portals have well developed functionalities but also have limitations preventing data reuse. These limitations are mostly related to data discovery and absence of metadata and licenses by the publishing institutions.

1 Introduction

The need to share structured data in standardized ways has led to the creation of data infrastructure (DI) whose main goal is to facilitate and coordinate data sharing and exchange [9]. Although DI is a response to the need of sharing large amounts of data, it is also a support to opening new ones due to well-established access network system, rules, and norms. An essential component of DI are portals which, according to Maguire and Longley [10], are defined as network access points. With the introduction of open data initiatives (e.g., EU Directive on open data and re-use of public sector information), portals have strengthened their role and have become places through which government organizations provide their data. There is no single definition of what a portal is [11], but it can be seen as a new type of information system (IS) [4]. Therefore, the success of a portal can be determined the same way; by evaluating the information quality (quality of provided data), system quality (quality of portal's functioning) and service quality (e.g., technical support) [12, 13]. Information quality describes scope and characteristics of provided data while system quality refers to technological solutions used in data provision and presentation. Service quality, on the other hand, concerns help users get when using the portal (e.g., training, helpdesk, etc.) and is focused on users of the portal rather than the system itself. Although portals serve the same goal, i.e., to provide data, they may differ in ways of supporting

it. Different organizations with different political, legal, but also technical backgrounds develop portals to fit specific needs which is why portals show diverse characteristics and functionalities.

In the last decade, number of OGD portals in Croatia has increased. Despite a considerable amount of resources¹ invested in their development and maintenance (e.g. National Open Data Portal) there is still no extensive analysis of their characteristics. Previous research, only partly cover this topic i.e., concern only certain aspects of portals/open data. For instance, [14] analyze only one Croatian national OGD portal and [15] reflects on portals' functionalities (e.g., dataset feedback) and some data specifications (e.g., machine readable formats). [16] on the other hand, also tackles the status of open data portals but focuses only on national ones and looks for advanced portal functions and interaction between data providers and users. None of these research treat portals as synergy of different components and therefore provide no information on their overall characteristics.

This study contributes to the limited existing empirical research on the status of OGD portals in Croatia through analysis of their mutual differences and similarities. The objectives are: (1) to compare and understand better their characteristics from thematic, semantic, functional, and technological perspectives; (2) to identify their strengths and weaknesses from a thematic, semantic, functional, and technological perspective and (3) to formulate recommendations for their improvement.

The aim of this paper is to fulfill this research gap – address the status of OGD portals in Croatia through analysis of their mutual differences and similarities. Identification of portals' strengths and weaknesses through a deeper understanding from a thematic, semantic, functional, and technological perspective will provide valuable information on the status and usefulness of Croatian portals. Valorization of characteristics and functionalities of each of them, followed by their mutual comparison, will provide new information which has the potential to solve existing problems (e.g., more linked open data, data availability) and ensure future portals' development.

2 BACKGROUND REVIEW

2.1 Status in Croatia

The government of the Republic of Croatia published in 2018 Open data initiative with goal to define main directions of OGD development in Croatia. Among others, this Initiative emphasizes the role of local and regional open data portals in support to better decision implementation [17]. The Initiative builds on Action plans for public sector development 2017-2020 where the role of portals as platforms for data provision has first been recognized². The presence of portals in strategic and action plans for Croatia proves its relevance in the national OGD context.

The analysis of characteristics of the portal is important in understanding its strengths and weaknesses. There is not much research on this topic in Croatia, and extensive research on the characteristics of portals is particularly lacking. Existing papers mainly deal with certain aspects of data/portals. For example, [14] focus on the geoportal of the State Geodetic Administration, looking at available data and services, use, and methods of data distribution. Opposed to that, [18] analyzes local geoportals concerning data on public utility infrastructures. Although the focus of the research is on the functionality of the portal, the standardization of services, and the type of software support, it includes only portals that are related to a particular group of data. In their work, [15] assess national OGD portals on international level and look for open data specifications (e.g., data themes, formats) and portal functionalities (e.g., feedback option) with no reflection on technology component of the system. The European Open Data Maturity Report 2021 analyses some functionalities of the portal, e.g., data discovery, but assesses only national open data portals³. Also, the assessment does not include characteristics such as levels of data openness or technological solutions. According to the Report, Croatia was degraded from a Fast tracker in 2020⁴ to a Follower in 2021. In the

