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Evaluating the Quality of Open Data Portals in Iran

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ABSTRACT

Purpose: The purpose of this study is to investigate the general characteristics (technical dimension, access and communication and participation) and the general characteristics of the data set of Iran's open data portals. **Methodology:** This is a descriptive survey study. A questionnaire with 28 criteria distributed among 30 Ph.D. students in Information Systems is based on the framework used in the research of Renata Máchová1 and Martin Lněnička. **Findings:** The average score of general characteristics of the open data portal with 33.22 is higher than general characteristics of the data set with the average score of 24.87. Overall score of the quality of components of Iranian open data portals is 91.29. The highest score obtained among the portals is related to Iran's open data portal (108.1). **Conclusion:** The results of comparing the average quality of Iran's open data portals show that the quality of these collections is at a low level. Comparing the average score of the quality of Iran's open data portals (108.1) with the three leading countries in the field of open data included Britain, India, and the United States (higher than 124) shows that Iran is not in a favorable position. It is necessary to pay attention to policy in the field of open data quality.

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1. Introduction

As the importance of the data-driven economy increases, governments with the ability to extract the most benefit from analyzing their data have power at the social, economic, cultural, and political levels.

In recent years, governments around the world have begun to open up their data, called the Open Government Movement, which has created open data portals and related infrastructures aimed at accessing government data and discovering the impact of parsing. Their analysis is in the relevant decisions.

Governments around the world are releasing large amounts of data in an accelerated manner. Although some of the published data is easily accessible, some are still stuck on paper. Through all levels of government, millions of data files are collected and stored from insurance information to unemployment rates, employment, finance, energy, and so on. Many of these data can be easily made available to the public. This data enables people to perform innovative processes.

According to Jetzek et al. (2019), the open data term points originally to data that has been generated or collected by government agencies for one specific purpose, but it is also now available to the public for other purposes. There are potential benefits of OGD as following:

1. The data can be shared and used by many at the same time at no additional cost;
2. The data have productive value, often used as a resource for the production of something of interest and are rarely consumed directly; and
3. The data is versatile and can be used as an input for a wide range of goods and services.

Today, "open data strategies to increase transparency, participation and / or efficiency" are defined and implemented by governments around the world (Huijboom and Van den Broek, 2011).

Reusable data format can activate new services and offer innovative jobs, improve service quality, reduce existing service costs, enhance citizen participation and / or government efficiency, increase trust Increase government transparency (in the case of open government data) (Welle Donker, and Loenen, 2017; Nikiforova, 2018).

Open data is usually used with a common assumption that it is of high quality and is ready to process without additional activities (such as quality checks). It is often used in analysis making important (business) decisions according to analysis results. Its quality influences decision-making and data quality problems can lead to huge losses.

Given the common assumption that open data is usually of high quality and ready to be processed and used without additional activities such as a quality review. By analyzing open data, they are often used in important decisions. Its quality influences decision making and data quality problems can lead to many damages that have been proven many times.

This fact, quality influences decision making and data quality problems can lead to many damages, has been proven many times (Friedman and Judah, 2013; Kelly, 2009; Moore, 2018).

To the best of our knowledge, despite several papers on OGD portal published in the world, there has not been a study on OGD portals in Iran. This necessitates the need to evaluate open government data in 2020.

Therefore, authors evaluated the OGD portals in Iran for the first time. The purpose of this study is to investigate the general characteristics (technical dimension, access and communication and participation) and the general characteristics of the data set and the quality of metadata of Iran's open data portals.

2. Literature Review

There have been many papers studied open data (Khayyat & Bannister, 2017; Juell-Skielse et al., 2014; Hjalmarsson et al., 2015; Hartmann et al, 2016). One of the objectives of open data is data produced by the officials and governments which its study and evaluation are prerequisites to unlocking the potential of extraction of valuable information from it. Official websites where

government data is published openly are called Open government data (OGD) portals. OGD portals foster discoverability, accountability, and reusability for stakeholders.

