

IMPROVEMENT STRATEGY FOR OPEN GOVERNMENT DATA USING FUZZY AHP: CASE STUDY JAKARTA OPEN DATA

STRATEGI PENINGKATAN UNTUK OPEN GOVERNMENT DATA MENGGUNAKAN FUZZY AHP: STUDI KASUS JAKARTA OPEN DATA

Dhea Junesty Pradipta¹, Septi Ariani², Dana Indra Sensuse³,
Sofian Lusa⁴, and Pudy Prima⁵

^{1,2,3,4,5}Faculty of Computer Science, University of Indonesia, Jakarta

E-mail: dhea.junesty81@ui.ac.id¹, septi.ariani@ui.ac.id², dana@cs.ui.ac.id³, sofian.lusa12@ui.ac.id⁴,
pudyprima@cs.ui.ac.id⁵

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Abstract

Open Government Data (OGD) implementation provides benefits for government performance and public services. Based on the Indonesian government's openness action plan 2018-2020, the importance of monitoring and evaluation of OGD implementation for sustainable development is emphasized. This study aims to prioritize criteria and provide recommendations for OGD evaluations at the Jakarta Open Data. Through the mix method approach, expert interviews have been conducted to test the validity of the criteria which then carried out the distribution of questionnaires to eleven expert respondents from five departments. The data is processed using the Fuzzy-Analytic Hierarchy Process (AHP) to determine each weight on twenty criteria in four dimensions. The results of this study indicate that in the short term, OGD internal evaluations in the DKI Jakarta provincial government can be done by assessing eight main priority criteria, namely accuracy, completeness, compliance, understandability, timeliness, openness, functionality, and reliability which are then based on overall criteria. These results are the basis for discussion in the Data Forum and the establishment of Standard Operating Procedure (SOP) to assist and accelerate the process of collecting, processing, verifying and validating data from 51 regional work units. Externally, the Jakarta Open Data team can pay attention to the conditions of citizen engagement in the OGD and the existence of a Memorandum of Understanding (MoU) between relevant ministries or agencies that does not yet have data officers or information and documentation management officers for effective and efficient data processing.

Keywords : *open government data, Jakarta Open Data, fuzzy-AHP, accuracy, completeness*

Abstrak

Implementasi Open Government Data (OGD) memberikan manfaat bagi kinerja pemerintah dan layanan publik. Berdasarkan rencana aksi keterbukaan pemerintah Indonesia 2018-2020, pentingnya pemantauan dan evaluasi pelaksanaan OGD untuk pembangunan berkelanjutan ditekankan. Penelitian ini bertujuan untuk memprioritaskan kriteria dan memberikan rekomendasi terhadap evaluasi OGD pada Jakarta Open Data. Melalui pendekatan metode campuran, wawancara ahli telah dilakukan untuk menguji validitas kriteria yang kemudian dilakukan distribusi kuesioner kepada sebelas responden ahli dari lima departemen. Data diproses menggunakan Fuzzy-Analytic Hierarchy Process (AHP) untuk menentukan setiap bobot pada dua puluh kriteria dalam empat dimensi. Hasil penelitian ini menunjukkan bahwa dalam jangka pendek, evaluasi internal OGD di pemerintah provinsi DKI Jakarta dapat dilakukan dengan menilai delapan kriteria prioritas utama, yaitu akurasi, kelengkapan, kepatuhan, dapat dimengerti, ketepatan waktu, keterbukaan, fungsionalitas, dan keandalan yang selanjutnya berdasarkan keseluruhan kriteria. Hasil tersebut sebagai dasar pembahasan di Forum Data dan pembuatan Prosedur Operasi Standar (SOP) untuk membantu dan mempercepat proses pengumpulan, pemrosesan, verifikasi dan validasi data dari 51 unit kerja regional. Secara eksternal, tim Jakarta Open Data dapat memperhatikan kondisi citizen engagement dalam OGD dan adanya Memorandum of Understanding (MoU) antar kementerian atau instansi terkait yang belum memiliki walidata atau information and documentation management officer untuk pemrosesan data yang efektif dan efisien.

