Open data availability in Croatian local government: Improving the quality of life

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Abstract
Turbulent times marked by fast societal changes and various people or nature induced crises point to the need to improve citizens' quality of life (QoL). With the accelerated technological development, the information technology and data are becoming increasingly used as a tool for the improvement of QoL. The development of Open Data (OD) portals, which display vast amount of public sector data, is one of the means to help creating a new value for the society and economy. The goal of this paper is to assess the availability of local government OD through OD portals and its potential to improve the quality of life of the local community. This research focuses on the analysis of the availability and content of the OD on the OD portals will be carried out on the example local governments in Croatia. The paper explores (1) To what extent is local government OD available to users (citizens, private sector, civil sector) via OD portals? (2) Is there a potential for the available OD to improve the quality of life? The results show that only a minority of local governments (less than two percent) publish their datasets on the OD portals, that the number and technical features of datasets is modest, and that they lack wider applicability. Compared to Eurostat QoL typology, citizens' everyday life is hardly to be improved, although available OD might positively affect political and economic dimension of QoL The findings open up new research questions for academics, but also have implications to practitioners indicating the shortcomings in the approach to OD. The paper innovatively links the availability of data with QoL typology, given that the improvement of citizens lives is at the core of concept of OD.

Keywords: open data, quality of life, open data portals, local government data, reuse of public sector information, government data availability.

1. Introduction
In February 2020, the world was struck with the global emergency never experienced before. The Covid-19 virus has caused a global pandemic and led to the crisis in every country and territory, which have been counting infected and dead on a daily basis. Although the pandemic may have had serious and disastrous effects, one underlying trend has been extremely positive – the health services, departments and agencies all over the world have been opening their data to allow comparison, visualization, trend tracking, app developing and decision-making at local, regional, state, or international level [11], [38].

The availability of government data, which is freely available in open and machine-readable format and can be further reused by citizens, business or civil society (open data)

has been a cornerstone of the concept of digital society and open government development in the last two decades. The government data is collected, produced and stored in the government and public bodies purposes, mostly legally prescribed or agreed. However, the innovation and creativity of the society, from individual citizens, non-governmental organizations, SMEs or big data companies may find ways to use the data that is available in machine readable and open formats, described and updated for other purposes that could lead to certain benefits for all. This is why the OD initiatives have been introduced on the global and regional level, as well as in certain sectors or by leading countries, focusing on the opening up of public sector information for the improvement of digital services and other outcomes based on data. In other words, the sole concept of OD encompasses the notion of better life and benefit for the society. To say it simple, the improvement of the quality of life (QoL).

In Croatia, the OD initiative has in the last decade created a favourable policy framework and main instruments of OD development, such as governance structure, data portals and formal obligations to publish data for all public bodies. The trend of opening up the data for the reuse is especially visible at the central government level (departments, agencies, etc.) and mostly to the sectoral data (geospatial, statistical, meteorological, etc.). However, Croatian local government OD developments are lagging behind the national level in the context of fragmented territorial structure and small units with low capacities despite the broad local government self-government (and delegated) scope of affairs which may have a tremendous potential to exploit OD for the development of OD based services and products.

The purpose of this research is to assess the availability of the OD at local government level in Croatia in terms of quantity and quality, and to assess whether the OD, which is currently available, could have a potential impact on the improvement of the QoL for the local population.

After the introduction (chapter 1) the paper continues with an overview of the concept of OD (chapter 2), followed by the presentation of the OD development and status in Croatia (chapter 3). The chapter 4 presents the research design and the sample of cities in this research. The research findings on the availability of data are presented in chapter 5, followed by the analysis of the compatibility of available OD datasets and quality of life indicators in chapter 6. The paper ends with a conclusion and some indications for future research in chapter 7.

2. The world of government open data

The IT development in the last three decades has opened up various opportunities for addressing societal, group or individual challenges by using data (information). In fact, in today's world data is everywhere, it has been considered as the main source of power, the new gold, the new oil. The public administration around the world, at any governance level (local, regional, national, supranational) or of any governance type (e.g. state agencies, public institutions providing health or educational services, public companies) tend to collect, produce, maintain and distribute vast amounts of data for the specific purposes which are usually prescribed by law. They keep registers, collect information on pollution,

prepare statistical data on university students, produce information about traffic, waste management or economic performance, as well as information on public spending and decision-making etc. The OD movement builds on the idea that such public sector information should be freely available to anyone to be used for any unspecified purposes, both commercial and non-commercial, with the possible (and desirable) outcome of creating additional economic or societal value. It could be a traffic application leading to less accidents or saved time travelling, scientific research which helps eradicating poverty in one city quarter, a platform for business that helps boosting business opportunities, or simple search of database of judicial decisions and legislation related to some issue which is of one's concern.