¹ E.g., Central State Office for the Development of Digital Society financial reports for 2017 and 2018, in Croatian, <https://rdd.gov.hr/financijski-dokumenti/86>

² Action plan, in Croatian, <https://rdd.gov.hr/UserDocsImages/SDURDD-dokumenti/Akcijiski%20plan%20provedbe%20Strategije%20razvoja%20javne%20uprave%20za%20razdoblje%20od%202017.%20do%202020.%20godine.pdf>

³ Open Data Maturity Report 2021 for Croatia, https://data.europa.eu/sites/default/files/country-factsheet_croatia_2021.pdf (19.04.2022)

⁴ Open Data Maturity Report 2020 for Croatia, https://data.europa.eu/sites/default/files/country-factsheet_croatia_2020.pdf (19.04.2022)

context of OD portals, follower means additional efforts need to be made to support better data findability and reuse. The lackings of all previous research, in terms of limited characteristics assessment, therefore, leaves room for more extensive analysis as proposed in this paper.

2.2 Information quality and system quality

Information quality of an IS can include data themes and data semantics. According to [19] OGD data must meet 10 rules of openness, i.e., be complete, original, up-to-date, accessible, machine processable, non-discriminatory, in open format, with open license, permanent and preferably without issuance fees. However, it is not enough only to provide open data, but also these thematic data must be relevant to end users. According to the [4], and based on The European PSI Directive suggestion and OECD Working Party of Information Economy 2006 report, most relevant data themes are: Geographic information (1), Traffic and transport information (2), Meteorological and environmental information (3), Social information (4), Agricultural, farming, forestry and fisheries information (5), Economic and Business (6), Legal information (7), Tourist and leisure information (8) and Natural resources information (9). Apart from data themes, information quality can include data semantics. Semantic web technologies (e.g., URI, RDF) enable connection of different data sources [20] which makes it easier to find open (meta)data on the web. This paved the way for the concept of Linked Open (Government) Data – LOGD defined as OGD connected via the World Wide Web [2, 21]. Data semantics also consider OGD openness level, i.e., absence of limitation on data re-use, usually assessed using Tim Berners Lee's five-star scale model (TBM 5*). Regardless of data theme and level of openness, data somehow needs to be findable for the end users. That is where system quality becomes important.

System quality can be understood as a measure of how well a system meets stakeholders' requirements [22, 12]. Since portals are access points for OGD, their characteristics affect user's experience. Portals are understood as data catalogues, so they have functionalities related to organizing, structuring, and displaying (presenting)⁵ content. By using them, user can get an impression of the data available and its suitability for certain applications. Usually, there are also additional functionalities related to the new generation of the web that allow communication for users with interest over same data. This way, by leaving feedback and evaluating the data, producers get input on how to improve the data, and users consequently get better and more relevant data. Technological component can also be considered as part of system quality. It refers to the technology used in establishing and maintaining the work of the portal (e.g., web servers, CMS). Public agencies and organizations work with limited budgets and many of them do not have office in charge of maintaining the system. In such cases, ready-made software solutions are mostly used.

3 ASSESSMENT FRAMEWORK

The methodology in this paper builds upon the assessment framework developed and applied to assess characteristics of OGD portals in Greece (see [4]). Its generic assessment criteria, not country-specific, allowing replicability of the assessment is expected to provide relevant information on the status of OGD portals in Croatia.

⁵ Data portals, <https://www.datopian.com/> (19.04.2022)

