measurement and assessment of OGD on platforms which will increase positive impact on them and will go toward higher standards of quality and government openness.

Automatic evaluation and assessment of OGD on platforms can be achieved by using open data platform's APIs. Their aim is to serve as machine accessible and readable source of information. They can be examined in order to check whether exposed information is conforming to defined quality levels.

Monitoring and analysing user behaviour, while exploiting OGD platforms, can have twofold advantage for platform managers. From one side, valuable information on utilized metadata of OGD datasets can be observed and potential black holes in their definition identified, while on the other side, empirical evidence of relations between of quality and OGD usage[29] can be obtained. Furthermore, OGD platforms should comply with FAIR principles (Findability, Accessibility, Interoperability and Reusability). Exhaustive OGD usage assessment, particularly in the form of pools, could be performed to reveal the impact on OGD adoption of contextual aspects, such as users' needs and competencies, as well as research of the role and influence of mediate OGD usage modes.

QODA Methodology

QODA (Quality of Open government DAtasets) methodology analyses two aspects: OGD Quality and OGD Portal Quality (depicted in Fig. 1). The proposed methodology is continuation of our research[5] considering current trends and state-of-the art in this area.

We have identified the need to address the quality of platform on which OGD are published, and that is the reason why in our methodology OGD platform is important constituent. QODA methodology enables evaluation of OGD quality, against predefined set of measures, which will be described in details in the following paragraphs

OGD quality aspect (OQA) in QODA methodology consists of 7 parts:

Complete – with this sub aspect we seek to ensure that each OGD dataset is equipped with metadata for description, whether they are machine readable, downloadable and eventually linked with other data (Eq. 1). According to this feature, complete is calculated and taken into account when OQA is determined. Keeping in mind that on some OGD platforms, description of the dataset is separated of the description of the dataset resource, we decided to scale description measure of complete aspect in the way that description of dataset takes 80% of the measure, while 20% goes to the description of the dataset (Eq. 2).

$$complete = description + download + machineReadable + linked \quad \ldots (1)$$

$$complete["description"] = 0.8 * datasetDescription + 0.2 * resourceDescription \quad \ldots (2)$$

Timely– under this aspect we consider if the data are actual, updated on time, how often they are updated, validity period and when was the last update. Previously mentioned information is equally important for both datasets in general and dataset resources, and that is the reason why they are equally weighted in the final score (Eq. 3).

$$timely = 0.5 * datasetTimellines + 0.5 * resourceTimellines \quad \ldots (3)$$

Primary – by this we mean their publication in original format, without aggregation and modification, directly from source of origination. In that form, they ensure the subtle level of granularity that is satisfactory from the aspect of legislation and other requirements[5].

Categorized– by grouping, or classification of OGD, by some established criteria, data availability and discoverability is increased. Moreover, categorized

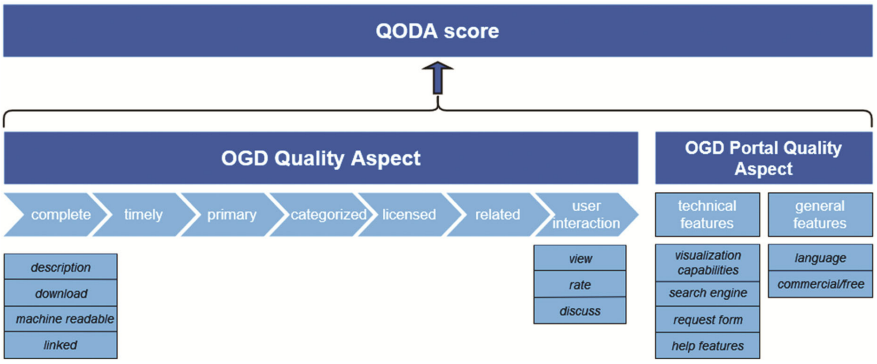

Fig. 1 — QODA methodology – Building blocks

OGD datasets make it easier to obtain desired information. For these purposes, the advantage of metadata accompanying dataset is utilized and thus contributes to the overall quality of OGD.

Licensed– by checking this sub aspect, we review whether OGD is truly open or available per request. Mostly, OGD are license free and available without any restrictions.

Related – relation of OGD with other data, especially with those on the same platform is important in searching for information of interest. Furthermore, relation of OGD datasets by exploiting semantic interlinking between datasets contributes to the established aim of our paper.

