Timeliness of Open Data in Open Government Data Portals Through Pandemic-related Data: a long data way from the publisher to the user

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Abstract— **The paper addresses the "timeliness" of data in open government data (OGD) portals. It is one of the primary principles of open data, which is considered to be a success factor, while at the same time it is one of the biggest barriers that can disrupt users trust in data and even the desire to use the entire open data portal. However, assessing this aspect is a very difficult task that, in most cases, becomes an impossible for open data users. There is therefore a lack of comparative studies on the timeliness of data of different national open data portals. Unfortunately, 2020 gave the opportunity to find out this. It became easy enough to compare how long is the data path from the data holder to the OGD portal by analysing the timeliness of Covid-19-related data sets in relation to the first case observed in a country. The study thus fills the gap of comparative studies by addressing 60 countries and their OGD portals concerning the timeliness of the data, providing a report on how much and what countries provide the open data as quickly as possible. It makes it possible to understand how quickly OGD portals react to emergencies by opening and updating data for their further potential reuse, which is essential in the digital data-driven world.**

Keywords— *frequency of updates, open data, open government data, pandemic, portal, timeliness, Covid-19.*

I. INTRODUCTION

Today, [open] data is a daily phenomenon. More and more governments are launching open government data portals that provide data that can be accessed and used by everyone for their own needs. This not only facilitates data-based decision-making, but also directly influences the trust and satisfaction of citizens with government, since the open government data (OGD) allow citizens to monitor government performance and management.

As a result, entrepreneurs, scientists, data enthusiasts reuse open data to propose solutions with added value to the public. While OGD by themselves affect citizens' trust in and satisfaction with the government [1], the participation and the reuse of data increase them significantly [2]. This means that the opening of data, should have positive impact and could bring benefits to both, the government, data publishers and users. This is all the more at the moment when most countries are affected by a pandemic.

Today, access to data allows public to even predict and alert citizens about potential risks, as was the case with *HealthMap AI*, which raised alarm even earlier than the research group *ProMed*, which noticed a post on social media talking about "unknown pneumonia" [3], recognizing the threat on December 30, 2019.

The value of the data available can be seen also in the fact that the genome of the Covid-19 was sequenced only one month after the first case of the virus was reported in China making it publicly available online [3], while during the SARS epidemic in 2003, when [open] data were not yet such a popular phenomenon, the genome was recognised and shared only few months after the outbreak.

As for open data which have huge potential, they provide many solutions ranging from different types of visualization, such as interactive maps on an outbreak that appeared on the web very quickly after the data were opened, allowing to make the pandemic more actionable, including very specific medicine-related studies – contact tracking applications, virus means of transmission, survival time on surfaces, potential antiviral treatments, as well as the extent to which individuals develop immunity after contracting and healing from the virus [2]. The nature of data reuses depend on the open data that vary from medicine-related data, such as epidemiological and health services to data on governmental measures, socio-economic and environmental impacts. Open data provide an opportunity to access data in [almost] real-time, enhancing clarity on the current situation and helping to make data-based decisions. The pandemic response today become even more data-driven than even before [4]. Counts of the number of Covid-19 tests, infections, and mortality become publicly available in many countries and are essential in shaping public health policies, providing accountability to the public and support common efforts [4, 6]. As an example, according to [5], the number of cases in Mainland China could have decreased by 66%, if the data collected would be opened just one week earlier. Here the timeliness of data, which is one of the main principles of open data, become crucial.

Today, citizens have significantly less limited access to data, and as a result, understanding of the crisis compared to the situation in which the population was decades and hundred years ago. However, *do we take advantage of these benefits? Are these data valuable? Do they come in time?* These questions are under discussion. Timeliness seems to be one of the most challenging principles for both, data publishers and data scientists. As a result, many studies are limited to analysis of the frequency of updates only. This is mainly due to the fact that it is almost impossible for data users to determine whether the data are opened in time, which means that they are made available as quickly as necessary in preserving the value of the data [7], as otherwise they lose their usefulness [8] and the potential to create value for society transforming data into knowledge.

Unfortunately, 2020 has come up with the possibility of eliminating this limitation by carrying out studies on how quickly open data on very current topics appears in the OGD portals. Since more than 227 countries and territories [9] are affected, it is easy to assume that in times of the digital world data on this disease should appear on open data portals. This paper therefore deals with questions - *how quickly data on Covid-19 [as an example of high value data sets] come to open government data portals*? This is done by addressing 60 countries and their national open data portals, by exploring:

a) the presence of Covid-19-related data in them,

b) their timeliness that is assessed in terms of the first case of Covid-19 identified in the particular country,

c) their machine-readability,

d) their currency, i.e. whether they are regularly updated,

e) whether these data are available on the European Data Portal (EDP) - for European countries only, and some other questions revealed during the analysis.

The experiment took place at the end of July 2020.

The paper therefore does not propose a solution to fight the virus or how to avoid or predict next possible pandemic, as well as does not research the content of data sets thoroughly, mainly by reporting on *how timely data on the virus come to OGD portals by allowing citizens to use them for their own needs and potentially significant and value-added solutions* that, today, appear more and more frequently.