To be considered as OD, the public sector information has to adhere to standards, established already in 2007 by Carl Malamud and Sebastopol principles [https://opengovdata.io/2014/8-principles/] – it has to be complete, primary (published by the creator), timely, accessible to widest range of users for widest range of purposes, and non-discriminatory; machine-processable (readable), non-proprietary (in open formats) and licence free (without restrictions above privacy and security issues). Open data is primarily open government data, but it can also include open business data and citizen-generated data [3]. Still, the focus is on public data in a way that the producer and publisher belong to the public sector. It is precisely the public sector (government, administration) that has witnessed tremendous managerial, political and technological transformations as explained by Janssen et al. [17].

A great number of countries and organisations, both (inter)governmental and civil society organisations, as the OECD [30], WB, Open Data Institute, W3C, etc., have been advocating OD as a corner stone of open and transparent government [36] and one of the pillars of digital government. The Open Government Partnership (OGP), a global initiative for open government based on the use of digital technology, sees it as an enabler of 'informed debate, better decision-making and the development of innovative new services' [25]. In the past two decades a number of policies of OD have been adopted and implemented in the United States, and the European Union, as well as in many other countries [43]. For example, more than 70 countries and regional governments have so far supported the Open Data Charter, first signed by G8 in 2013 [32]. Similarly, more than 70 countries and many local governments participating in the OGP have committed themselves to promote OD publication and reuse [24], [25]. The EU's attempt to mainstream the OD across the Union as a tool to enhance the EU digital economy and society, has resulted in the adoption of the very important piece of legislation in 2003 – the Directive on the Re-use of Public Sector Information [5], later improved by the amendments in 2013 [7] and replaced by the Directive on Open data and the Re-use of Public Sector Information in 2019 [9].

The most prominent objectives of OD publication and reuse include improved government accountability and transparency, citizens participation, as well as innovation and improved efficiency with regard to the solving societal problems [3]. The OD lead to many benefits - for political and democratic process (more transparency, equal access, empowerment),

organisation (visibility, improvement of satisfaction), innovation (new services, knowledge stimulation), economy (competitiveness and innovation), operational and technical aspect (better quality, improving processes, new data) [3]. Moving beyond the traditional access to information upon a request of the user, towards proactive publication of information on the internet, the new concept is primarily focused on the publication of machine-readable data in line with OD standards on the websites and data repositories, especially OD portals. Open data portals are single point portals where metadata are catalogued and datasets of public bodies accessible in one place. Regardless on which level of government the OD portals are established, such as e.g. European data portal [https://www.europeandataportal.eu/] or the EU data portal [https://data.europa.eu/] or as national or local government portals, etc., they are seen as instruments of enhancing the availability and incentivising the publication of OD, but their quality remains disputed [31], and dependable on may factors, such as, for example the size of local government for local portals [29].

The availability, usage and impact of OD are largely dependent on the awareness, policies, actions and networks of the organisation that publishes the data, as well as a plethora of technical aspects of OD. Thus, the OD and the context it emerges is very complex and interconnected. For example, actors included in the OD landscape are many, influencing the share of responsibilities and ownership over process and data [3] - they include politicians, data collectors, data processor, data publishers, infrastructure providers, companies, software vendors, infomediaries, citizens, regulatory institutions. These actors are only an element of the more complex OD infrastructure, the domain in which OD are created and used and which consists of a combination of social (non-technical, such as regulation, policies, governance, funding) and technical elements (data tools, technologies, standards, etc.) which are interrelated and interact, ensuring the supply and use of OD [45], [33]. An even broader concept – OD ecosystem - tries to provide a more dynamic and holistic approach to OD provision and re-use, in terms of the basic physical and organisational structure and facilities needed for the functioning of an OD ecosystem [33], [44].

3. An overview of the open data status in Croatia

The open data movement and regulation is relatively recent in Croatia. The idea that the users from civil society or private sector would use the government data, which is freely available for other purposes different from those it was originally created for, emerged in the late 2000s in relation to the process of the accession to the European Union. One of the first comprehensive efforts to open specific government data for the benefit of all was made by the transposition of the EU INSPIRE Directive [6] which established the infrastructure for spatial information, first by the Law on State Survey and Property Register in 2007, and later by the Law on National Infrastructure of Spatial Information in 2013. Similar applies to statistical data from 2012 onwards (Law on Official Statistics).