User interaction– by utilization of this sub aspect of OQA measure, we are checking user contribution in OGD promotion and reuse, by exploiting whether end users are using OGD datasets, whether user expresses their satisfaction with published data by rating them and whether they contribute to the forming of the discussion. This will guide and direct the OGD publishers to the valuable source of information for further improvements of the platform and OGD itself.

OGD portal quality aspect (OPQA) in QODA methodology consists of two parts:

Technical features – features of the OGD platform such as visualization capabilities, search engine capability, request form for seeking of datasets and help documentation represent the basic prerequisites for achieving quality[3,9] and fitness for use, from the technical point of view.

General features– availability of language change and information whether OGD platform is license free, or commercial, are constituent for successful user consumption of OGD data in modern applications.

$$opqa = 0.7 * technical\ Features + 0.3 * general\ Features \quad \ldots (4)$$

As both OQA and OPQA values contribute to the final QODA score. Its calculation is performed according to the Eq. 5.

$$\text{QODA score} = 0.7 * \text{oqa} + 0.3 * \text{opqa} \quad \ldots (5)$$

QODA methodology reflects the requirements and experiences of the data consumers and balance metadata functionality against applicable constraints, in order to extract, as much as possible, information from OGD, which can be of the great potential for assessing the OGD quality.

To calculate QODA score, we seek for metadata elements on OGD platforms for the purposes of denoting presence or absence of such elements, along with checking whether the element is filled with data, as well as, if data are of some kind.[8] We examine metadata elements shown in Table 1.

Table 1 — Examined metadata for OGD quality — (*Contd.*)

platform	quality aspect		parameter	metadata field
CKAN	OGD Quality Aspect	complete	description	[notes], resources → [description]
			download	resources → [url]
			machine readable	resources → [format], {csv, json, xml...}, resources → [mimetype]
			linked	[relationship_as_object], [relationships_as_subject]
		timely		[metadata_created], [metadata_modified], extras → [temporal_coverage_from], extras → [temporal_coverage_to], extras → [frequency-of-update], extras → [date_updated], resources → [created], resources → [last_modified]
		primary		resources → [format]
		categorized		[tags], [groups], extras → [categories]
		licensed		[is_open], [private], [license_title], [license_id], [license_url]
		related		[relationship_as_object], [relationships_as_subject]
	OGD Portal Quality Aspect	user interaction	view	tracking_summary → [recent], tracking_summary → [total]
			rate	[rating_count], [rating_average]
			discuss	
		technical features	visualisation capabilites	
			search engine	
			request form	
			help features	
		general features	language	
			commercial/free	

(*Contd.*)

Table 1 — Examined metadata for OGD quality — (*Contd.*)

platform	quality aspect		parameter	metadata field
DKAN	OGD Quality Aspect	complete	description	[notes], resources→[description]
			download	resources → [url]
			machine readable	resources → [format], {csv, json, xml...}, resources → [mimetype]
			linked	[relationship_as_object], [relationships_as_subject]
		timely		[metadata_created], [metadata_modified], extras → [temporal_coverage_from], extras → [temporal_coverage_to], extras → [frequency-of-update], extras → [date_updated], resources → [created], resources → [last_modified]
		primary		resources → [format]
		categorized		[tags], [groups], extras → [categories]
		licensed		[is_open], [private], [license_title], [license_id], [license_url]
		related		[relationship_as_object], [relationships_as_subject]
		user interaction	view	tracking_summary → [recent], tracking_summary → [total]
			rate	[rating_count], [rating_average]
			discuss	
	OGD Portal Quality Aspect	technical features	visualisation	
			capabilites	
			search engine	
			request form	
			help features	
		general features	language	
			commercial/free	
Socrata	OGD Quality Aspect	complete	description	[description]
			download	[download Count]
			machine readable	[columns]*
			linked	
		timely		[created At], [publication Date], [rows UpdatedAt], metadata → custom fields → 'Time Frame' → [Date Created], metadata → custom fields → 'Time Frame' → [Period of Coverage], metadata → custom fields → 'Time Frame' → [Update Frequency]
		primary		[columns]*
		categorized		[tags], [category]
		licensed		license → [name], [rights], grants → [flags]
		related		
		user interaction	view	[viewCount], [viewLastModified]
			rate	[average Rating], [totalTimesRated]
			discuss	[number Of Comments]
	OGD Portal Quality Aspect	technical features	visualisation	
			capabilites	
			search engine	
			request form	
			help features	
		general features	language	
			commercial/free	
		complete	description	metas → default → [description]
			download	
			machine readable	[fields]*
			linked	metas → default → [references]
Open Data Soft	OGD Quality Aspect	timely		metas → default → [modified], metas → default → [metadata_processed], metas → default → [data_processed], metas → dcat → [temporal_coverage_start], metas → dcat → [temporal_coverage_end]