The rest of this paper is organized as follows: Section II refers to the principles of open data, focusing on timeliness, and describing the rationale for the research, Section III addresses the method used and the results of the experiment, Section IV provides brief results and discussion, and Section V provides conclusions.

II. THE RATIONALE FOR THE STUDY

The open data are characterized by a set of 8 principles [7]. According to these principles, in order to admit data as open data, they must be: (1) complete, (2) primary, (3) timely, (4) accessible, (5) machine-processable, (6) non-discriminatory, (7) non-proprietary and (8) license-free. This set of principles was defined in 2007 aiming to develop a set that could be used as a checklist to data to be opened. 13 years later, this set has not changed, but it is sometimes accompanied by additional principles, that are mostly research-related and not so widely used.

For more specific principles - completeness, primariness, timeliness and machine processability, they are classical "pillars" which should be satisfied at the first stage of data preparation for their further publishing. This set of principles is often addressed at different levels, ranging from government to individual studies of independent researchers. A number of different frameworks have been proposed in recent years to assess whether these principles have been respected for independent data sets or for all open data portal. However, while some aspects can be easily examined, for instance, whether the data are machine-processable or complete (but even this principle is sometimes under discussion because of the different interpretations of this concept), some aspects are difficult to verify. This is the case for **timeliness**.

Timeliness is defined as "***data is made available as quickly as necessary to preserve the value of the data***" [7]. [10] stresses that "***open data is only valuable if it's still relevant. Getting information published quickly and in a comprehensive way is central to its potential for success***". However, reality shows that this is a challenge for data publishers and portal holders. Recent studies have demonstrated that timeliness is a barrier to the use of open [government] data observed by many researchers [11 -13], as this affects user's intention to use open data and the all open data portal [15 - 18] – users become less likely to create open data-based services if a lack of this principle is observed [19].

However, data providers fail in delivering data satisfying the principle of timeliness [15, 19-25]. This is even more crucial for medicine-related open data (also proved by the number of studies conducted on a timeliness, including the above [21-24]), since the more timely the data source has the potential to be used in early warning systems that could lead to the early deployment of different solutions bringing benefits to society, including antiviral therapy and vaccination campaigns (see [26]). However, studies show that timeliness sometimes is not satisfied, and according to [23], in some cases its rate does not exceed 40%.

This was also demonstrated in [27 - 29], where the frequency of updates – as aspect closely related to the principle of timeliness – was assessed as relatively weak aspect (partly fulfilled). In addition, a more detailed study on Latvia's open data portal [28], addressing every data set on the portal, has demonstrated that at least 25% of data sets are not updated as often as data publishers promise (for 20% it is difficult to reach a conclusion at the moment since they are too new to compare promised and real data on the data updates). This demonstrates that even very limited studies on the frequency of updates reveal a number of challenges. Limitations, according to which investigation on the frequency of updates were mainly possible, are related to the fact that it is almost impossible for data users to determine whether data are opened in a timely fashion, which means that they are made available as quickly as necessary preserving the value of the data [7], because otherwise they lose their usefulness [8] and potential to add value to society by transforming raw data into knowledge.

Unfortunately, Covid-19 have presented an opportunity to eliminate this limitation by carrying out studies on how quickly the open data on such current topics appear on the OGD portals. It was therefore decided to establish whether countries publish data on Covid-19 in the OGD portals and whether this is done in time.

III. ANALYSIS

This section deals with the method used to assess 60 countries and their national open data portals, and the results obtained.

A. Analysis Method

During the study carried out, 60 countries were addressed, inspecting:

(1) *are the open data on Covid-19 published?*

(2) *have they been published in a timely manner?* which was verified by comparing the dates of the first case identified in a given country and the first release of open data on this topic,

(3) *are these data regularly updated*?

(4) *are the data available in a machine-readable format?*

(5) *whether open data on the particular country are available on the European data portal* (for European countries only).

The number of countries addressed is explained through [30] addressing 32 European countries, while the previous author study [29] looked at a further 9 countries. The need to carry out an analysis of the countries addressed in [29] is explained by the fact that the data previously collected are used as complementary data for deeper analysis, potentially revealing more valuable conclusions. This is achieved by addressing 2 specific aspects analysed in [29], namely "*release date and frequency of updates*" and "*machine-readability*" assessed by 40 participants. This assessment was carried out by applying the framework of [31], according to which a three-level Likert scale (fulfilled = 3, partially fulfilled = 2, and unfulfilled = 1) was used to measure the usability of 41 OGD portals. However, considering the specificity of this study and its linkage with the Covid-19 topic, an additional 19 countries were examined which were selected on the basis of earlier first cases of disease.