Kata Kunci : *open government data, Jakarta Open Data, fuzzy-AHP, akurasi, kelengkapan*

INTRODUCTION

In recent years, governments around the world have developed Open Government Data (OGD) initiatives, understood as the combination of open government and open data (Martín, Rosario, & Pérez, 2015). The open government concept implies greater transparency, participation, accountability, and access to public information (Albano, 2013), whereas open data refers to the dissemination of information that allows everyone to reuse, redistribute, at no cost, and modify content (Kubler, Robert, Traon, Umbrich, & Neumaier, 2016). There are three concerns to describe open data. First availability and access, which means data should be presented completely and easily accessible and redistributed, the second re-usage and redistribution, which means data are allowed to be used and redistributed to anyone, and the third universal participation, is everyone may access and use data without discrimination (“Guide: The Open Data Handbook,” 2009). In addition, OGD gives citizens the opportunity to participate in overseeing and criticizing government action, if necessary.

Open Government Data (OGD) are the data created by the government or some entities under government supervision that could be used, re-used and redistributed by anyone without restriction that is available without any restrictions and that can be easily found and accessed (Parung, Hidayanto, Sandhyaduhita, Ulo, & Phusavat, 2018; Veljkovic, Bogdanovi-Dinic, & Stoimenov, 2014). These data can include data on transport, spatial data, weather information, reports, pictures and other information of public importance (Veljkovic et al., 2014). The open government data is the raw material in co-creation processes between government and the civil society (Craveiro, Alcazar, & M R Martano, 2016).

According to (Attard, Orlandi, & Auer, 2016), there are some benefits of OGD such as using open government data that has the potential of not only resulting in economic benefits but also has good social and

governmental impacts. Releasing government data will impact transparency and accountability factors, while the release of specific datasets can encourage stakeholders to create innovative services and boost economic growth (Attard et al., 2016). Transparency of a government is a means for achieving accountable government that measures and tracks the outcomes of its actions and takes responsibility for the results (Veljkovic et al., 2014). The release of information will also aid stakeholders in making informed decisions based on relevant data (Attard et al., 2016).

Furthermore, through the publishing of government data, citizens are given the opportunity to actively participate in governance processes, such as decision-making and policy-making, rather than sporadically voting in an election every number of years (Attard et al., 2016). Other benefits of OGD are like, it has the potential to increase productivity, improve products and services by value addition to the original OGD and most importantly to make way for the data-driven innovation with new age products and services (Mishra, Misra, Kar, Babbar, & Biswas, 2017).

In Indonesia, Open Government Indonesia (OGI) is a movement to realize the openness of government since Indonesia joined the Open Government Partnership (OGP) in 2011 (Aulia & Kurniawan, 2018; OGI, 2018). The main purpose of open government initiative is to encourage the implementation of transparency, accountability, participatory and innovation to strengthening government administrative performance and public service (OGI, 2018). The OGI implementation is inlined with many laws such as Law Number 14/2008 on Public Information Disclosure, Law Number 25/2009 on Public Service Delivery, and Government Regulation Number 45/2017 on Public Participation in Local Government (OGI, 2018). In the Indonesian government's openness action plan 2018-2020, one of them emphasized the need for monitoring and evaluation of the implementation of OGD for sustainable development, providing access to

justice for all, building effective, accountable and inclusive institutions in all tiers (OGI, 2018). Based on the research of Purwanto, Zuiderwijk, and Janssen (2020), the main challenge in the implementation of OGD in Indonesia is ensuring accurate data generated that affects the use of data by the public. In addition, according to Parung et al. (2018), the highest barrier in adopting OGD in Indonesia is the availability of legal consequences regarding open data.

The Special Capital Region (DKI) of Jakarta Province is the first region in Indonesia that has implemented an open data program since 2015 (Aulia & Kurniawan, 2018). Based on Open Government Action Plan 2016 – 2017 (OGI, 2015), DKI Jakarta Province becomes one of five regions in Indonesia as a target to strengthening data management and publication with the open data format. The measurement of success on the OGI Action Plan 2016-2017 is the availability of 1000 datasets in 2016 and 1500 datasets in 2017 on Jakarta Open Data Portal (data.jakarta.go.id). However, from the assessment of maturity level of open government data result by Widyaningrum (2017), the available datasets in 2016 is 400 datasets from 1000 datasets target and in 2017 is 1006 datasets from 1500 datasets target.