The general Open Data paradigm was introduced by the Open Government Partnership (OGP) Initiative in 2012 when the first Action Plan 2012-2014 of the Croatian Council for OGP was adopted [24]. The document envisaged the opening up of certain datasets,

especially the fiscal data, but also committed the Government to the adoption of the new legislation. The same year the process of the transposition of the EU PSI Directive [5] had started and the new Law on the Right of Access to Information [41] was adopted in 2013. This Law envisaged, among other requirements of transparency and citizens' participation, the possibility of the reuse of government information (OD) by making data, whenever possible, freely available to the users and ensuring the review mechanism. The Law was amended in 2015 [42] to transpose the Amended PSI Directive [7] and to incentivise a greater availability of data. It has introduced OD portals, restricted the possibilities of charging and introduction of exclusive rights, required the application of recommended standard licenses (Creative Commons), imposed a greater transparency of the process and extended the scope to cultural data (museums, archives, libraries). The by laws regulating the licenses which introduced Croatian national OD license adopting the CC-BY license, as well as those regulating exclusive rights database and charging were adopted in the period 2016-2018. The obligation to OD applies to all public authorities, from central state bodies (government, departments and agencies, legislature, courts), local governments, public institutions (schools, health facilities, nature parks, etc.) to public companies and other public sector organizations (professional chambers). In addition, strategic documents have envisaged various activities aimed at the publication of OD (e.g. OGP action plans, Anti-corruption action plans, etc.).

In March 2015 the national Open Data Portal [https://data.gov.hr/] was launched (and connected to the European data portal [https://www.europeandataportal.eu], followed by some local government data portals (Zagreb 2015, Rijeka 2016, Virovitica 2017, Varaždin 2020). Also, the period from 2014 to 2020 has witnessed many OD promotion events, from hackathons, trainings, roundtables, conferences, and guidelines, followed by more extensive projects from 2019, such as Horizon2020 Twinning Open Data Operational (TODO) 2019-2022 [14] , Open Data for European Open Innovation (ODEON) 2019-2021 [23] and ESF project that aims at the improvement of the OD portal led by the Government Central Office for Digital Society Development [10]. The main governmental actors in implementing promotional, educational and project activities are Information Commissioner, an independent authority which oversees the implementation of the Law on the Right of Access to Information, and the relevant Government bodies – Ministry of Public Administration and the State Office for the Digital Society Development which maintain the OD portal and coordinate the OD activities within the government. The subsequent OGP Action plans (2016-2018, 2018-2020) have also ensured the opening up of certain specific datasets and registers in machine readable and open formats, as well as other strategic documents (e.g. Anti-Corruption Strategy 2015-2020) and most importantly, the Open Data Policy which was adopted in 2018. Most often, these activities were designed and implemented with the cooperation of civil society organizations (NGOs, academia, media), business representatives, and local governments' associations.

The assessments of the status of OD in Croatia are not extremely favourable. The Information Commissioner has frequently warned the public authorities in the annual reports to the Parliament on the failure to open all datasets and ensure that the users are familiarised with the possibility of the reuse of public sector information. According to the

EU Open data maturity index [13] which assesses the policy, the data impact, the quality of data and the portal features, Croatia has improved from 14th position in 2015 to 12th position in 2019 but still remaining a follower (in 2017 Croatia was fast tracker) [13]. On one hand, Croatian OD status scores above the EU average in some dimensions, at least on paper – for example, in relation to OD policy frameworks and governance, or some technical features of the portal. On the other hand, the critical elements of the assessments however have persisted throughout the years, and they concern mostly the quality of data, especially in terms of completeness and currency, the portal usage and promotion, OD awareness and the economic impact of data.

4. Research on local government open data

4.1. Research design

The objective of this research to assess the availability of local government OD through OD portals and its potential to improve the quality of life of the local community.

This research aims to answer the following research questions (RQ):
(1) To what extent is local government OD available to users (citizens, private sector, civil sector) through OD portals? (RQ1)
(2) Is there a potential for the available OD to improve the quality of life of the local community? (RQ2)

In order to obtain answers, the research focuses first on assessing the local government OD availability on OD portals (local and national), and, secondly, on assessing the importance of the available OD for the QoL measured by the commonly accepted typology. The research methods applied in this research include the content research of national and local government OD portals.

The focus of the RQ1 is dominantly quantitative (how many datasets are available?). However, it also tackles the qualitative dimension in terms of technical and legal aspects. So the availability of data is measured by the quantitative criteria (number of datasets) and qualitative criteria which determine the extent of easiness of use of data (technical openness, legal openness, actuality of content, accessibility to people with disabilities, and multilingualism of structure and content). The research focus of the RQ2 is predominantly qualitative but also quantitative – to what extent do the datasets match the content of the QoL typology, or – is there a link between the datasets and the areas that are considered crucial for the QoL of the community.