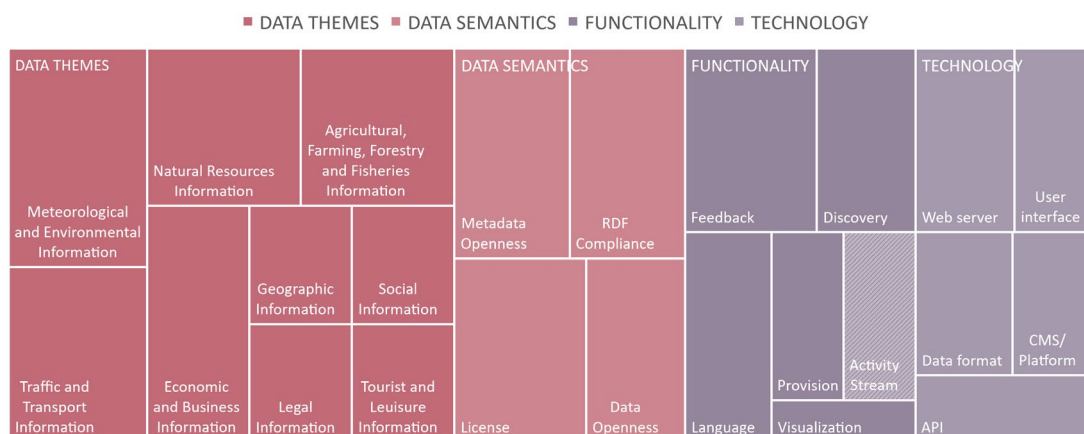


Figure 1: Assessment Framework structure (based on [4])

Proposed framework consists of four main parts: data themes, data semantics, functionality, and technology (Figure 1). Each aspect is assessed using several indicators: data themes (9), data semantics (4), functionalities (6) and supporting technology (5); more detailed description can be found in [4]. Characteristics of Croatian portals caused changes in the original framework with certain indicators' values (Figure 7) been refined and one additional indicator to describe system's functionality – activity stream – been added (Figure 1). This additional indicator tracks changes to provide information who and when updated the data. In absence of metadata, this information is highly valuable for the end user. To ensure unambiguous results, indicators' values do not overlap and are formulated in line with suggestions to use quantitative analysis methods [23, 24].

3.1 OGD portal identification

OGD portals for the assessment were discovered through web browser using key words 'OGD portal', 'open government portal' and 'open data portal'. 21 portals were identified but the assessment was narrowed to twenty (Table 1). Portal MORE (<http://baltazar.izor.hr/portal/pocetna>) was excluded from the assessment as its fragmentation in four different parts (different data available in different platforms) made it hard to perform the evaluation. Remaining portals cover different data themes and belong to different administrative levels (Table 1). Many of these portals provide open spatial data so within twenty analyzed, there were in total fifteen geoportals. Also, majority of portals analyzed are primary portals, i.e., do not provide data coming from different sources.

Table 1: Assessed OGD portals

National level	Regional level	Local level
National OD Portal (NODP)	Zagreb SDI Geoportal (ZIPP)	Zagreb OD Portal (ODPZG)
Cadaster Geoportal (CAD)	Sisak-Moslavina County Geoportal (SMŽ)	Varaždin OD Portal (ODPVŽ)
State Geodetic Administration Geoportal (SGA)	Primorje-Gorski Kotar Geoportal (PGŽ)	Rijeka OD Portal (ODPRI)
National SDI Geoportal (NSDI)		Virovitica OD Portal (ODPVT)
Physical Planning Information System (PPIS)		Jastrebarsko OD Portal (ODPJA)

National level	Regional level	Local level
Geoportal Hrvatske vode (GHV)		
Geoportal Hrvatske ceste (GHC)		
Hydrographic Institute Geoportal (HIG)		
Geoportal Hrvatske autoceste (GHA)		
ARKOD		
IOR Geoportal (IOR)		
Envi atlas okoliša (ENVI)		

* OD – Open Data; SDI – Spatial Data Infrastructure

3.2 Information quality

Thematic perspective analyses data themes available on portals and is covered with nine data themes (Figure 1). Themes are binary indicators where portals can have maximum score of nine, depending on the data topics covered.

Semantical perspective analyses the use of semantic web technologies in OGD portals. Data semantics within this paper are assessed with (meta)data openness, license existence and RDF compliance (Figure 1). Data and metadata openness are analyzed using widely used Tim Berners Lee’s (TBL) five-star model. Five-star scale is cumulative model which means that existence of higher level understands fulfilled scale’s lower level: 1* lowest level - 5* highest level.

- Data semantics are evaluated using TBL five-star linked data model (Figure 2):



Figure 2: Data levels of openness (based on TBL 5* model)

- Metadata semantics are evaluated using Maturity Scheme of Metadata Management (refined five-star data scale, according to [4]). Maturity Scheme in this paper is upgraded with additional sublevels in all levels except for level two (Figure 3).