Although the results of [29] were obtained from observations of 40 individuals, their correctness cannot be proved since it is a summary of subjective views, when an individual interacts with the portal, this study uses a very simple approach aimed to providing clear undoubtful results. The method used belongs to daily tasks of open data portals – keywords related to the research question are used to filter data sets (i.e. "*covid*", "*covid-19*", "*corona*", "*coronavirus*", "*virus*"). In most cases, "*covid*" keyword was sufficient to select all data sets related to the matter, however, depending on the open data portal and its language, some additional keywords and translations in the respective languages were performed. In addition, while some portals were user-friendly in terms of filtering search results by the publishing date, other portals (a) were not able to filter data by publishing date (only "*recent updates*" or "*most popular*"), (b) there was no search filter at all. Another point is that many portals do not provide data on the date of data publishing, the frequency of updates, and the date of the most recent update. These aspects were addressed in [29], however, this study demonstrates in which cases these data really do matter. Otherwise, the nature of the study requires mainly a repeat of the same simple action on all the portals being addressed.

The 2nd question - *have they [Covid-19-related data] been published in a timely manner?* - was broken down into (a) *data mentioning Covid-19*, (b) *country-specific exact data on Covid-19* as it was observed that many data sets containing "*covid-19*" as a tag or keyword relate to other non-medicine-related topics, such as data sets on the restaurants delivering meals, traffic changes, etc. that is in line with European Data portal (EDP [3]), according to which the data available on Covid-19 ranges from epidemiological, healthcare facility and medical research to data on governmental measures and the socioeconomic and environmental impacts of the pandemic. Thus, it was not enough to find data with a matching keyword and then sort it by the date of publishing, and additional investigation was necessary.

In addition, relevant indicators of [29] are provided, which show whether previous experiments are sufficient to thoroughly explore the portal, particularly such specific aspects as timeliness. As regards the first part of this question, related to the first case diagnosed in the country concerned, this data was derived from [9].

The 5th question - *whether open data on the particular country are available on the European data portal?* - was examined because the EDP is a widely used platform, available in 25 languages, and it "harvests the metadata of Public Sector Information available on public data portals across European countries. Information regarding the provision of data and the benefits of re-using data is also included" [3]. Moreover, in recent months, it led a section dedicated to Covid-19 aimed at providing a better understanding of the current global emergency by empowering citizens by presenting relevant data sets, data-related initiatives and editorial pieces on the topic. In terms of data, by the second half of August it collected 799 data sets on 19 countries and 60 data related initiatives such as different dashboards related to the matter. It was also one of the first websites collecting various data sets tracking the current state on the subject. In addition, the EDP sometimes contains even more data on specific countries than their national open data portal, which is the case for Latvia, for which the EDP collects data not only from OGD portal *data.gov.lv* but also from geospatial portal *geolatvija.lv*, thereby enriching the collection of country-related data sets. As a result, while data were collected for 19 countries, the total number of data catalogues from which the relevant data came to the portal is 27.

All these questions were asked to each portal selected. This resulted in a set of individual protocols in the form of Table I.

Another questions to be addressed is *whether these data are really valuable for users*? This question can be answered by understanding whether the open data are reused.

TABLE I. PROTOCOL

Aspect examined/ question asked	Value type	Source
When was 1st case of Covid-19 identified?	date	[7]
Are the open data on Covid-19 available on the OGD portal?	Boolean	OGD portal
When was the term Covid-19 first mentioned?	date	OGD portal
When was the 1st Covid-19-related open data set released?	date	OGD portal
What is the total number of Covid-19-related open data sets?	number	OGD portal
Were the data published in a timely manner? Comparison of the first case (FC) against open data availability (ODA) – date of the release of the first data set	[-1,0,1], where 1 – "in less than 2 weeks", 0 – "in a month", -1 – "more than in a month"	comparison of [7] and OGD portal
Number of Covid-19-related open data sets available in the European Data Portal (EDP)	number	EDP portal
Are Covid-19 related data sets updated frequently?	yes/ not always/ no	OGD portal
Are Covid-19 related data sets provided in a machine-readable format?	yes/ not always/ no	OGD portal

Most portals do not provide possibility to obtain these data, but there are some portals that provide information about data usage in the way of number and sometimes even nature of the reuse, number of views and downloads. Thus, the last question raised in the scope of this study, *(6a) which portals provide this type of information* and *(6b) what this information tells about the value of the data opened*? These data related to the last questions were examined separately (apart the protocol in Table I), as portals provide them in a very different manner.

As a result of the analysis of these portals and the resulting protocols, a joint protocol was obtained for all the countries examined, partly presented in the next subsection (Table II).

B. Results of the analysis

In total, 60 countries were addressed during the study. For 8 countries - Liechtenstein, China, Macau, Cambodia, Egypt, Lebanon, Afghanistan, Iraq - national open data portals have not been found. However, this does not mean that these countries do not support open data initiatives, since several country-related data sets can be found on the web (i.e. at least for Cambodia, Egypt, Lebanon and Afghanistan), but since OGD portals are the focus of this study, these countries are not being addressed. Thus, 52 countries owning their own national open data portals were further addressed. The results obtained during their analysis are provided in Table II.

It was concluded, that **among 52 national open data portals, only 32 portals** (61.5% of 52 portals and 53.3% of 60 countries addressed) **provide their users with Covid-19-related open data** (see Fig. 1).