The key indicators which will enable to answer the research questions are:
a) the level of government portal (national; local); is data available only on local government portal or also on national level portal, which attracts more users and is connected to the European data portal;
b) the number of available datasets, as measured by unique datasets (by content of the dataset);
c) the level of technical openness defined by Five stars model (file format and stars mark); the high quality of OD is mostly considered at level 3 and above;

d) the level of legal openness defined by used licenses; the usage of CC-BY license guarantees the high level of openness because it only requires the user to name the source;
e) actuality of content measured by date of update or modification of data; the more data is updated, the better availability;
f) accessibility to people with disabilities; meaning the extent to which people with disabilities are given equal access to OD;
g) multilingual structure and content, in terms of the possibility of non-native speakers to detect and use the OD;
h) the compatibility of the content of datasets with the quality of life indicators typology (for the RQ 2).

4.2. Sample

The local government in Croatia consists of 428 municipalities and 128 cities, with 20 counties at the regional level. The local units - municipalities and cities - differ according to the level of urbanization, and cultural and historical features, which are reflected in their scope of affairs and fiscal capacity to perform the designated tasks. Among the very heterogeneous group of 128 cities (ranging from 1.576 to 790.017 inhabitants) there are a) 52 cities below the 10.000 threshold, b) 51 regular cities, c) 25 big cities (16 cities above 35.000 inhabitants, 8 seats of counties, and the capital City of Zagreb which enjoys a county level status) [19]. The differentiation has an impact on the scope of affairs and the scope of data collection in each local government. Around 70% of the population lives in city type local governments.

Big cities are responsible for crucial local services [19] in the area of housing, spatial and urban planning, including the issuing of building permits, communal services, children care, education, social services, primary health protection, culture and sports, consumer protection, environmental protection, fire protection service and civil protection, traffic and road maintenance, and other tasks. Other cities have a slightly narrower scope of affairs, while the City of Zagreb performs a greater range of tasks, including the county level tasks and state administration tasks at the regional level. Despite the differences among the groups of the cities, these tasks, along with the tasks delegated to the cities from the central government, directly focus on the fulfilment of the needs of the community and raising the QoL of the population.

For the purpose of this study, the sample of local governments includes cities that either have established their own OD portals (Rijeka, Varaždin, Virovitica, and Zagreb) or publish their data on the national OD portal (Bjelovar, Novska, Pula, Split, Umag). Two cities are also connected to the OD portal but with 0 (zero) datasets published so far (Poreč, Dubrovnik). Three cities fall in both groups since their portals are connected to the national portal (Zagreb, Rijeka and Virovitica). This means that there are 9 unique entities in our sample of local governments (see Table 1), including 7 big cities and 2 regular cities (Umag and Novska). The population of these nine cities equals 30,1% of the population of the country according to the 2011 Census. Although some local governments publish their data in open format on their webpages, this research is focused on OD portals, as central points for OD publication and the example of higher level of awareness and knowledge on OD.

4.3. Research findings I – Availability and quality of data

The usage of OD portals of the Croatian local authorities is at the early stage of development and low level of maturity – only 0,72% local governments (cities and municipalities) have their own OD portal, and additional 1,26% use national OD portal. The assumptions of reasons for such level of maturity are related the developing culture of OD usage and awareness of OD usage that is still at a low level, as confirmed by the Open Data Maturity ranking of the European Commission [13].

The findings of the research, presented in Table 1, are as follows:
(a) regarding *the level of government portal* only a few cities have published datasets on OD portals (9 out of 128, or 7.03%). Out of this number, eight cities have used national infrastructure by publishing their OD datasets on national OD Portal, while three cities have also created their own local OD portal (Zagreb, Rijeka, Virovitica); with one city creating only their local OD portal (Varaždin), without publishing simultaneously on the national portal. In sum, less than 10% of the cities have decided to publish their datasets on the OD portals.

(b) *the number of available datasets*, as measured by unique datasets (unique by content) amounts to 228 datasets at local portals (Rijeka 148, Zagreb 71, Virovitica 6, Varaždin 3). At the national OD portal eight cities have published 303 datasets (Rijeka 173, Zagreb 103, Pula 15, Virovitica 6, Bjelovar 3, Split 2, Umag 2, Novska 1). These numbers show relatively small number of datasets published by most of the cities. However, the share of the cities' datasets on the national portal is relatively high – they constitute 37.75% of all published datasets.

(c) *the level of technical openness* defined by Five stars model (file format and stars mark) shows that most of the data is at the medium level of technical quality (three stars). The Five Star Linked Data, established by Tim Berners-Lee, the inventor of the World Wide Web and promoted by W3C Community and Business Groups, considers the high quality of OD as data at level 3-stars (CSV, JSON, etc.) and above. By applying the Five Stars model on datasets published by local governments in Croatia, the data presented in Table 1 show that the portals display most datasets at 3-star level (52,19% on local portals, 58,03% on national portal), followed by 2-star level (47,37% data on local OD portals, 38,36% datasets on national OD portals). Only a minority of datasets is published at 1-star level (0,44% on local and 3,61% on national portal).