(*Contd.*)

Table 1 — Examined metadata for OGD quality — (*Contd.*)

platform	quality aspect		parameter	metadata field
Open Data Soft	OGD Quality Aspect	primary		[fields]*
		categorized		metas → default → [keyword]
		licensed		metas → default → [license], metas → default → [license_url]
		related		metas → default → [references]
	OGD Portal Quality Aspect	user interaction	view	
			rate	
			discuss	
		technical features	visualisation	
			capabilites	
			search engine	
			request form	
			help features	
		general features	language	
			commercial/free	
U Data	OGD Quality Aspect	complete	description	[description], resources→[description]
			download	resources → [url]
			machine readable	resources → [format], {csv, json, xml...}, resources → [mimetype]
			linked	
		timely		[createdAt], [frequency], [frequency_date], [last_modified], [last_update], [temporal_coverage], resources → [last_modified], resources → [latest], resources → [published]
		primary		resources → [format], resources → [mime]
		categorized		[tags]
		licensed		[private]
		related		
	OGD Portal Quality Aspect	user interaction	view	metrics → [views], metrics → [reuses], metrics → [followers]
			rate	metrics → [issues]
			discuss	metrics → [discuss]
		technical features	visualisation	
			capabilites	
			search engine	
			request form	
			help features	
		general features	language	
			commercial/free	

Condition used in all cases: 1 - defined, 0 - undefined

As it can be seen from Table 1, evaluation of *complete* sub aspect is done through four parts where each part is examined by separate metadata fields on OGD platform. These metadata fields are different from platform to platform, and they are not unique for all. For example, CKAN and DKAN platforms are same in general, and they share almost all fields. Moreover, in analysis of machine readable feature, we assess dataset format in order to check whether indeed they are machine-readable or not. OQA aspect can be calculated automatically, while OPQA must be done manually. This is the reason, why in Table 1 general and technical features are empty for metadata fields. For some sub aspect of OQA there are more than one metadata fields to be examined and all of them should be considered.

For some sub aspects of OQA there are no adequate metadata fields (*related* sub aspect of OQA for Socrata, OpenDataSoft and uData) to be examined, and thus they obtain 0 value. Metadata fields marked with '*' means that they have separated API for access and consumption of that data. Consequently, this means that such data are machine-readable by default. Moreover, some platforms such as Socrata and OpenDataSoft have separate API for download of OGD datasets and they are marked in that manner.

Results and Discussion

Evaluation of QODA Methodology — Usecase Approach

In order to perform preliminary check of chosen OGD portals, we have selected portals from the official websites of the CKAN (https://ckan.org), DKAN (https://getdkan.org), SOCRATA (https://dev.socrata.com), Open Data Soft (https://www.opendatasoft.com) and uData (https://github.com/opendatateam/udata) platform. For each platform we have selected up to 15 portals, with exception for the uData platform which is relatively new and there are just 4 portals running on it. For selected OGD portals, we examined how many datasets are published, average number of complete metadata fields per dataset and average number of machine readable formats per dataset. Results of these assessments are presented in Table 2.

What we see from Table 2 conforms to expectations that CKAN platform has most published datasets per portal, but the level of complete metadata fields and machine-readable formats is not very high. In this regard, DKAN platform has better results, as DKAN is OGD platform very similar to the CKAN. Also, it can be noticed that SOCRATA and Open Data Soft OGD platforms have best results for the level of average number of machine-readable formats per dataset. This is because these platforms have separate API calls for accessing published data. More precisely, SOCRATA and OpenDataSoft publish data only in tabular format, and offer possibility to export them in various machine-readable formats such as, CSV, JSON, XML, RDF etc. Furthermore, among all tested portals, only SOCRATA powered OGD portals