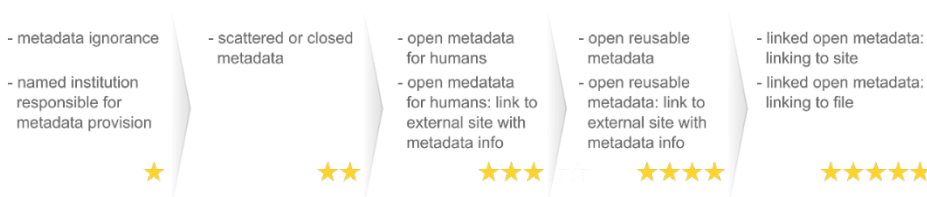


Figure 3: Metadata levels of openness (based on TBL 5* model)

- License information is assessed with two main values: not existing and existing. Existing can be further developed as public domain license, Creative Commons BY and Not open license. License indicator is related to portal, not dataset, so it is possible to have more than one value per portal.
- RDF compliance concerns existence of technologies supporting RDF that allow web data interchange. This indicator is binary, i.e., either portal provides data compliant with RDF or not.

3.3 System quality

Functionality analysis of a portal reflects on possibilities users have while interacting with the portal. It is assessed using six indicators: activity stream, language, provision, visualization, feedback, and discovery. Values for indicators are taken from the assessment framework used in Greece (see [4]) and broadened with additional ones found while assessing functionalities of Croatian portals (Figure 4). Each indicator can be evaluated with more than one value.

Activity stream refers to the lineage of the data where it is possible to track its changes. This indicator is binary with two possible values: existing or not existing. Language indicator, related to user interface, can be evaluated with three values: only Croatian, Croatian and English and more than two languages. Provision indicator, referring to supported ways of data provision, has nine additional values added to the framework (Figure 4). Data visualization assesses ways in which portal can visualize data. It is measured with twelve values eight of which are identified while assessing Croatian portals.

Feedback refers to communication channels between data providers and users. Possible values are existing or not existing where existing options can differ in number of interactions tools (email, rating, etc.): classes 1-6 feedback options.

ACTIVITY STREAM - existing - not existing	PROVISION - download data as file - online preview of data on a map - preview data in a chart* - preview data in a table* - download data as JSON* - embedding the data in* another web place* - link to another site* - export preview as .pdf* - data as web service* - share data via social network*	VISUALIZATION - not possible - in charts - on maps - in a table - filtering within the dataset* - search within preview* - changing type of graph* - changing coordinate reference system* - cluster marker option* - base layer option* - layer transparency* - import external data in visualization*	DISCOVERY - simple document list - free text search - browsing through categories - browsing through filters - browsing through interactive map - SPARQL search - browsing by publisher*
LANGUAGE - Croatian - Croatian and English - more than 2 languages			FEEDBACK - not existing - 1 feedback option* - ... - 6 feedback options*

* additional values identified in Croatian portals

Figure 4: System's functionality indicators (based on [4])

Technology analysis refers to technological solutions used for establishment and maintenance of portals. It is assessed using five indicators whose values cannot be predefined due to number of possible solutions:

1. Web server refers to place where portal is hosted.
2. Content Management System (CMS)/Platform describes which CMS is used to manage portal.
3. User interface concerns technologies used for presentation of content to end user.
4. Data format expresses formats in which data is provided to the user.
5. API concerns technologies used in application programming interfaces and web service interfaces.

4 RESULTS AND ANALYSIS

For the first three assessment categories (thematical, semantical, and functional), data was acquired directly from portals. For example, categorization of data within the portal made it available to discover data and determine portals' thematical coverage. Other data, such as ways of visualization or provision were acquired when entered specific datasets. The last category, technology, was assessed using web application Netcraft (www.netcraft.com). Apart from allowing to find all data on technological support of the portal on one place, this web application is free for use.

4.1 Data themes and data semantics

Figure 5 shows results of thematic coverage and data semantics assessment. For each of the portals, figure shows frequencies, i.e., number of values found for each indicator.