These data sets appear also the most popular on the OGD portals, as they address probably the most urgent and crucial data up today. This is the case not only for individual OGD portals of countries addressed but also for EU Open Data Portal (*data.europa.eu*) collected by the mid of August in total of 106 data sets.

Unexpected results were observed in the case of portals of Finland, Slovenia, Romania and Greece which according to [30] are considered to be competitive enough with regard to open data, however no Covid-19-related open data sets were found in these portals. However, this fact has already been established by some individuals within [29], as the aspect of "*release date and frequency of updates*" for portals of Romania and Greece have been assessed as partly fulfilled. According to [4], this makes cross-country comparisons difficult when [many] countries face challenges in data opening.

DISTRIBUTION OF 60 COUNTRIES BY PRESENCE OF THE OGD PORTAL AND COVID-19-RELATED DATA
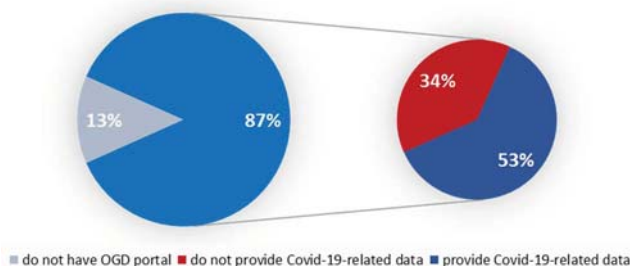

Fig. 1. Distribution of 60 countries by presence of the OGD portal and Covid-19-related data.

While at the level of each individual country, opening up data and models that are the basis for decision-making on the Covid-19 pandemic (or any other issue), enable people to understand the decisions, scientists to scrutinise and improve them, and neighbouring countries support each other [6].

Of course, data reliability is a matter of no less importance, but this paper addresses timeliness and data availability leaving this question for other studies.

As regards the **timely release in relation to the first case detected in the country**, only a few countries published appropriate data in a timely manner. The nature of the data opened is mainly related to the number of cases identified, the data on these cases, the number of tests (in some cases they were added later, when the activity took place) and the results of these tests. Austria, France, Switzerland and the USA are countries that have published relevant data in first two weeks (7.7% of 52 portals and 6.7% of 60 countries), while 5 countries – Estonia, Colombia, Latvia, Cyprus and Ireland, opened them in the first month, 14 countries have done this in more than a month (26.9% or 23.3% of 60 countries), and for other countries these data cannot be identified (see Fig. 2) since these portals have not provided appropriate data (in the scope of specific data sets or because they do not provide these data at all). This is the case even for such competitive countries as Spain, Finland, Netherlands, Italy. As for European countries, the best results were demonstrated by Austria, France, Switzerland, Estonia, Latvia, and Cyprus.

In the case of Spain, the presence of customer support must be mentioned, which means active discussions between users and portal staff and meeting their requests in a short time. As part of the service quality, this is a major benefit and even a driver for citizens' trust in OGD [32].

For the most competitive countries in the way of data release, these results mainly correspond to [29], where all these countries gained from 2.63 to 3 out of 3 points (corresponding to "fulfilled") and only the USA gained 2.33 and Ireland – 2.55 for the relevant "*release date and up to date*" aspect. At the same time, the countries that published Covid-19-related data in a month after the first case were mainly assessed with 1.84 to 2.22 points, with the exception of Luxembourg, Germany, Canada and Taiwan, gained rather high results in [29] but demonstrating a delayed response in times of an emergency / pandemic.

Another interesting point is that 14 countries have published some data sets, partly related to Covid-19 or informative materials before more specific data sets aimed to provide data on the current state in the country that can be further reused producing valuable results. For 4 countries - Spain, France, Cyprus and Switzerland, this is a positive example of managing open data, because they have adapted/ updated already existing data sets with Covid-19 data, since the pandemic affected a number of aspects of everyday life, and in many cases data on such topics as public places, traffic and other were also affected. However, although this is a positive point in most countries, since not only the statistical data sets but other valuable data sources were also published, in three cases - Poland, Denmark, New Zealand – data of that nature are only data available.