There are different indicators to observe and evaluating in OGD portals; such as Considerations, development and expectations (De Juana-Espinosa & Luján-Mora, 2020). On the other hand, the analysis of usability in the national open data portals can be used for preventing and reducing corruption and reaching innovative solutions that create added value for society (Nikiforova, 2020b; Wirtz et al., 2019) which only 6% of studies cover studying this indicator. Evaluating usability is one of the most important barriers related to publishing of open data (McBride et al., 2018). Despite OGD portal popularity, there are only a few studies on the topic of open data portals and do not exceed to 7% (Nikiforova, 2020a). The availability of OGD is crucial in decision-making by government agencies. In addition to better decision making, making data available can help prevent or minimize the abuse of government resources (Alzamil & Vasarhelyi, 2019)

Open data specification, open data set feedback, and open data set request are three key aspects to evaluate open data portals too (Máchová .et al., 2018).

Moreover, evaluation of indicators of information retrieval such as accuracy and recall in open government data portal is significant as the main pillar of public transparency (Barcellos et al., 2020).

Five-star methodology introduced by Berners-Lee which contains availability of data on the web in any non-proprietary format and in a machine-readable structure, published using open standards from the W3C, and all these 4 links to other Linked Open Data (2020), used for real-time monitoring of open data and evaluating the data quality in portals (Raça et al., 2020).

The six challenges in accessibility to OGD are identified on dataset level: dataset previewing, dataset size, dataset formats, dataset purpose, dataset labeling, and dataset literacy (Ferati et al., 2020). Wikidata and DBpedia as two examples of knowledge graphs (KGs) which link OGD portals to the public seem to a clear and accessible solution to enable fine-grained analyzes or searches on OGD on the level of publishing organizations (Portisch et al., 2020).

While there is an extensive literature on the benefits and challenges of open government data, there are far fewer empirical studies that explore and document how these initiatives are unfolding at the local government scale (Wilson & Cong, 2020).

Different phases in the open data innovation process have been studied and the result showed interventions stimulated the use of open data and raised awareness within government, but that various mechanisms inhibited the realization of the ambitions of open government data(Ruijer & Meijer, 2020) Heuristic annotations using the type hierarchies in existing Knowledge Graphs resulted ODArchive, a large corpus of structured data collected from over 260 Open Data portals worldwide, alongside with curated, integrated metadata (Weber et al., 2020).

In recent years, evaluating the level of openness of data has attracted the attention of researchers. Some approaches involve evaluating a set of open data features selected to determine a particular aspect, such as (data quality), while others tend to evaluate the openness of data in general. For example, a five-step model (David, 2008) for evaluating the feature of open data availability is presented.

Socrates is one of the companies which is actively working in this field. The company has been evaluating open government data. Using three surveys, the government, citizens and developers conducted a study on open government data. The survey was published in the form of a questionnaire with the aim of evaluating open government data from the perspective of government, data consumers and data partners. The survey results of these questionnaires were divided into five groups: attitude and motivation, current status of open data, current status of data availability, high value data, and participation.

Berners-Lee (2006) has proposed a star-based rating system model for assessing the availability of public data. Based on this model, data receive a star if it is available on the web without permission. If the data is published in a machine-readable format, it will receive two stars. If the data is published in a non-proprietary format, it receives three stars. When the data meets all the previous requirements and also uses the Semantic Web standards for identifying items, the data receive four stars. If all the above rules are followed and the data is provided with context, the data will receive five stars.

The European Commission has used the Sir-Berners-Lee star rating system to measure data availability. However, more accurate sub-indices were defined to clearly measure the result. Unfortunately, this study remained unfinished and did not end.

Another, the Open Knowledge Foundation, has defined a scoring model that includes a set of nine principles of open government data. These include data inventory, data in digital format, publicly available, free, available online, freely licensed, machine-readable, widely available, updated. These principles are based on the eight principles of open government data developed by the Open Data Working Group. Finally, one of the best models is the Renata Máchová and Martin Lněnička framework.

Table1.