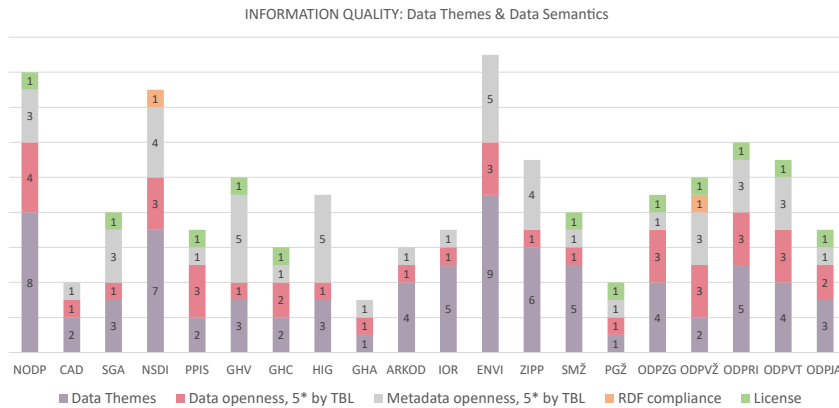


Figure 5: Information quality: data themes and data semantics

Seen from the figure, not all portals provide all data themes. Half of portals assessed (10) provide less than four data themes. GHA and PGŽ have the least theme coverage, only one. On the other hand, ENVI covering all nine data themes is followed by NODP and NSDI with eight and seven themes covered. Most present themes on assessed portals are Geographic Information (16), followed by Traffic and Transport Information (11), Meteorological and Environmental Information (10) and Natural Resources Information (10). High presence of geospatial data on portals can be linked to two different causes. Geospatial data is recognized as highly relevant data in both European (high-value datasets; Directive 2019/1024/EC) and Croatian open data policies. Also, in recent years, there have been several national programs for business processes transformation (e.g., cadaster register) resulting in creation of digital databases with spatial data now ready to be provided as open. Spatial data is followed by Traffic and Transport thematic group present at 11 out of 20 assessed portals. Directive (EU) 2019/1024/EC understands road signs as part of mobility, high-value dataset, while National Open Data Policy (2018) states traffic data has high reuse potential. Even though the Directive (EU) still hasn't been implemented in national law⁶, government stimulates opening this kind of data as part of national OGD development. On the contrary, legal information, dealing with laws, legislation, etc., is available within only five portals which is not surprising as the remaining fifteen are rather geoportals than portals; laws are seen as nonspatial data.

Seen from Figure 5, portals show different levels of data openness. Half of the portals assessed (50%) have 1* data openness level. Only NODP has 4* data openness, but not for all available data. Since the Portal counts many data publishers, diversity of openness levels is not unexpected. On the other hand, metadata openness does not follow data openness. Seen in the Figure 5, six portals have higher metadata openness when compared to data openness. Two of these, ZIPPI and NSDI, are data catalogues whose main purpose is to provide additional information about the main data. GHV, HIG and ENVI have highest metadata openness: linked open metadata, but they do not provide information the same way (Figure 6): ENVI links metadata to external file while for the remaining two portals link leads to a website. Figure 5 also reveals that five portals have data suppliers focusing more on data than metadata openness. Four of these (except for NODP) have 1* metadata openness: no metadata is given or just naming the responsible party (CAD). The remaining portals (9) have the same openness for data and metadata.

⁶ Law, in Croatian, <https://www.zakon.hr/z/126/Zakon-o-pravu-na-pristup-informacijama> (19.4.2022)

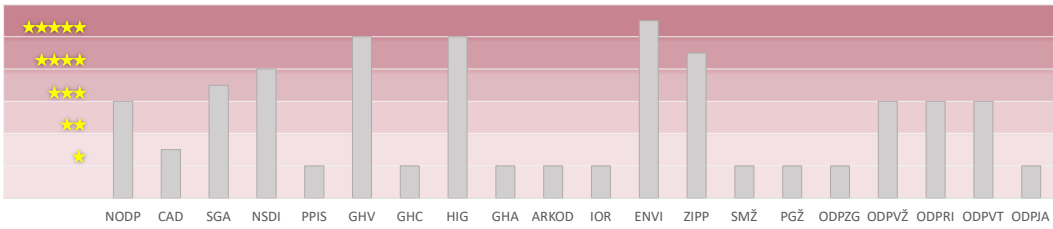


Figure 6: Metadata openness levels

Only two (10%) portals are RDF compliant: ODPVŽ and NSDI. This result shows that majority (90%) of Croatian portals do not support technologies enabling more effective data discovery. Figure 5 also indicates that not all portals have stated data license. But, among twelve that do so, different types of licenses were found (Figure 7). Only one portal, ODPVŽ, provides its data under “public domain” license while six portals do not provide data in “open license”.