TABLE II. ANASLYSIS RESULTS

#	Country	Release date & frequency of updates [29]	machine-readability [29]	1st case of Covid-19 [7]	Open data available	1st mentioning (DD/MM/YYYY)	Release date (DD/MM/2020)	# of data sets	FC/ODA (-1,0,1)	EDP available #	frequently? (yes/no)	machine-readable? (yes/no)
1	France	**3,00**	**2,97**	24.02.	1	09.09.2014	29.02.	106	1	362	yes	yes
2	Spain	**2,91**	2,09	31.01.	1	26.06.2018	n/a, March	97	0	108	yes	yes
3	Ireland	2,55	2,36	29.02.	1	31.03.2020	31.03.	11	-1	12	yes	mainly
4	Cyprus	**2,84**	**2,69**	09.03.	1	18.12.2017	07.04.	19	0	17	yes	yes
5	Finland	**2,85**	2,24	29.01.	0							
6	Slovenia	**3,00**	**2,94**	04.03.	0							
7	Austria	**2,97**	**2,84**	25.02.	1	25.02.2020	25.02.	16	1	1	no	yes
8	Romania	2,13	2,03	26.02.	0							
9	Luxembourg	**2,91**	2,00	29.02.	1	02.04.2020	23.04.	29	-1	30	yes	yes
10	Netherlands	2,13	2,00	27.02.	1	n/a	n/a	12	n/a	16	yes	not always
11	Latvia	**2,90**	2,10	02.03.	1	27.03.2020	27.03.	2	0	2	yes	yes
12	Poland	**2,94**	2,00	04.03.	1	20.05.2020	-	1	-	-	no	yes
13	Italy	2,15	2,18	30.01.	1	01.03.2020	n/a, 01.03.	29	0	21	yes	yes
14	Germany	**2,88**	2,00	27.01.	1	25.03.2020	25.03.	11	-1	35	yes	yes
15	Greece	2,28	2,00	26.02.	0							
16	Croatia	2,00	2,03	25.02.	1	28.04.2020	28.04.	1	-1	1	yes	yes
17	Belgium	**1,94**	2,00	04.02.	1	n/a	n/a	17	n/a	16	yes	yes
18	Estonia	3,00	2,06	27.02.	1	14.03.2020	14.03.	3	0	-	yes	yes
19	Denmark	**1,19**	2,06	27.02.	1	16.03.2020	-	1	-	-	no	no
20	Norway	2,19	2,16	26.02.	0							
21	Bulgaria	2,00	**2,81**	08.03.	0							
22	UK	2,20	2,00	31.01.	1	07.04.2020	05.06.	17	-1	29	not always	mainly
23	Malta	**1,97**	**1,66**	07.03.	0							
24	Switzerland	**2,63**	2,09	25.02.	1	05.11.2019	05.03.	7	1	5	yes	mainly
25	Portugal	**2,63**	2,00	02.03.	0					1		
26	Sweden	2,16	2,00	31.01.	1	27.03.2020	27.03.	5	-1	4	yes	yes
27	Lithuania	**1,84**	2,16	28.02.	1	10.04.2020	10.04.	1	-1	-	no	yes
28	Czech Republic	**1,63**	2,00	01.03.	1	n/a	n/a	16	n/a	18	yes	yes
29	Slovakia	**2,79**	2,03	06.03.	0							
30	Hungary	**1,81**	2,06	04.03.	0							
31	Iceland	2,53	**2,83**	28.02.	0							
32	Russia	2,19	**2,90**	31.01.	0							
33	Taiwan	**2,78**	2,31	21.01.	1	12.04.2020	12.04.	6	-1		no	yes
34	Canada	**2,97**	2,16	25.01.	1	06.02.2020	15.04.	62	-1		yes	not always
35	Colombia	**2,67**	**1,97**	06.03.	1	27.03.2020	27.03.	6	0		yes	yes
36	New Zealand	2,06	2,03	28.02.	1	02.03.2020	-	13	-		no	yes
37	India	2,13	**2,91**	30.01.	1	07.05.2020	07.05.	156	-1		not always	yes
38	USA	2,33	2,00	20.01.	1	04.02.2015	31.01.	160	1		yes	yes
39	Singapore	**3,00**	2,23	23.01.	0							
40	Australia	2,06	2,19	25.01.	1	29.03.2020	29.03.	28	-1		yes	mainly
41	Japan	2,00	2,10	16.01.	0							
42	Thailand	n/a	n/a	13.01.	1	18.03.2020	20.03.	2	-1		yes	yes
43	South Korea	n/a	n/a	20.01.	1	11.03.2020	25.03.	22	-1		not always	mainly
44	Hong Kong	n/a	n/a	22.01.	1	n/a	n/a	1	n/a		yes	yes
45	Sri Lanka	n/a	n/a	27.01.	0							
46	UAE	n/a	n/a	29.01.	0							
47	Philippines	n/a	n/a	30.01.	0							
48	Iran	n/a	n/a	19.02.	1	n/a	n/a	2	n/a		not always	yes
49	Israel	n/a	n/a	21.02.	1	06.03.2020	07.04.	2	-1		yes	yes
50	Bahrain	n/a	n/a	24.02.	0							
51	Kuwait	n/a	n/a	24.02.	0							
52	Oman	n/a	n/a	24.02.	0							

a. n/a – not available (columns 3, 4, 7, 8, 10, 11),

b. OD – open data (column 6),

c. FC/ODA – first case (FC) against open data availability (ODA) – the date of the release of the first data set (columns 10),

d. [-1,0,1] – 1 – OD appeared in less than two weeks, 0 – in a month, -1 – more than in a month (column 10),

EDP – European Data Portal (column 11)

The positive point is that **nearly all published data are in a machine-readable format** and can be easily accessed and processed without additional actions, so in most cases there are no barriers to reuse data and gain value from it, as 24 countries provide data in a machine-readable format. South Korea, Australia, Switzerland, United Kingdom, Canada, Netherlands and Ireland sometimes experience difficulties with machine-readability of open data, where Canada and the Netherlands face bigger challenges, which means that sometimes *.html* to other resources and *.pdf* are provided without machine-readable files, making the re-use of data extremely challenging.