A Review of different models

Model's Name	Indicators/Aspects to be measured
Four-Stage Model of data availability (David Osimo, 2008)	• Availability
Five-Star Model data availability (SirBemers-Lee, 2010)	• availability
(European Commission Model, 2011)	• Number of open datasets available • Timelines • Data format • Reuse Conditions • Pricing • Accessibility • Take-up by citizens • Take-up by app developers • Number of application developed based on open data
Open Data Benchmark (Socrata, 2011)	• Accessibility • Availability
Scoring Model by open knowledge foundation	• Data Exit • Data in Digital Format • Publicity Available • Openly Licensed • Machine-Readable • Available in Bulk • Updated

As it is clear there should be a useful and suitable form to present OGD. However, there is a lack of patterns for providing data in data portals, as well as data models interpretable by machines that could be useful for this task (Barcellos et al., 2020).

An examination of databases shows that no study has been conducted to evaluate the quality of open data portals in Iran. Therefore, this study seeks to evaluate Iran's open data portals using a standard framework. Therefore, the researcher is looking for the answer to the quality of Iran's open data portals?

3. Methodology

The present study is a descriptive survey in terms of the purpose of the research. The framework used in this research is based on the framework used in the research of Renata Máchová and Martin Lněnička (2017). This

framework follows the quality dimensions and criteria defined by Batini et al. (2009). As can be seen in Table2, the proposed framework is divided into two parts. The first section focuses on general characteristics, which include the technical dimension, the availability and access dimension, and the communication and participation dimension.

Table2.

The benchmarking framework for general characteristics of open data portal

List of metrics	Description of the requirements for the quality evaluation
1. Technical dimension	
1.1 Authority and responsibility	Portals should provide information about the authority, which hosts the portal and the governance model or institutional framework supporting data provision models
1.2 Data management system	Portals should provide information about the data management system, which is used to power the portal
1.3 Language	Portals should offer more language versions to gain more users (attention) and improve the overall quality of this portal
1.4 Free of charge	Portals should provide that all datasets and services are available free of charge and without any restrictions under open licenses
2. Availability and access dimension	
2.1 Number of datasets	Portals should provide the number of datasets they include
2.2 Number of applications (re-uses)	Portals should provide number of applications developed based on the open data re-used
2.3 Search engine (filter)	Portals should adopt and make visible an overall organization structure and provide strong dataset search capabilities and selection tools using different criteria for browsing through categories and browsing through filters
2.4 API	Portals should provide API for stakeholders to develop applications using open data
2.5 User account	Portals should support user account creation in order to personalize views and information shown
2.6 Thematic categories	Portals should provide thematic categories of the datasets provided by the portal [27], [42]. The portal should clearly distinguish categories (themes) from tags (keywords
2.7 Tags (keywords)	Same tags should be used to classify data of the same type and category
3. Communication and participation dimension	
3.1Forum (feedback)	Portals should provide an opportunity to submit feedback on the data from the users to providers and forum to discuss and exchange ideas among the users
3.2 Request form	Portals should provide a form to request or suggest new type or format type of open data
3.3 Help (usability)	Portals should include high quality of documentation and help functionality to learn how to use the portal and improve the usability
3.4 Frequently Asked Questions (FAQ)	Portals should provide a FAQ section to help resolve any potential issues
3.5 Social media	Portals should be connected to a social media platform to create a social distribution channel for open data. OGD users and providers can inform each other about what they did with and learned from a dataset

Table 3 shows the second case, the benchmarking framework for general characteristics of dataset which evaluates the general characteristics of the data set and the quality of their metadata. In total, 28 complete criteria are defined.

Table3.
The benchmarking framework for general characteristics of dataset

List of metrics	Description of the requirements for the quality evaluation
1. Title and description	Datasets should be provided together with their description and also how and for what purpose they were collected
2. Publisher	Datasets should be provided together with their publisher to verify authenticity of their source
3. Release date and up to date	Datasets should be explicitly associated with a specific time or period tag. All information in the dataset should be up to date
4. License	Datasets should provide license information related to the use of the published datasets. Datasets that doesn't explicitly have an open license are not open data
5. Geographic coverage	Datasets should be determined if the coverage of data is on the national, regional or local level
6. Dataset URL	Datasets URL should be available for each dataset
7. Dataset (file) size	Datasets (file) size should be available
8. Number of views (visits)	Total number of online views should be available for a dataset
9. Number of downloads	Total number of downloads should be available for a dataset
10. Machine-readable formats	Datasets should be provided in formats that are as convenient, easy to analyze and modifiable as downloadable files in well-known formats
11. Visualizations	Datasets visualization capabilities should be provided, e.g., as visualizations in charts or visualizations in maps
12. User rating and discussion message	Datasets should provide capabilities allowing to collect user ratings and comments on a dataset or to discuss conclusions based on data use