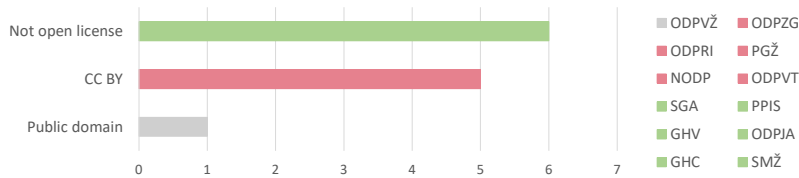


Figure 7: Data Licenses

4.2 Functionalities and technology

Figure 8 shows results of portals’ functionalities assessment. For each of the portals, figure shows frequencies, i.e., number of values found for each indicator. As seen from the figure, portals show high number of functionalities where all portals support at least five proposed functionalities. Discovery indicator contains seven possible values. Seen on the figure 8, eight portals have more than three ways to look for data. PPIS is the only portal supporting browsing through interactive map while only NODP supports SPARQL search. PGŽ and IOR on the other side, have only one discovery tool: simple document list and browsing through categories. Different data provision ways are also very much present at portals assessed. Seven portals support data provision in more than five ways. PGŽ and IOR again support only one way of data provision: view only on a map. Both portals are view only portals so data in provided this way is not unexpected. As seen in the Figure 8, portals support different data visualizations. While all of them support preview of data on a map, only five portals allow users to import external data and combine it with preview data: SGA, NSDI, PPIS, GHC and ENVI. SMŽ and IOR support modest visualizations with only three data preview options. This was to be expected as portals are classified as view only. In addition to functionality analysis, portals show very limited feedback mechanisms. 60% of assessed portals do not support feedback option or it is not easily discovered. Remaining portals support at least one feedback option, usually contact by email. Only NODP supports six different ways for users to interact with data providers (email, review, comment, etc.). Finally, activity stream functionality is available on only five portals. These portals visually all look alike which means they use the same, pre-developed technology.

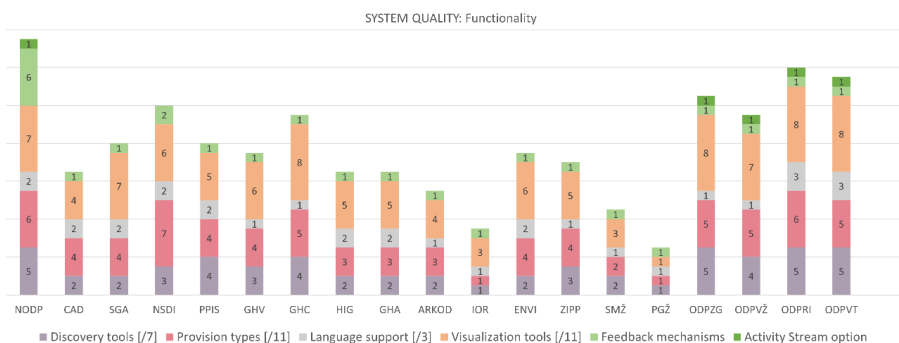


Figure 8: System quality: Functionality

Figure 9 shows results of technology assessment. Seen in the Figure 9a most used web server technology is NGIX and/or Apache with fifteen portals using it. ODPVŽ is the only portal using CentOS web server solution, and it is using it along with Apache. IIS, Microsoft web server product, is used to support SMŽ. All software are open source^{7, 8, 9, 10} (with the exception that IIS is bundled only on Windows operating system) whose availability for free may have persuaded organizations to use it as technological solution for their portal. Web server information for NODP, NSDI, ODPJA and GHA could not be found. Figure 9b indicates that CMS information could not be reached for 65% assessed portals. Also, the overall sum of results shows that some portals use more than one control management system: NODP and ODPVŽ use CKAN along with Drupal, ODPZG is using CKAN in combination with Microsoft Azzure and ODPVT is supported by CKAN, Microsoft Azzure and OpenDataStore. CKAN and Drupal are open source^{11, 12} software while Microsoft Azzure is a paid product¹³. Data provision via API is not supported by 75% of assessed portals (Figure 9c). ODPZG, ODPRI, ODPVT use CKAN API which is compatible with CKAN CMS used to support these web portals. NODP uses RESTful API and ODPVŽ, apart from bulk download, provides its data via DKAN API. Figure 9d reveals that the number of programming and styling languages used to present data on a portal exceeds number of portals. This indicates that in many cases combination of these two is needed in order to get the desired user interface style. In most cases (14 portals) JavaScript is combined with at least HTML and CSS. Only ODPVŽ uses RDF framework for representation of interconnected data while ARKOD is the only one using Client pull network communication style. Apart from that, SMŽ is the only one using Google Hosted Libraries, content distribution network.