However, this can be explained by the fact that these portals have published not only data but also related external links and laws, as well as news to inform their citizen about the matter as much as possible. Compared to [29], only Switzerland and Canada were evaluated better than in the current study, while for other highly assessed portals this tendency was identified in the previous study. Moreover, some portals – USA, Estonia, Colombia, Latvia, Lithuania, Luxembourg, Sweden, Germany, Croatia, Australia, Taiwan and New Zealand, demonstrated even better results publishing Covid-19-related data, while according to [29] this aspect is a challenge for these countries.

22 countries provide users with up to date data by which is meant that they are **regularly updated**, while 4 countries face some challenges (this is the case for Iran, India, South Korea, United Kingdom) and for 6 countries - New Zealand, Taiwan, Lithuania, Denmark, Poland, Austria - this is a big challenge, however, for two countries – Portugal and Finland these data cannot be provided (see Fig. 3) since the data on the updates are not available. Overall, given that this aspect is usually the most complicated for almost all open data, the results obtained are relatively good.

As an example, in the case of Latvia, data on new cases, tests, number of sick (their age, city, etc.) and complexity of that cases, appear more quickly than on any news portal - it seems that portals process data that are retrieved from the OGD portal and only then publish their news, thus the OGD portal becomes the most up-to-date tool to track the situation in the country. According to the number of views and the associated filter "by popularity", both Covid-19-related data sets are the most popular data sets on the portal, so the society has noticed and use them. Unfortunately, there is a lack of information about the nature of the reuse of these data that is also the case for some other countries (France, Spain, Taiwan, Cyprus, Poland, Austria, etc.).
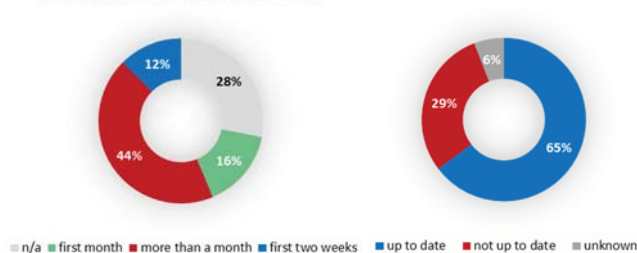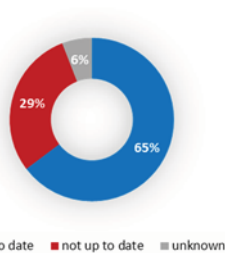
For the data available in the European Data Portal, Table II (column 11) shows that for 10 out of 17 covered countries the total number of Covid-19-related data sets exceeds the number of data sets provided by their national portals. This is in line with author's observation mentioned previously. This fact is easily explained by the number of sources processed by EDP, since for most countries it is more than just national portal. This is an interesting point for Portugal, as the national portal of Portugal do not have any open data on this subject, but the EDP – has (however, this data set is obtained from another resource). To sum up, by the mid of August EDP collected 849 Covid-19 related data sets and 8 use-cases.

As regards the last question related to the assessment of the popularity of the data provided by the portals analysed, it was observed that the open data provided by Cyprus was used to create 3 Covid-19-related open data-based applications, same as Spain and Taiwan, while open data portal of Switzerland contains 2 use-cases, but Polish and Austrian data were used to create 1 application. In terms of data reuse, however, France is the leader, which data were used to produce 129 applications.

The data released by the Netherlands and Luxembourg were also interesting and valuable to their users since 6 data sets among 12 and 29 Covid-19-related open data sets were reused. Taking a step back to the protocol provided in Table II, it can be seen that France was among the countries that supplied Covid-19-related data to the audience as soon as possible and the first occurrence of the data were 5 days after the first case identified in the country. It should also be noted that the high number of re-uses of open data in France, including data related to Covid-19, can be easily explained by an excellent opportunity provided by the portal to users – a tool that allows stakeholders to upload their use-case, thereby facilitating user participation, eliminating all middle-steps (in the way of providing information on the re-use to the portal holder, who should process and publish it on the portal).

As for other countries, open data of Austria and Switzerland were also made available in a timely manner of less than a week. However, the open data of Taiwan and Luxembourg became available with a delay, but, nevertheless, in terms of pandemic and its harmful nature, the audience was attracted to them. In addition, the fact that these data became available not right after the first case identified does not mean that these data are not up to date as shown in the 12th column of Table II.

It should also be emphasized that the lack of information on the reuse of open data does not mean that these data are not re-used, as is sometimes concluded. One of the examples here is the Latvian Covid-19-related open data, which, despite the lack of the information on their reuse in terms of specific use-cases, are used at both - national and international levels, including the contact tracking application "*Apturi Covid*" ("*Stop Covid*"), which obtains statistical data from Latvia's open data portal, informing its users on these data also. According to the Ministry of Environmental Protection and Regional Development of the Republic of Latvia [34], Covid-19 related open data help to limit the spread of the virus and facilitates taking of data-based decision regarding the fight against the virus for the institutions involved in this as it intended to be.