(d) *the level of legal openness* is defined by used licenses; the usage of CC-BY license guarantees the high level of openness because it only requires the user to name the source, without further restrictions. The CC-BY is found to be the most used on the local OD portals (Rijeka, Zagreb, Virovitica). On the local portal of Varaždin the licence used is CC0 (public domain). The information about legal openness of datasets on national portal is set commonly for all under CC licences but also refers to the national OD licence that corresponds to the CC-BY.

(e) *actuality of content*, measured by date of update or modification of data, has been checked by automatically sorting by "date of update" available on OD portal. The

administrators of the datasets are responsible for the update. The dynamic datasets, which are updated in real time, present a minority of content the OD portals Croatia. On the other side of the spectrum, in many cases the datasets relate to the specific past time frame (e.g. a year in the past, e.g. dataset relating to 2016) so there is no need to update them. The value of static datasets has been contested, as shown by Inkpen et.al. [16] – if the structure of the datasets changes they might not be compatible for the different periods. The real value of published open datasets on local government authorities in Croatia, presented in Table 1 might be improved by creating such datasets that are continuously growing with the time by adding new records with each update. In such a case, the value of datasets would grow because they could contain a lot of data, structured on the same way and related to the long time period.

(f) *accessibility* to people with disabilities is not assured at all on the Croatian OD portals, both at the local and national level. The option of adjustment of website to people with disabilities is not in function, despite the legal obligation defined by the EU Web Accessibility Directive [8]. The improvement of functionality of the OD Portal in terms of accessibility to people with disabilities is envisaged in several national projects.

(g) *multilingual structure and content* are not assured; All portals are accessible only in one language (Croatian), and only Zagreb Portal has also OD structure (but not content) in English.

Table 1. Availability of local government open data on OD portals

Properties		**Rijeka**	**Zagreb**	**Virovitica**	**Varaždin**	**Total of local OD portals**	**Structure of format (%)**	**Rijeka**	**Zagreb**	**Pula**	**Virovitica**	**Bjelovar**	**Split**	**Umag**	**Novska**	**Total of national OD portals**	**Structure of format (%)**
The level of government portal		local						national									
The number of available datasets		**148**	**71**	**6**	**3**	**228**	**100**	**173**	**103**	**15**	**6**	**3**	**2**	**2**	**1**	**305**	**100**
The level of technical openness	HTML, JSON, CSV, WMS (***)	70	46	0	3	119	52,19	80	79	15	0	3	0	0	0	177	58,03
	ASPX, XLSX, XLS (**)	78	24	6	0	108	47,37	87	23	0	6	0	1	0	0	117	38,36
	DOCX, DOC, PDF (*)	0	1	0	0	1	0,44	6	1	0	0	0	1	2	1	11	3,61
The level of legal openness defined by used licenses		CC-BY	CC-BY	CC-BY	CC0 (public domain)												
Actuality of content		November 18th 2020	September 17th 2020	April 24th 2017	August 21th 2020			not defined	not defined	not defined	not defined	not defined	not defined	not defined	not defined		
Accessibility to people with disabilities		No	No	No	No			No	No	No	No	No	No	No	No		
Language		HR	EN	HR	HR			HR	HR	HR	HR	HR	HR	HR	HR		
Multilingual Structure		Yes	No, just EN	Yes	No, just HR			No, just	No, jus	No, just	No, just HR	No, just HR	No, just	No, just	No, jus		

							HR	t HR	HR			HR	HR	t HR		
Multilingual Content	No, just HR	No, just HR	No, just HR	No, just HR			No, just HR	No, just HR	No, just HR	No, just HR	No, just HR	No, just HR	No, just HR	No, just HR		

Source: Authors, based on data collected from Varaždin http://otvoreni.varazdin.hr/, Virovitica http://opendata.virovitica.hr/, Rijeka http://data.rijeka.hr/ and Zagreb http://data.zagreb.hr/ (13 November 2020).

5. Open data for the improvement of quality of life

5.1. Overview of relevant quality of life frameworks and models

Contemporary societies place a great importance on the quality of life and the tools for improvement of quality of life (QoL). The digital revolution that includes use of OD which on the way is opening a whole range of opportunities, it affects almost all aspects of people's lives and can greatly affect people's quality of life as well as their social inclusion, as debated by Velsberg et.al. [35], Nevado-Peña et.al. [21], Virkar & Pereira [34], Yeh [37], Dameri [4], Ahlgren et.at. [1], Roztocki and Weistroffer [28], Pla-Castells [26]. The government has a critical role in the improvement of QoL by formulating and implementing policies. Nowadays, governments of both developed and developing countries have recognized the importance of digital technologies and OD their potential to improve QoL, and enhance economic and social growth and development, as shown by Gebka and Castiaux [15], Cisotto, and Pupolin [2], Janssen et.al. [18], Pereira [27], Mellouli et.al. [20].