When it comes to formats, Figure 9e shows that majority of portals (17 out of 20) provide data in up to two format types. These results are related to some portals (e.g., SMŽ) being data browsers with no download option, but only provide export in .pdf. It is also to be pointed that these formats are not related to a single data file, but to the portal in general.

⁷ NGIX, <https://www.nginx.com/resources/wiki/> (15.04.2022)

⁸ Apache, https://httpd.apache.org/ABOUT_APACHE.html (15.04.2022)

⁹ CentOS, <https://www.centos.org/about/> (15.04.2022)

¹⁰ Microsoft IIS, <https://www.microsoft.com/en-us/download/details.aspx?id=48264> (5.04.2022)

¹¹ CKAN, <https://ckan.org/> (15.04.2022)

¹² DRUPAL, <https://www.drupal.org/> (15.04.2022)

¹³ Microsoft Azzure, <https://azure.microsoft.com/en-us/free/> (15.04.2022)

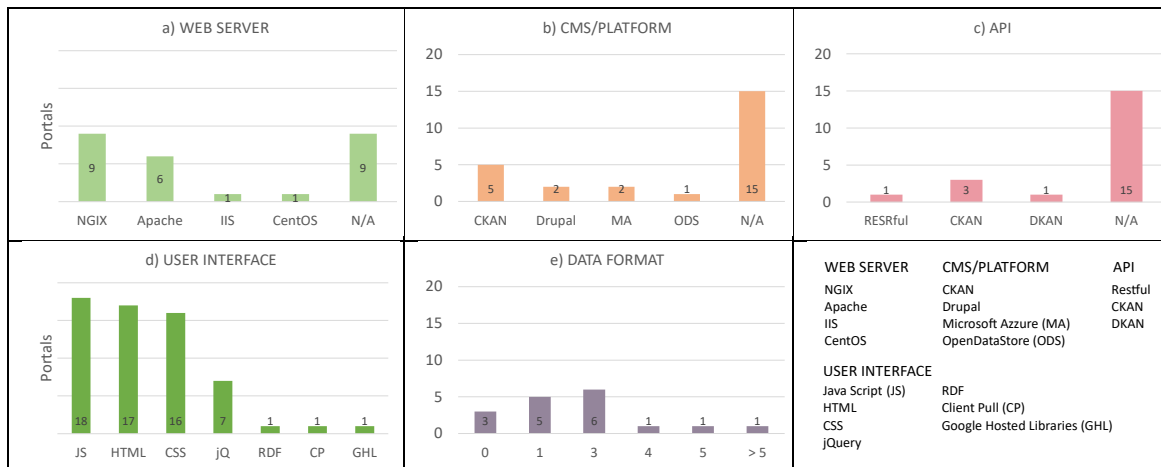


Figure 9: System quality: technology

Formats, in terms of most present ones show .pdf is the most common data format with 13 portals offering data in this structure. It is followed by .xlsx - not open format (7 portals) and .csv and .xls with five portals each. Additionally, data tends to be provided also as a service which is not a format, but it is the way for people to access the data.

5 DISCUSSION

Based on the results, it can be stated that Croatian portals show diversity of characteristics. It was identified that many portals provide data for view only purposes. This means that additional efforts need to be made to remove obstacles preventing their full accessibility. High-value data (geospatial, mobility and environment) have shown great presence as these thematic groups are the most frequent ones in the portals analyzed. Results also suggest that licenses, very important part of an open data ecosystem, are not recognized as such. Many of data are provided with no clear information for what purposes it could be reused. In addition, analysis results show that in 50% cases metadata information is missing. Having in mind what open data is and what are its requirements, it can be stated that absence of metadata has high impact on the reuse making Croatian portals not so efficient in data identification. When it comes to visualization tools, portals show high performances. Combined with data discovery and technological results it is evident that efforts are made to make portals user-friendly. What is missing are the tools for stakeholders' interaction, as very few feedback options are available. Finally, results show another important obstacle in data reuse, the API option, as 75% of assessed portals don't provide this possibility.