Table 2 — Statistical analysis of examined OGD portal

Platform	Portal	Number of datasets	AVG number of complete metadata fields per dataset	AVG number of machine-readable formats per dataset
uData	https://data.gov.rs/api/1/datasets	1822	64%	67%
	https://dados.gov.pt/api/1/datasets	4910	65%	39%
	https://data.public.lu/api/1/datasets/	1600	63%	13%
	https://www.data.gouv.fr/api/1/datasets/	41037	66%	40%
CKAN	https://ckan.publishing.service.gov.uk/api/3/action/package_list	52448	68%	30%
	https://open.canada.ca/data/api/3/action/package_list	31755	63%	29%
	https://ckan.opendata.swiss/api/3/action/package_list	6963	74%	13%
	https://datos.gob.mx/busca/api/3/action/package_list	9287	60%	14%
	https://data.go.th/api/action/package_list	5898	74%	45%
	https://data.gov.au/api/3/action/package_list	13376	72%	13%
	https://www.govdata.de/ckan/api/3/action/package_list	49571	64%	5%
	https://open.africa/api/3/action/package_list	6490	64%	45%
	https://data.gov.ie/api/3/action/package_list	13373	75%	36%
	https://data.humdata.org/api/3/action/package_list	31796	71%	39%
	https://data.gov.ro/api/3/action/package_list	2691	69%	78%
	https://data.gov.sk/api/3/action/package_list	2841	72%	60%
	https://dados.gov.br/api/3/action/package_list	11029	75%	56%
	https://data.buenosaires.gob.ar/api/3/action/package_list	423	78%	46%
	http://opendata.hu/api/3/action/package_list	67	60%	21%
DKAN	https://data.gov.gh/api/3/action/package_list	315	100%	90%
	https://data.city.kyoto.lg.jp/api/3/action/package_list	606	100%	78%
	https://data.gov.jm/api/3/action/package_list	32	100%	83%
	https://dadesobertes.diba.cat/api/3/action/package_list	76	90%	81%
	https://opendata.by/api/3/action/package_list	229	100%	49%
	http://data.mmr.cz/api/3/action/package_list	43	73%	100%
	https://dati.gov.it/opendata/api/3/action/package_list	52519	72%	82%
	https://data.cambridgeshireinsight.org.uk/api/3/action/package_list	235	72%	65%
	https://opendata.transport.nsw.gov.au/api/3/action/package_list	206	60%	5%
	https://datosabiertos.rosario.gob.ar/api/3/action/package_list	245	100%	78%
	https://data.nicva.org/api/3/action/package_list	164	100%	80%
	https://opendata.bonn.de/api/3/action/package_list	327	100%	82%
	https://dati.comune.genova.it/api/3/action/package_list	138	100%	81%
	https://data.louisvilleky.gov/api/3/action/package_list	280	100%	53%
	https://data.gov.sa/Data/en/api/3/action/package_list	6442	100%	75%

(*Contd*.)

Table 2 — Statistical analysis of examined OGD portal

Platform	Portal	Number of datasets	AVG number of complete metadata fields per dataset	AVG number of machine-readable formats per dataset
SOCRATA	https://data.edmonton.ca/api/catalog/v1	2519	100%	100%
	https://data.cityofnewyork.us/api/catalog/v1	3516	100%	100%
	https://www.dati.lombardia.it/api/catalog/v1	5432	100%	100%
	https://data.texas.gov/api/catalog/v1	1284	100%	100%
	https://data.honolulu.gov/api/catalog/v1	306	100%	100%
	https://cohesiondata.ec.europa.eu/api/catalog/v1	1139	100%	100%
	http://www.datos.gov.co/api/catalog/v1	28964	100%	100%
	https://healthdata.gov/api/catalog/v1	4308	100%	100%
	http://www.pivcide.pr/api/catalog/v1	70	100%	100%
	http://data.usaid.gov/api/catalog/v1	1510	100%	100%
	http://data.sfgov.org/api/catalog/v1	1087	100%	100%
	http://citydata.mesaaz.gov/api/catalog/v1	930	100%	100%
	http://data.cincinnati-oh.gov/api/catalog/v1	156	100%	100%
	http://data.novascotia.ca/api/catalog/v1	1113	100%	100%
	http://www.data.act.gov.au/api/catalog/v1	1127	100%	100%
OpenDataSoft	https://public.opendatasoft.com/api/v2/catalog/datasets	623	50%	100%
	https://data.explore.star.fr/api/v2/catalog/datasets	42	57%	100%
	https://data.laregion.fr/api/v2/catalog/datasets	1711	46%	100%
	https://www.data.corsica/api/v2/catalog/datasets	502	56%	100%
	https://opendata.vancouver.ca/api/v2/catalog/datasets	177	36%	100%
	https://ressources.data.sncf.com/api/v2/catalog/datasets	216	51%	100%
	https://opendata.wuerzburg.de/api/v2/catalog/datasets	107	62%	100%
	https://opendata.comune.bologna.it/api/v2/catalog/datasets	425	53%	100%
	https://data.gouv.nc/api/v2/catalog/datasets	153	49%	100%
	https://transparencia.sns.gov.pt/api/v2/catalog/datasets	148	58%	100%
	https://data.education.gouv.fr/api/v2/catalog/datasets	92	50%	100%
	https://opendata.bristol.gov.uk/api/v2/catalog/datasets	221	64%	100%
	https://data.leicester.gov.uk/api/v2/catalog/datasets	181	66%	100%
	https://data.montreuil.fr/api/v2/catalog/datasets	152	66%	100%
	https://data.bs.ch/api/v2/catalog/datasets	152	54%	100%