However, it is important to note, that national OGD portals are not the only source of open data and their reuse, as

Fig. 2. Timeliness of Covid-19 related open data.

Fig. 3. Currency of open data.

demonstrated by the open data portal of Catalonia (Spain), which provides a list of different region-related open data-based visualisations, applications and other solutions that help citizens in these hard times with as detailed and easy-to-understand data on the current state, evolution of pandemic, affected areas, restrictions, etc. as possible [33].

This demonstrates public interest in open data, which means that OGD is not only a modern trend but also a powerful tool valuable to both, the government and the society that is also in line with [2].

IV. RESULTS AND DISCUSSION

To sum up, of the 52 national open data portals, only 32 portals provide their users with Covid-19-related open data.

Moreover, only 4 countries published data in the first two weeks, while another 6 countries opened them in the first month, and 14 countries have done this in more than a month after the first cases, while for other countries these data cannot be collected at all.

Most countries provide data in a machine-readable format, while some countries sometimes face challenges in this respect. For some countries this is due to the fact that these portals publish not only data but also related external links and laws, as well as news to inform their citizen about this issue as much as possible.

Most portals provide users with data that are regularly updated, while 6 countries face great challenge in this respect, as long as some countries do not provide data on updates at all, therefore no conclusions can be reached on the data currency, so users may be less likely to use the data. However, given that this aspect is usually the most complicated for nearly all open data, the portals addressed demonstrated relatively high results.

In addition, some OGD portals were found to have a delayed response during the pandemic compared to the normal situation without emergencies. However, in some aspects, such as machine-readability, most OGD portals demonstrated significantly better results, i.e. Covid-19-related data were provided in an easy to process format, while usually this aspect is a challenge for some countries.

V. CONCLUSIONS

Open data are characterized by a list of principles that should be satisfied to admit data as open data. This paper addresses one of them, that, despite being one of the primary, is perhaps one of the most challenging, because it can disrupt users trust in data and even the desire to use the entire open data portal - "timeliness".

Usually the assessment of this aspect is a very difficult non-trivial task, but 2020, unfortunately, provided us with an opportunity to find out this. This became simple enough by addressing the timeliness of Covid-19-related data sets in relation to the first cases in the country. This is even more crucial in times of pandemic when the OGD portal becomes the most up-to-date tool to track the situation in the country and source for producing value-added open data-based solutions and data-driven decision-making, making clear, how quickly OGD portals respond to emergencies by opening and updating data for their further potential reuse, which is essential in the digital data-driven world, especially during pandemic.

Thus, the study fills out the lack of comparative studies on the timeliness of data of 52 OGD portals (addressing 60 countries), providing a report on how much and what are those countries providing open data as soon as possible, taking into account the emergent situation and which countries face challenges in these terms.

It is clear that these results cannot be generalized, since only one specific topic has been addressed, but, nevertheless, this shows the behaviour trends of the OGD portals in terms of extreme situations. The results of a very simple analysis show that even a pandemic cannot compel OGD portals to publish the data that complies with all open data principles. However, there are countries which portals are sufficiently competitive. In most cases, these countries are the same ones that show high results out of pandemic times.

The paper also shows that open data, particularly those published and updated in time, attract audience interest and are used not only to track the state of play in the country, but also to develop solutions that benefit the entire society as expected from the open data (the case for France, Spain, Cyprus, the Netherlands, Taiwan, Austria, Switzerland, etc.). Thus, the publication of open data should be done not only because it is a modern trend, but also because it incentivises scientists, researchers and enthusiasts to reuse them by transforming data into knowledge and value, providing solutions transforming and improving the world.

REFERENCES

[1] N. Gonzálvez-Gallego, L. Nieto-Torrejón, M.C. Pérez-Cárceles, "Is Open Data an Enabler for Trust? Exploring the Link and the Mediating Role of Citizen Satisfaction," International Journal of Public Administration, 1-10, 2019.

[2] M. S. Altayar, "Motivations for open data adoption: An institutional theory perspective," Government Information Quarterly, 35(4), 633-643, 2018

[3] European Data Portal (2020), *The Power of Data in the Everlasting Battle: Humanity vs. Virus (2/2)*. [Online]. Available from: https://www.europeandataportal.eu/en/covid-19/stories/power-data-everlasting-battle-humanity-vs-virus-22

[4] Open Data Watch, DATA in the time of COVID-19, https://opendatawatch.com/what-is-being-said/data-in-the-time-of-covid-19/

[5] S. Lai et al., "Effect of non-pharmaceutical interventions for containing the COVID-19 outbreak in China,"medRxiv, 2020.

[6] Open data Institute, https://theodi.org/article/covid-19-making-data-and-models-open-is-part-of-the-fight-against-it-governments-must-act-now

[7] Tauberer, J., "Open Government Data: The Book," [online]. 2014, [vid. 2015-04-12]. Dostupné z: https://opengovdata. io.