Each criterion turned to and used as a question that should be included in a questionnaire for distribution to users. These 28 questions are assessed on a five-point Likert scale to measure agreement or disagreement with such a statement (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). Each question can give a score of one to five points, with a total score of 28 to 140.

The evaluation questionnaire was initially reviewed by 5 professors in the field of open data and information systems. The reliability of the questionnaire was confirmed by them. Reliability refers to whether the instrument selected for the measurement has the characteristics of the instrument for which it was designed. Cronbach's alpha coefficient was used to evaluate validity. The validity of the measuring instrument depends on the extent to which the measuring instrument achieves the same results under the same conditions. Cronbach's alpha score in this study was 0.79.

The questionnaire was then designed electronically and given to 30 Ph.D. students in Information Systems. In the first three columns, there are all the evaluated dimensions for the general profile of the portal, followed by the sum of these scores. The average score of the general data set specification can be described in the fourth column and the general characteristics of the data set in the fifth column. Finally, the final evaluation score is in the last column.

The benchmarking framework for general characteristics of open data portal is seen in table 2. It includes

Twenty-one portals of Iran were identified to evaluate OGD. These portals are:

Iran Open Database, Statistical Center of Iran, Iran Trade Development Organization, Central bank of Islamic Republic of Iran, Shaparak Card Electronic Payment Network, Tehran Stock Exchange Technology Management Company, Islamic Consultative Assembly Research Center, Iran Real Estate Market Information System, Smart Tehran, Amar Electrical Industry Company, Ministry of Agriculture, National Aviation Organization, Tehran Chamber of Commerce, Mining and Agriculture, Iran Cooperative Chamber, Ministry of Mining Industry and Trade, Institute of Higher Education Research and Planning, Iran's national library, Imam Khomeini Relief Committee, Iranian Seismological Center, Country Tender Information Database, Transparency for Iran.

4. Findings

The framework for evaluating the quality of open data portals in Iran consisted of two parts. In the first part, the general characteristics of the open data portal and in the second part, the general characteristics of the datasets were examined. The dimensions of the first part were: technical, access, communication, and participation. In the second part, the general characteristics of the data set were examined. The components of this section were: Title and description, Publisher Release date and up to date, License Geographic coverage, Dataset URL, Dataset (file) size, Number of views (visits), Number of downloads, Machine-readable formats, Visualizations, User rating, and discussion message. The highest score obtained among the portals is related to Iran's open data portal (108.1).

Table 4.
The results of the open data portals quality evaluation

	Open data portal	1				2	Overall score
		1	2	3	sum		
1	Iran Open Database	10.5	15.2	13.3	39	30.1	108.1
2	Statistical Center of Iran	10.2	14.3	13.2	37.7	29.1	104.5
3	Iran Trade Development Organization	9.9	14.2	13.2	37.3	29	103.6
4	Central bank of Islamic Republic of Iran	9.3	14.1	13.2	36.6	29.1	102.3
5	Shaparak Card Electronic Payment Network	9.4	13.9	12	35.3	28.9	99.5
6	Tehran Securities Exchange Technology Management Co	9.6	12.9	12.4	34.9	28.8	98.6
7	Islamic Consultative Assembly Research Center	9	11.9	12.1	33	28.4	94.4
8	Iran Real Estate Market Information System	8.9	12.1	12.4	33.4	27.1	93.9
9	Smart Tehran	10.8	13.2	12.7	36.7	25.5	98.9
10	Amar Electrical Industry Company	9.4	12.4	13.2	35	27.1	97.1
11	Ministry of Agriculture	9.2	11.5	12.3	33	26.5	92.5
12	National Aviation Organization	8.7	11	12.1	31.8	23.3	86.9
13	Tehran Chamber of Commerce, Mining and Agriculture	8.1	11.9	11.1	31.1	22.9	85.1
14	Iran Cooperative Chamber	8.3	12	10.1	30.4	22	82.8
15	Ministry of Mining Industry and Trade	8.7	11.9	11.2	31.8	20.1	83.7
16	Institute of Higher Education Research and Planning	8.2	12	11.7	31.9	19.8	83.6
17	Iran's national library	9.1	11.6	11	31.7	20.1	83.5
18	Imam Khomeini Relief Committee	7.8	10.1	10	28.9	21.9	78.7
19	Iranian Seismological Center	8.3	9.9	11	29.2	19.4	77.8
20	Country Tender Information Database	7.7	10	10.5	28.2	18.1	74.5
21	Transparency for Iran	7.8	9.99	10.2	27.99	17.2	73.18