has all complete metadata fields, i.e. all metadata defined. Some of the analysed OGD portals has lower than 50% (or near that value) the level of complete metadata fields per dataset on OGD portals, which may throttle the power of OGD. These portals should address this issue, as more detailed metadata for each dataset on portal, contributes to the overall quality of OGD, which consequently improves application processing.[5]

By observing the data for the number of the OGD datasets per portal, we came to conclusion that would be time consuming to test all of them, and therefore we decided to apply statistical sampling of the datasets in order to perform tests needed for checking whether the proposed methodology for determining the quality of OGD is applicable. For this purpose, we need to select a relevant subset of the datasets on each OGD portal. This can be achieved by using statistical approach which can ensure a reliable method for sample size calculation with given constraints[30] as shown in Eq. (6). Included constraints were confidence level (Z), margin of error (c) and accuracy (p).

$$S = \frac{Z^2 * p * (1-p)}{c^2} \quad \ldots (6)$$

$$S = \frac{S}{1 + \frac{S-1}{P}} \quad \ldots (7)$$

c describes the precision of a chosen sample and deviation of expected results. For the purposes of our assessment, it was valued at 10. Z is in the form of percentage, and helps to check whether sampled data meet the required feature and whether they are inside of the confidence interval. In our assessment, we choose confidence level of 95%, for which Z will take the value of 1.65 as per table of standard normal curve. p stand for accuracy. Reliable prediction of this percentage is not feasible, which is the reason why we have chosen 50% for p parameter. Taking into account whole assessed population denoted by P, by Eq. (7) we obtain necessary sample size.

In assessment of OGD portals against QODA methodology described throughout this paper, we apply

use case study approach. Assessment was performed on the OGD portals as listed in Table 2 for aspects defined in Table 1. Assessed OGD portals are of country or city level. Each metadata is tested, to see whether it is defined or not, and if it is defined it receives value 1, otherwise 0. Then we summarize the values for each sub aspect and calculate the mean value. Further, values for each sub aspect are added and divided by total number of sub aspects obtaining thus the final value for OQA aspect of QODA methodology. The OPQA aspect of QODA methodology is calculated manually. This manual calculation is done in that manner that for each portal we examine whether the proposed characteristic is defined or not (consequently obtaining 1 or 0), then sum the values and divide it with total number of characteristics. In Table 3 we present results of assessment.

The best results has OGD portal in Portugal with value 0.7131. This portal is powered by uData OGD platform. The newly established uData OGD platform solves some shortcomings of existing platforms, both open source and commercial, among which is performance issues, easy interface and better API support. Closer to the Portugal national OGD portal is Basel (Switzerland) OGD portal, a city level portal, with QODA score of