[8] M. N. Cantor, R. Chandras, C. Pulgarin, "FACETS: using open data to measure community social determinants of health," Journal of the American Medical Informatics Association, 25(4), 419-422, 2018.

[9] *COVID-19 pandemic by country and territory*. [Online]. Available from: https://en.wikipedia.org/wiki/COVID-19_pandemic_by_country_and_territory

[10] Open Data Charter (ODC), *Principles*. [Online]. Available from: https://opendatacharter.net/principles/

[11] S. Saxena, "Drivers and barriers towards re-using open government data (OGD): a case study of open data initiative in Oman," Foresight, Vol. 20(2), 2018.

[12] S. Saxena, "Usage by stakeholders" as the objective of "transparency-by-design" in open government data," Information and Learning Science, 2017.

[13] A. S. Hellberg, K. Hedström, "The story of the sixth myth of open data and open government. Transforming Government: People, Process and Policy", Vol. 9 Iss 1 pp. 35–51. 2015.

[14] A. Zuiderwijk, M. Janssen, "Open data policies, their implementation and impact: A framework for comparison," Government Information Quarterly 31, 17-29, 2014.

[15] P. Escobar, G. Candela, J. Trujillo, M. Marco-Such, J. Peral, "Adding value to Linked Open Data using a multidimensional model approach based on the RDF Data Cube vocabulary," Computer Standards & Interfaces, 68, 103378, 2020.

[16] G. Smith, J. Sandberg, "Barriers to innovating with open government data: Exploring experiences across service phases and user types," Information Polity, 23(3), 249-265, 2018.

[17] G. S. Craveiro, J. A. Machado, J. S. Machado, "The use of open government data to citizen empowerment", In Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance (pp. 398-399), 2016.

[18] G. Magalhães, C. Roseira, "Exploring the barriers in the commercial use of open government data," In Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance (pp. 211-214), 2016.

[19] U. Atz, "The tau of data: A new metric to assess the timeliness of data in catalogues," In CeDEM14 Conference for E-Democracy and Open Government, 22, 147-162, 2014.

[20] B. S. Hitz-Gamper, O. Neumann, M Stürmer, "Balancing control, usability and visibility of linked open government data to create public value," International journal of public sector management, 32(5), 457-472, 2019.

[21] L. Sigurdardottir et al., "Data quality at the Icelandic Cancer Registry: comparability, validity, timeliness and completeness," Acta oncologica, 51(7), 880-889, 2012.

[22] A. Vetrò et al., "Open data quality measurement framework: Definition and application to Open Government Data," Government Information Quarterly, 33(2), 325-337, 2016.

[23] G. Viscusi, B. Spahiu, A. Maurino, C. Batini, "Compliance with open government data policies: An empirical assessment of Italian local public administrations," Information Polity, 19(3, 4), 263-275, 2014.

[24] G. Silva, P. Bartholomay, O. G. Cruz, L. P. Garcia, "Evaluation of data quality, timeliness and acceptability of the tuberculosis surveillance system in Brazil's micro-regions," Ciência & Saúde Coletiva, 22, 3307-3319, 2017.

[25] G. Hyman et al., "Open data in Amazonia and its implications for sustainable development," AGUFM, PA22A-02, 2019.

[26] L. Dailey, R. Watkins, A. Plant, "Timeliness of data sources used for influenza surveillance," Journal of the American Medical Informatics Association, 14(5), 626-631, 2007.

[27] A. Nikiforova, "Comparative analysis of national open data portals or whether your portal is ready to bring benefits from open data," In IADIS International Conference on ICT, Society and Human Beings, pp. 81-88, 2020.

[28] A. Nikiforova, "Assessment of the usability of Latvia's open data portal or how close are we to gaining benefits from open data," In IADIS 14th International Conference on Interfaces and Human Computer Interaction, pp. 51-28, 2020.

[29] A. Nikiforova, K. McBride, "User-centred Comparative Usability Analysis of 41 Open Government Data Portals: Understanding What Works and What Does not", 2020 (in press).

[30] European Data Portal, *Open Data in Europe 2019*. [Online]. Available from: https://www.europeandataportal.eu/en/dashboard/2019

[31] R. Máchová, R., M. Hub, M. Lnenicka, "Usability evaluation of open data portals." Aslib Journal of Information Management, 2018.

[32] A. Purwanto, A. Zuiderwijk, M. Janssen, "Citizens' Trust in Open Government Data: A Quantitative Study about the Effects of Data Quality, System Quality and Service Quality." In *The 21st Annual International Conference on Digital Government Research*, pp. 310-318, 2020

[33] Generalitat de Catalunya. Govern obert. http://governobert.gencat.cat/ca/dades_obertes/dades-obertes-covid-19/

[34] Data.gov.lv, "*Latvijas atvērtie dati par COVID-19 tiek izmantoti visā pasaulē*" https://data.gov.lv/lv/aktualitates/latvijas-atvertie-dati-par-covid-19-tiek-izmantoti-visa-pasaule (available in Latvian)