In 2019, there are 4401 datasets available. Based on the expert interview with head of the public information section at Statistics, Information and Communication Offices of DKI Jakarta province and the head of the DKI Jakarta development planning administration subdivision, the soaring data availability is supported by the implementation of key performance indicators since 2018 where each unit made an agreement at the beginning of the year for data that needs to be added or updated. For two years, the DKI Jakarta province received informative awards in terms of public information disclosure from the Central Information Commission. The evaluation is carried out based on the development of the website related to the Information Management and Data Officer

and the announcement of information to the public (Komisi Informasi Pusat, 2019)

Internally there has not been an evaluation of the implementation of open government data in the DKI Jakarta provincial government. There is a governor's regulation number 181/2014 concerning Data Management Systems and Procedures Development Information but in practice, based on expert interviews, there are no detail procedures related to the quality of OGD that was mutually agreed so that there are still datasets that are deemed not feasible for publication. In the (Aulia & Kurniawan, 2018) research results, there was a competency driver issue that cannot be fulfilled properly because the staff selection process is not based on advanced work analysis or data processing. Another issue is system-level interventions that are more technical about quality data publication from 51 regional work units in DKI Jakarta Province. Based on expert interviews, it is not yet known which criteria are important to evaluate in the implementation of OGD in the Jakarta Open Data and there is no procedure in OGD evaluation in the Provincial Government of DKI Jakarta.

From these issues, we must know: “What criteria are important and what recommendations need to be made in evaluating open government data?”. This study aims to determine the priority criteria using the Fuzzy AHP method and recommendations in evaluating the implementation of OGD in the DKI Jakarta Provincial Government. The criteria in this study use the OGD success evaluation model by (Purwanto, Janssen, & Zuiderwijk, 2017) which is then validated through expert interviews to find out the addition or subtraction of the criteria according to the condition of the Jakarta Open Data. Valid criteria are then distributed through questionnaires to three expert groups based on data processing, data verification, and data entry in the Jakarta Open Data which are then calculated using the AHP fuzzy method. Recommendations are given based on criteria that exceed threshold values.

OGD evaluation has been done in the various study. Several studies related to this research include research conducted by (Purwanto et al., 2017) on General Election Commissions (KPU), (Mishra et al., 2017) on India OGD's platform and (Parung et al., 2018) on a case of Indonesia.

Purwanto et al., (2017) proposes an OGD evaluation model by simplifying the version of the IS Success Model and combining the OGD process and the concept of public value. The background in this study is few of the research that is more focused on evaluating OGD in developing countries, and little know the conversion of OGD to public value. The results consist of dimensions of data quality, web, service, and social media that have an influence on the use of OGD collaboration and OGD user satisfaction. This amplification leads to the creation of public values: efficiency, transparency, engagement, collaboration, and trust in the government.

Mishra et al., (2017) assessed the OGD initiative by using the AHP method to prioritize factors. The results obtained are several factors such as people, technology scope, policy, economic and institution that are identified as having a strong impact on e-governance initiatives.

Parung et al., (2018) conducts research to identify barriers and strategies in adopting OGD. Measurement of data using Fuzzy AHP-Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) through the distribution of questionnaires to several government representatives who work in the data and information. The results obtained are 27 barriers in five categories of barriers (legal and privacy, government culture, social, technical and economic) and ten strategies that have been identified and ranked based on the level of importance.

METHODOLOGY

This study consist of four steps: research preparation, data collection, data analysis and drawing conclusions in accordance with figure

1. In general, the research process can be explained as follows:

Step 1 – Research Preparation: conduct research problem analysis and then look for literature to solve problems. The final results of this step are increasingly dimension and significant criteria from various studies that have been done before, as well as making weight measurement instruments.