Table 3 — Results of assessment by QODA methodology — (*Contd.*)

platform	portal	OQA value	OPQA value	QODA score
uData	https://data.gov.rs/api/1/datasets	0.5775	0.5000	0.5543
	https://dados.gov.pt/api/1/datasets	0.5902	1.0000	0.7131
	https://data.public.lu/api/1/datasets/	0.5920	0.8750	0.6769
	https://www.data.gouv.fr/api/1/datasets/	0.5678	0.6250	0.5850
CKAN	https://ckan.publishing.service.gov.uk/api/3/action/package_list	0.3927	0.4500	0.4099
	https://open.canada.ca/data/api/3/action/package_list	0.4028	0.8750	0.5445
	https://ckan.opendata.swiss/api/3/action/package_list	0.3628	0.7500	0.4790
	https://datos.gob.mx/busca/api/3/action/package_list	0.4765	0.6250	0.5211
	https://data.go.th/api/action/package_list	0.4797	0.6250	0.5233
	https://data.gov.au/api/3/action/package_list	0.4824	0.6250	0.5252
	https://www.govdata.de/ckan/api/3/action/package_list	0.4887	0.5000	0.4921
	https://open.africa/api/3/action/package_list	0.4579	0.8750	0.5830
	https://data.gov.ie/api/3/action/package_list	0.4704	0.8750	0.5918
	https://data.humdata.org/api/3/action/package_list	0.4713	0.6250	0.5174
	https://data.gov.ro/api/3/action/package_list	0.4574	1.0000	0.6202
	https://data.gov.sk/api/3/action/package_list	0.5115	0.7500	0.5831
	https://dados.gov.br/api/3/action/package_list	0.4879	0.5000	0.4915
	https://data.buenosaires.gob.ar/api/3/action/package_list	0.4228	0.3750	0.4085
	http://opendata.hu/api/3/action/package_list	0.4602	0.7500	0.5471
DKAN	https://data.gov.gh/api/3/action/package_list	0.5087	0.5000	0.5061
	https://data.city.kyoto.lg.jp/api/3/action/package_list	0.3364	0.5000	0.3855
	https://data.gov.jm/api/3/action/package_list	0.4985	0.3750	0.4615
	https://dadesobertes.diba.cat/api/3/action/package_list	0.4871	0.6250	0.5285
	https://opendata.by/api/3/action/package_list	0.4949	0.6250	0.5339
	http://data.mmr.cz/api/3/action/package_list	0.4979	0.8750	0.6110
	https://dati.gov.it/opendata/api/3/action/package_list	0.4499	0.5000	0.4649
	https://data.cambridgeshireinsight.org.uk/api/3/action/package_list	0.4960	0.6250	0.5347
	https://opendata.transport.nsw.gov.au/api/3/action/package_list	0.4722	0.5000	0.4805
	https://datosabiertos.rosario.gob.ar/api/3/action/package_list	0.4930	0.5000	0.4951
	https://data.nicva.org/api/3/action/package_list	0.4894	0.6250	0.5301
	https://opendata.bonn.de/api/3/action/package_list	0.4837	0.6250	0.5261
	https://dati.comune.genova.it/api/3/action/package_list	0.4877	0.5000	0.4914
	https://data.louisvilleky.gov/api/3/action/package_list	0.4134	0.7500	0.5144
	https://data.gov.sa/Data/en/api/3/action/package_list	0.3540	1.0000	0.5478
SOCRATA	https://data.edmonton.ca/api/views	0.6733	0.5000	0.6213
	https://data.cityofnewyork.us/api/views	0.6379	0.3750	0.5590
	https://www.dati.lombardia.it/api/views	0.6452	0.5000	0.6016
	https://data.texas.gov/api/views	0.5964	0.5000	0.5675
	https://data.honolulu.gov/api/views	0.6188	0.5000	0.5832
	https://cohesiondata.ec.europa.eu/api/views	0.5987	0.3750	0.5316
	http://www.datos.gov.co/api/views	0.5609	0.6250	0.5801
	https://healthdata.gov/api/views	0.6140	0.3750	0.5423

(*Contd.*)