As it is presented in table 5, the average score of general characteristics of the open data portal with 33.22 is higher than general characteristics of the data set with the average score of 24.87.

Table5.

Average quality of components of Iranian open data portals

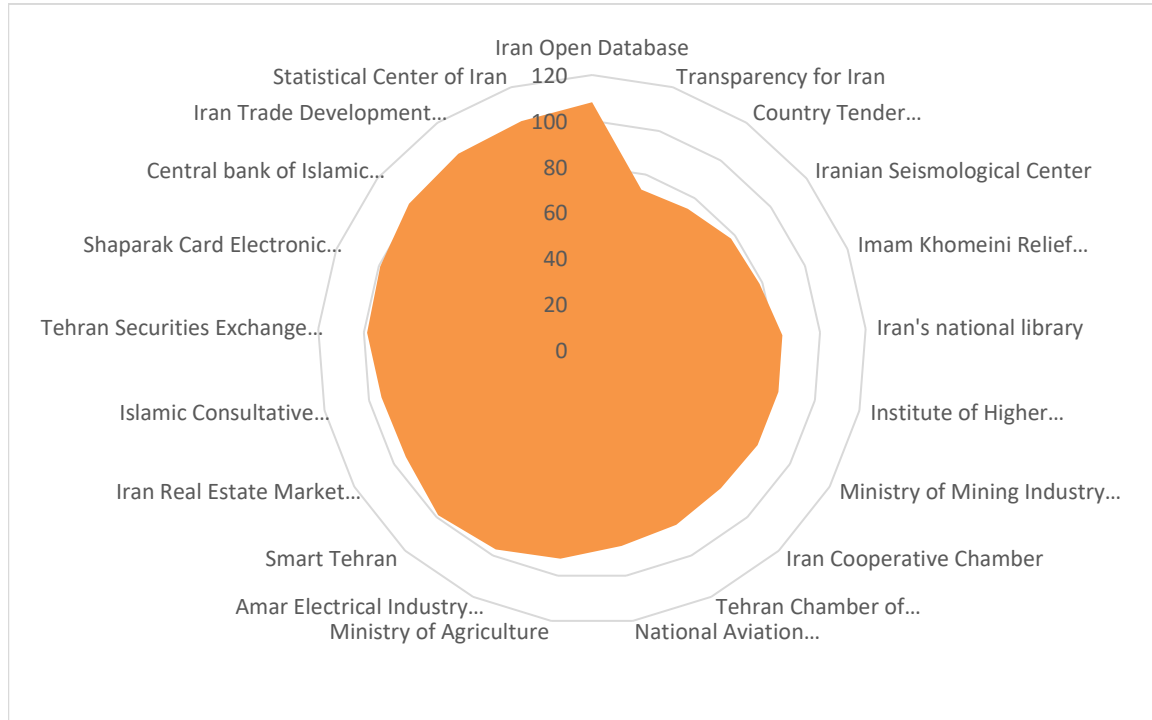| Title	average
general characteristics of the open data portal	33.22
general characteristics of the data set	24.87
Overall score	91.29

Figure 1. Comparison chart of the status of open data portals in Iran

5. Discussion

Findings show that the total average score of the general Characteristics of open data portals (33.22) is higher than the General characteristics of the dataset (24.87). In other words, the quality of technical dimension, availability and access dimension, Communication, and participation dimensions are higher than the quality of the characteristics of data sets.