The concept of QoL is difficult to define because for each individual QoL may have different meaning to different people, groups or societies. Also, each discipline (economics, health, psychology, etc.) defines QoL in its own way. However, almost all definitions agree in one that the QoL is higher if people have happy and satisfactory lives. Years of research in this area have shown that quality of life is a multidimensional concept and that depends not only on satisfactory material and financial conditions or economic prosperity, but also on many other factors. Some of these factors include, for example, education, health, entertainment, housing conditions, culture, etc. Therefore, a number of frameworks and models have been developed with the intention of measuring the concept. Some of the relevant frameworks and models arise from research carried out by official institutions such as OECD [22], World Health Organization (WHO) [39] and Eurostat [12].

Relevant factors that affect the quality of life according to the OECD model are [22]: 1) health status, 2) work and life balance, 3) education and skills, 4) social connections, 5) civic engagement and governance, 6) environmental quality, 7) personal security and 8) subjective well-being. WHO [39] defines Quality of Life „as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns". The domains and indicators defined by WHO QoL framework are presented in the Table 2.

Table 2. Domains of overall Quality of Life and General Health by WHOQOL

Domain	Facets incorporated within domains Overall Quality of Life and General Health
Physical health	Energy and fatigue Pain and discomfort Sleep and rest
Psychological	Bodily image and appearance Negative feelings Positive feelings Self-esteem Thinking, learning, memory and concentration
Level of Independence	Mobility Activities of daily living Dependence on medicinal substances and medical aids Work Capacity
Social relationships	Personal relationships Social support Sexual activity
Environment	Financial resources Freedom, physical safety and security Health and social care: accessibility and quality Home environment Opportunities for acquiring new information and skills Participation in and opportunities for recreation/leisure Physical environment (pollution/noise/traffic/climate) Transport
Spirituality/Religion/Personal beliefs	Religion /Spirituality/Personal beliefs

Source: WHOQOL [40], Measuring Quality of Life

One of the frameworks for measuring the QoL relevant for Croatia as a member of the European Union is a Quality of Life framework created by Eurostat. Eurostat framework the Quality of Life presents as one multidimensional concept (see Table 3) that includes a full range of factors that influence what people value in living, beyond the purely material aspects and it is broader than economic production and living standards. As a multidimensional concept it is defined through 8+1 key dimensions: 1) Material living conditions, 2) Productive or main activity, 3) Education, 4) Health, 5) Leisure and social interactions, 6) Economic and physical safety, 7) Governance and basic rights, 8) Natural and living environment, 9) Overall experience of life.

Dimension „Material living conditions“ is related to financial satisfaction and the housing conditions, which includes financial resources available for spending or saving and ownership of or access to material goods and services. „Productive or main activity“ is dimension focused on employment and refers to both paid and unpaid work and to other types of main activity status. The third dimension „Education“, refers to acquired expertise and skills, to the continued participation in lifelong learning activities and to aspects related to the access to education. „Health“ as the fourth dimension is most often perceived as one of the most valuable assets, because good health enables people to actively participate in the labour market, as well as to have good social relationships. In the European policy, health is a goal of the utmost importance. The indicators included in this dimension refer to: life expectancy and healthy life years and self-perceived health. „Leisure and social

interactions“ is also an important dimension that affects quality of life, because for an individual’s psychological balance is important having someone to rely on in case of need as well as being able to engage in social activities. The sixth dimension which refers to „Economic and physical safety“ is a crucial aspect of citizens’ lives. Insecurity is a source of fear and worry that can have a negative impact on the quality of life in general. On the other hand, the economic safety concept covers aspects such as wealth, debt, and job insecurity, and economic crisis has shown how economic safety is important for quality of life. „Governance and basic rights“ as the seventh dimension includes indicators related to discrimination across genders, relationship between residents and political institutions, level of trust of residents in major institutions and their trust in others, including how it differs amongst various socio-demographic groups. The dimension that is also of great importance is „Natural and living environment“ because pollution has direct adverse effects on fundamental resources such as clean air and water but also indirect effects on people’s health and well-being, as well as ecosystems and biodiversity. Thus, environmental indicators which have been identified for this dimension are: air quality, self-reported exposure to noise and any kind of pollution, and satisfaction of citizens with their living environment. As the last separate dimension which is defined is „Overall life satisfaction“. Indicators of this dimension are based on subjective evaluations and perceptions of different domains and are focused on the well-being of people in the European Union (EU). They are divided according to OECD guidelines on measuring subjective well-being into three distinct but complementary sub-dimensions: 1) life satisfaction, based on an overall cognitive assessment, 2) affects, or the presence of positive feelings and absence of negative feelings and 3) eudaimonics, the feeling that one’s life has a meaning [4].