The research conducted in this paper contributes to the understanding of existing status of open data portals in Croatia as it uses more extensive approach. For example, [14] in their work focus on one geoportal (SGA) and its data provided (data categories), functionalities, data semantics and technological solutions. Even though they analyze data categories – data products, data is spatial data only meaning that only geographic data theme is covered. For data semantics, they describe data, metadata and licensing but do not state the level of (meta)data openness. Instead, they just mention that certain data is provided in specific form (e.g., WMS). Also, technological solutions are more oriented towards technology used in user interfaces, databases, and visualization rather than web server and/or API component. Portal's functionalities reflect on some aspects of data discovery (e.g., browsing through category) but are lacking feedback options. In his work, [18] analyses local geoportals related to cadastral (utility cadaster) data while assessing data categories, portal's functionalities, and technological solutions. Data assessment is related to more than one data theme but is still focused on data with spatial component only. Portal's functionalities assessment is limited to some functionalities e.g., data discovery, view and download and do not reflect on feedback options or portal's supported language interfaces. Technological solutions only provide information if portals use commercial or open-source

software. In [15] authors analyzed open data portals aiming to address data themes and portal's functionalities (including data formats). This assessment shows great number of assessment criteria related to data (data themes, formats, ...) and feedback options (ratings, requests for data, ...) but does not encompass information on data and metadata openness or technologies used to make portal operational. In the context of this paper, [16] assesses only national open data portals and is oriented mainly towards portal's functionalities (e.g., possibility to download, search by format, feedback mechanisms, preview option, etc.) with additional criteria about data categories (e.g., name top five data categories), metadata (e.g., metadata available in clear plain language) and provision via APIs (e.g., analytics on API usage).

The results of this assessment roughly align with results of the European ODM Report for Croatia for year 2021 [16]. Croatian portals show poor data availability via APIs, provide very limited interaction between data providers and users but do provide good visualization tools. These tools support well both, spatial and nonspatial data, as data can be previewed in tables/charts and on a map. Also, analysis shows portals provide very limited number of data, especially on local level. National and regional portals, even if have more datasets, often lack metadata needed to interpret and use it the right way.

Some of these findings show that problems present in portals route back in data initiatives, legislation, and action plans. Croatia still hasn't implemented Open Data Directive (EU 2019/1024/EC) which means that government organizations are still encouraged rather than obliged to open their data. Also, providing data in higher levels of openness is not obligatory which means that organizations open their data in the currently existing form. Higher levels would require more finances that public organizations, mainly being funded by the government, need to ensure in their budget.

Evident from the scope of the framework, methodology in this paper builds on the existing research approaches by including a list of additional indicators to reflect on portal's characteristics. This provides more comprehensive portal overview rather than focusing only on certain aspects. In addition, the framework is not country-specific which assures replication of the model to other countries.

6 CONCLUSION

It can be stated that Croatian OGD portals show diversity of characteristics in all four categories. These differences vary and are mainly related to different institutions in charge of portals. Also, portals generally show high functionality options and advanced technology solutions but are lagging in quantity and semantics of data provided. Thematically speaking, portals show that government institutions dealing with spatial data are more likely to open their data as these data themes are the most present ones. Results of the assessment suggest that more efforts need to be made to provide data in more open way. Some of the obstacles could be solved simply by providing and/or linking metadata, which would contribute to better visibility of datasets and thus cause its higher usage. Also, providing licensed data in more open formats, such as .csv instead of .xls or .odt instead of .pdf and .doc, could result in wider usage of the data. Another easy-to-apply solution concerns feedback mechanisms. Existing technological functionalities are already well developed and can support implementation of feedback options whose existence is highly important for data quality. These simple yet effective recommendations in addition to more specific national open data strategy and actions plans could solve some of the existing problems and could highly improve portals' usage and increase their impact among stakeholders.

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