Table 3 — Results of assessment by QODA methodology

platform	portal	OQA value	OPQA value	QODA score
	http://www.pivcide.pr/api/views	0.6536	0.3750	0.5700
	http://data.usaid.gov/api/views	0.6536	0.5000	0.6075
	http://data.sfgov.org/api/views	0.6300	0.3750	0.5535
	http://citydata.mesaaz.gov/api/views	0.5952	0.3750	0.5291
	http://data.cincinnati-oh.gov/api/views	0.6274	0.3750	0.5517
	http://data.novascotia.ca/api/views	0.6522	0.3750	0.5690
	http://www.data.act.gov.au/api/views	0.5991	0.3750	0.5319
Open Data Soft	https://public.opendatasoft.com/api/v2/catalog/datasets	0.7342	0.3750	0.6264
	https://data.explore.star.fr/api/v2/catalog/datasets	0.6178	0.3750	0.5450
	https://data.laregion.fr/api/v2/catalog/datasets	0.5239	0.3750	0.4792
	https://www.data.corsica/api/v2/catalog/datasets	0.6986	0.3750	0.6015
	https://opendata.vancouver.ca/api/v2/catalog/datasets	0.4871	0.5000	0.4910
	https://ressources.data.sncf.com/api/v2/catalog/datasets	0.6214	0.3750	0.5475
	https://opendata.wuerzburg.de/api/v2/catalog/datasets	0.5633	0.3750	0.5068
	https://opendata.comune.bologna.it/api/v2/catalog/datasets	0.5517	0.3750	0.4987
	https://data.gouv.nc/api/v2/catalog/datasets	0.7991	0.3750	0.6719
	https://transparencia.sns.gov.pt/api/v2/catalog/datasets	0.4768	0.3750	0.4463
	https://data.education.gouv.fr/api/v2/catalog/datasets	0.6435	0.3750	0.5630
	https://opendata.bristol.gov.uk/api/v2/catalog/datasets	0.6436	0.3750	0.5630
	https://data.leicester.gov.uk/api/v2/catalog/datasets	0.6214	0.3750	0.5475
	https://data.montreuil.fr/api/v2/catalog/datasets	0.7144	0.3750	0.6126
	https://data.bs.ch/api/v2/catalog/datasets	0.7504	0.6250	0.7128

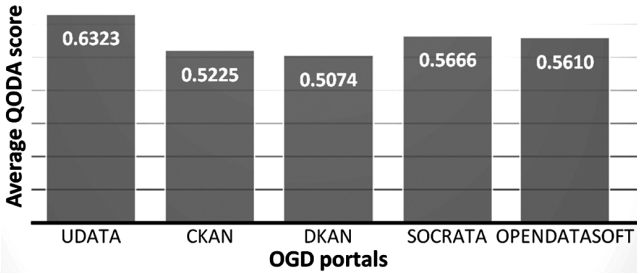

Fig. 2 — Overall quality of OGD portals for each platform shows average QODA score per each platform of analysed OGD portals

0.7128. Lowest results were noticed for city portal of Kyoto with value of 0.3855, powered by DKAN.

Furthermore, it can be noticed, that only few portals have highest score for OPQA aspect, and similarly, more than a half of assessed portals have a value lower than 0.5. From the user point of view, this aspect of QODA methodology is important for their perception of usage of OGD platform, enabling thus availability of tools and methods for fast data analysis and preview.[13,26,29] Moreover, this confirms our assumption that quality features of the OGD platforms must be considered in determining the quality of OGD in a whole as OGD platforms makes OGD available to all, whether they are developers or ordinary users.

It can be seen that Fig. 2 shows average QODA score per each platform of analysed OGD portals. uData has a great potential to be a leader in this area, while the other platforms can improve their rating. SOCRATA and OpenDataSoft goes toward this, as they offer machine processing of published OGD data, boosting in this manner the availability of OGD in applications, while for others these should be recommendation.

Conclusions

As OGD platforms represent the bridge between the government and users of OGD, governments need to pay more attention to OGD quality maintenance. The QODA methodology presented in this paper is the resumption of research we have referenced before. Here we have proven that OGD quality depends on data provider, but nevertheless, either national or city level data publishers may have data quality problems. Quality of OGD must be continually monitored and potential quality problems need to be detected, explored and solved. Consequently, this will affect the usability of OGD by end users, as well as the success of the initiative in general.

Our QODA methodology contributes to the identification of potential issues in OGD quality that can affect its consumption in applications and provide the specification of OGD quality requirements that should be addressed for achievement of the better quality of data. Also, QODA methodology can be utilized for identification of places in metadata structure of OGD platform that need to be improved upon. From practical point of view and based on findings of applied use case

study approach, it is recommended to OGD publishers to constantly track the exploitation of published OGD datasets with aim to have timely and punctual information on OGD portals with special attention on quality features.

Further research should be done towards fine grained adjustment of QODA coefficients which will reflect in more accurate and precise information about quality of OGD. In this regards an in-depth check of appropriateness of targeted quality features in the light of provided metadata values can help. Also, checking whether metadata values that are part of quality features check correspond to what is annotated is helpful. If the OGD quality is not high enough, potential users may not see a positive impact and will find portals unusable and not fitting their purposes. The quality of OGD has direct impact on trust and indirect on the user satisfaction.

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