Table 3. Dimensions of Quality of Life by EUROSTAT

Dimension	Subdimension
1. Material living conditions	General overview
	Income
	Income distribution and inequality
	Risk of poverty
	Severe material deprivation
	Difficulties with making ends meet - a subjective indicator of poverty
	Housing conditions
2. Productive or main activity	Productive or main activity in the context of quality of life
	Quantitative aspects of employment
	Quality of employment
	Other main activity: proportion of the inactive population
3. Health	Europeans live longer and healthier lives
	Gender, age and income-related differences
	Access to healthcare provision
	Healthy and unhealthy behaviours
4. Education	Education in the context of quality of life

	About one third of those aged 25-64 had a tertiary degree in 2019
	Average adult literacy scores lower in southern Member States
	Over 85 % of 3-year-olds in early childhood education
	Early leavers from education and training: 16 countries reached their national targets
	NEETs: young people neither in employment nor in education and training
	More than 1 in 10 of those aged 25-64 attended training in last four weeks
	Over 50 % of persons aged 16-74 had basic or above basic digital skills
	Less than one third of persons aged 25-64 do not know any foreign language
5. Leisure	Leisure time
	Social interactions
	Getting together with family, relatives and friends
	Participation in voluntary activities
	Supportive relationships
	Conclusions
6. Economic security and physical safety	General overview
6. Economic security and physical safety	Economic security
	Economically vulnerable groups
	Unpaid debts and arrears
	Physical safety
	Physical safety by degree of urbanisation
	Conclusion
7. Governance and basic rights	Active citizenship
	Voter turnout
	Trust in the political and legal systems
	Equal rights
	Conclusions
8. Natural and living environment	Key messages
	Exposure to pollution, grime and other environmental problems
	Urban population exposure to air pollution
	Noise pollution from neighbours or from the street
9. Overall experience of life	Overall life satisfaction in the context of quality of life
	Life satisfaction in Europe
	Life satisfaction by income and age groups
	Conclusions

Source: EUROSTAT, https://ec.europa.eu/eurostat/cache/infographs/qol/index_en.html

The comparison of the above instruments is presented in Table 4. The comparison shows that the OECD factors and Eurostat dimensions mostly mutually correspond, striving to capture the multiplicity of life aspects. The WHO domains, understandably, are related to the individual well-being in terms of immediate physical, physical and social surroundings.

Table 4. Comparison of frameworks of QoL

Factors of QoL BY OECD	Domain of QoL by WHO	Dimensions of QoL by EUROSTAT
Health status	Physical health	Health
	Psychological	
Work and life balance	Level of Independence	Material living conditions
		Productive or main activity
Education and skills		Education
Social connections	Social relationships	Leisure
Civic engagement and governance		Governance and basic rights
Environmental quality	Environment	Natural and living environment
Personal security		Economic security and physical safety
Subjective well-being	Spirituality/Religion/Personal believes	Overall experience of life

Source: Authors

5.2. Research findings II - The potential of the available datasets to improve the QoL

Relating to the RQ2, we use the indicator (h) the compatibility of the content of datasets with the quality of life indicators typology (see 4.1. above). For that purpose, we identified and categorized datasets of local governments available on the OD portals in terms of the QoL typology for which we use the Eurostat typology.

The national and local OD portals for 2 big cities (Rijeka, Zagreb) overlap and some datasets appear simultaneously on both national and local portals, with the difference in the formats they are presented.

The 91 of 228 datasets are uncategorized so it is impossible to get automatically statics about dataset groups. The categorizations are not strictly defined, so the cities can define the category of datasets, as they want or need. For example: Rijeka has used the following categories: Economy and finance, Energy, Infrastructure, Education, Environment, Transport, Regions and cities, Population and society, Government and public sector, Health, Science and technology, uncategorized. Zagreb applies the categories: Address book, Finance, Economy, Grants, Infrastructure, Public procurement, Concessions, Education, Financial support, Statistic, Tourism, Health, uncategorized.

For the purpose of this research the datasets published on the OD portals are re-categorized by applying the QoL dimensions defined by Eurostat. The results are presented in the Table 5. Some datasets can be used in more than one context (dimension) of QoL. The data show that OD available on the national OD portal published by the Croatian cities predominantly fall in the category of governance and basic rights (90 datasets or 28.75%), meaning that

the data is available for exercising the democratic procedures, taking government into account or exercising democratic engagement. The second group relates to datasets in the area of material and living conditions (58 or 18.53%), in relation to economic indicators such as income, poverty and similar, which can be used both for informing the citizens, but also for economic analyses which can further be used to make a scientific base for policy decisions. In the third and fourth group are activity related information (42 or 13.42%) and environmental information (37 or 11.2%). The categories which are mostly directly concerning the everyday life and personal development of citizens are represented with less than 31 dataset or 10% - Leisure (9.27%), Education (8.95%) or even with less than 15 or 5% of datasets – Health (5.11%) and Safety (13%).