It is also observed from the results that basically the best performing belongs to open data portal of "Iran Open Database ". Next are the Statistics Center of Iran and the Trade Development Organization of Iran and the Central bank of the Islamic Republic of Iran. The status of Iran's open data portals is lower than the United Kingdom, India, and the United States. The average quality of open data portals in these countries is higher than 124, while the highest average received

in Iran is 108.1. The quality of Iran's open data portals (91.29) is close to that of Pakistan (91.2), Norway (90.7), Poland (90.6), Kenya (90.2), Sri Lanka (90). Israel, Tunisia, Burkina Faso, Lithuania, Malaysia, Brunei are at lower levels than Iran. Comparing the quality of Iran's open data portals with the three leading countries in the field of open data (Britain, India, and the United States) shows that Iran is not in a favorable position. Of course, in the evaluation, it should be noted that Iran is still in its infancy in the field of open data, and comparing Iran with countries that have invested in the field of open data for years may not be appropriate.

6. Conclusion

Governments and organizations, industry and commerce, companies, researchers, and of course the people are among the main

producers and users of open data. Open data increases the responsiveness and participation of individuals and the level of self-awareness and self-regulation of governments and allows them to be more creative. Open data provides the public with the necessary access to use existing information. By opening up data and making it available, governments can be much more effective. Improving government performance in realizing citizenship rights is one of the functions of open data, as it allows citizens to monitor government performance. Improving public services and creating new economic opportunities will also be other benefits of open data design. Estimates show that the economic value of open data could be as high as $ 5.3 trillion worldwide. It should be noted that Open Data has no restrictions on the copyright or similar limitations, and most have similar concepts to the subject of Open Content. Therefore, creating an open data system is associated with challenges, one of which is the lack of cross-sectoral cooperation. Lack of cross-sectoral collaboration can also make data in public organizations tailored to internal structures inaccessible or unusable. Also, many information businesses working in the field of business activities related to research analytics generally have to rely on diverse and general Internet-centric data on business and financial information resources. In addition, data initiatives have been able to make commercial, economic, and related data available to the public simultaneously with public information on the Internet. In open economics, free data is not free, and just because we say we have open data does not mean that it overshadows privacy and privacy. Data in organizations, agencies, banks, customs, taxation, registration, and all data that people deal with in their daily lives are considered economic data that can provide the basis for the business of jobs by maintaining the confidentiality of information of individuals and families. The subject of open data economics, in terms of our current system, refers to the data that we are all publishing, but it overshadows privacy and exposes personal, corporate, or household information. Therefore, one aspect of the case goes back to the management of this section, and the other part to the data that is currently considered to be confidential. Not only is this information not considered confidential, but it must be fully disclosed to businesses. In a way, in an open data economy, the balance of data dissemination is not properly observed. Iran's problems in accessing data include:

- Lack of a single infrastructure for sharing open data organizations
- Lack of a single trustee to manage the open data of the country's organizations
- Problems for ordinary users (researchers, etc.) in accessing organizations' data
- Doing parallel work to prepare data, one of the major disadvantages of which is wasting government funding

It is very important to ensure the quality of open data. There is no document in Iran called the standard of open data quality. Therefore, it is necessary to improve the current situation by first developing a quality management document for open governmental and non-governmental data. Researchers in this article suggest that open data management training packages be provided to employees in the public and private sectors to get acquainted with the necessary standards and the importance of their dissemination. Also, the data-driven culture should be promoted in organizations and the management of organizations should be based on open data. Of course, the creation of value from open data depends on the data culture in the organization.

7. **Recommendation for future research**

Open government data in Iran is a relatively new topic and many areas need to be studied in depth. Some of the areas that could be the subject of future research are:

- Developing a strategy to spread awareness of open government data among citizens in Iran
- Iranian government policy in the field of open science, open data, open innovation

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