Table 5 . Categorization of OD local government datasets by Eurostat QoL dimensions

QoL Dimension / City	Material living conditions	Productive or main activity	Health	Education	Leisure	Economic security and physical safety	Governance and basic rights	Natural and living environment
Rijeka	51	31	7	19	20	6	60	30
Zagreb	6	10	9	8	8	7	25	6
Virovitica	1	1	-	1	1	-	2	1
Varaždin	-	-	-	-	-	-	3	-
Total	58	42	16	28	29	13	90	37
Share	18.53	13.42	5.11	8.95	9.27	4.15	28.75	11.82

Source: Authors

6. Conclusions and recommendations

This paper presents the research process that used the defined research criteria in order to obtain the objective arguments that respond to the research questions.

In relation to our RQ1 (To what extent is local government OD available to users (citizens, private sector, civil sector) on the OD portals? - it can be concluded that governments at the local level in Croatia are still not ready enough to present the data that are in their competence as open and free for reuse to their fellow citizens and companies. The quantity of available datasets on the portals is low and their technical quality is moderate. The fact that only 9 out of 128 cities (or out of 555 local governments) in total publish their data on OD portals and that there are only 300 datasets on national OD portal sufficiently backs up this conclusion. Several cities publish only a few datasets, which is certainly below any acceptable threshold. For example, Rijeka and Split are cities with the same competences and similar size, but while Rijeka publishes 173 datasets, Split publishes only two. However, positive finding is that data is predominantly available without legal restrictions, by using CC-BY licence.

The findings on the technical availability of data show that approximately half of the available datasets is presented in the format that corresponds 3-stars level (52,19% on local

OD portals, 58,03% on national portal). The higher-level stars datasets that are most potent and valuable are completely absent from the portal. The most of published datasets are static data – catalogues, address books, financial reports, and information about public service providers. The most valuable data - dynamic data as well as large datasets that are expected to be frequently updated – are not available.

The local governments fail to ensure the same possibility of OD reuse for all potential data users, especially in relation to citizens with disabilities. Also, they fail in translating the content of OD portals (in general) in more than one language that could make published datasets more usable to wider group of users, as well as to the specific language minorities.

In relation to our second RQ2 - "Is there a potential for the available OD to improve the quality of life?" – our findings show that the potential for improving the quality of life among local governments in Croatia who publish datasets on the portals is highest in relation to governance and citizens' rights as well as general macroeconomic indicators. So, the political and economic aspects are covered by almost half of all available datasets. On the other side, everyday issues and challenges such as health, education, leisure or environment are represented by less than 15% each, despite the fact that precisely such datasets are very adaptable and usable for creating apps and other tools that can improve lives on the daily basis. In addition to content, the other features of data as presented in relation to RQ1 heavily affect the value of data for QoL improvement (e.g. how recent are datasets, what format etc.)

The presented findings show only a fraction of the picture of OD at local level in Croatia. This research has shown the following: (1) local government data is not available in large amount, depriving citizens from their right to access and reuse public sector information; (2) only a few governments use data portals, failing to increase the accessibility and usage of their datasets; (3) datasets do not ensure equality and wide usage since they are not capable to meet needs of certain groups and wider public; (4) available datasets are not very valuable given the predominance of static data and the frequency of update; (5) that dataset formats are moderate at best, but (6) legal restrictions are more or less absent. The mere content of datasets indicates that the local government are mostly inclined to publish data that relate to political and economic issues of the community, but much less are able to affect aspects of everyday living, such as health, education, or transport. Some of the reasons might be found in the legal obligation to publish financial data as well as the fact that political data is very frequently prepared by local governments.

The future research could help gaining more understanding on local government OD and its relationship with QoL by analysing a greater set of datasets by inspecting city websites, as well as websites of other types of local governments (municipalities and counties). Also, the more in-depth research into the factors that positively influence the development of OD portals and publication of OD could help developing a conceptual framework for OD in Croatia. A special attention might be given to the organisational level – local government and its leadership, local servants, organisational culture, information management, as well as ties with external actors – which are all expected to contribute to the OD availability and

usage. In addition, some practical examples of usage of OD for improvement of QoL could help us explain factors that lie beneath the OD phenomenon.

On the practical level, it can be easily concluded that local governments should invest more into development of OD portals and their functionalities, as well as publication of datasets and their quality. The categorization of datasets in accordance to the Eurostat categories might have the incentivising effect for the local governments to publish datasets aspects of citizens' well-being.

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