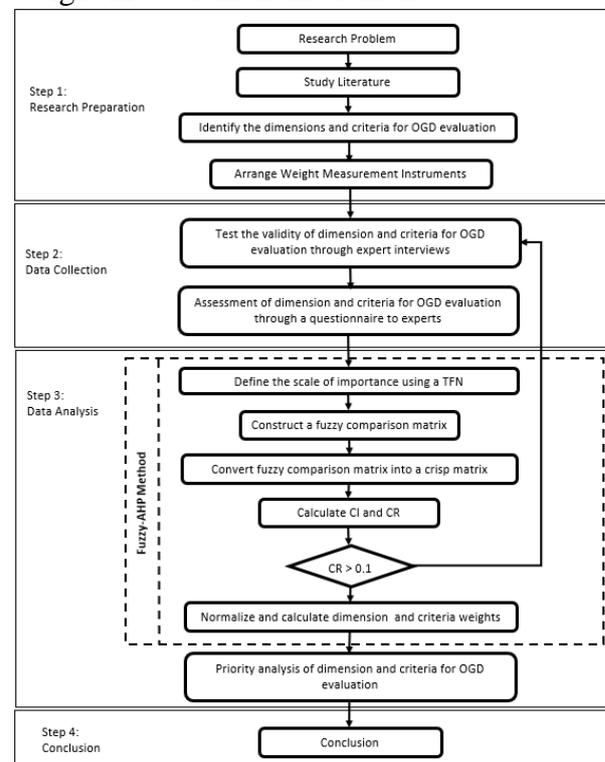


Figure 1. Research Methodology

Step 2 – Data Collection: to validate the criteria in each dimension, we used a qualitative approach by conducting expert interviews with the head of the public information section at Statistics, Information and Communication Offices of DKI Jakarta province as the person in charge (PIC) of data processing and the head of the DKI Jakarta development planning administration subdivision as the PIC of data verifier.

Result of validated criteria is then arranged in a questionnaire. The quantitative approach is carried out by distributing questionnaires to experts who involved and responsible to manage open data in the DKI Jakarta Province. The experts are divided into three groups as shown in Figure 2: data processors at Statistics, Information and

Communication Offices of DKI Jakarta province, data verifiers at DKI Jakarta development planning administration subdivision and liaison officers (LO) representatives from 51 regional work units in DKI Jakarta province.

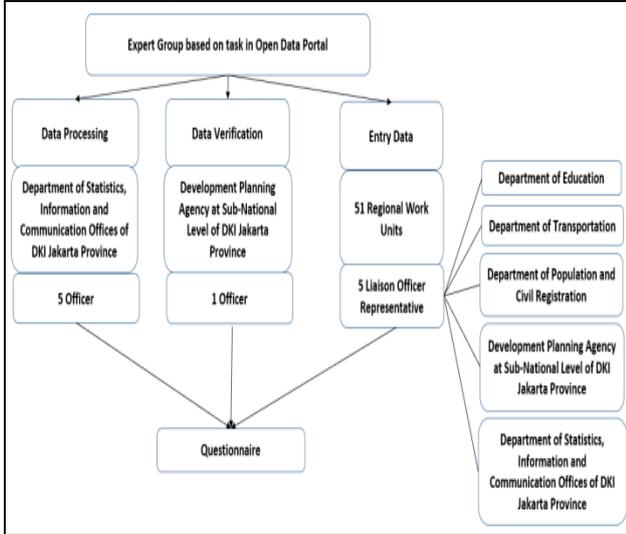


Figure 2. Questionnaire Distribution to Experts

Step 3 – Data Analysis: measurement of the weight of each criterion in this study using the AHP fuzzy method. This method has been created by integrating fuzzy set and AHP models and has been used by several researchers to prioritize assessment criteria by providing group decision support (Mishra et al., 2017). In Kai, Sun, & Chung (2019) research, based on sensitivity analysis, Fuzzy AHP is more stable when it changes in weight criteria compared to AHP (Kai et al., 2019). Data from the questionnaire were then processed using fuzzy AHP to prioritize each dimension, each criterion, and global criteria. There are five steps of the fuzzy AHP (Parung et al., 2018):

1. Define the scale of importance using a fuzzy number for a pairwise comparison matrix

In Fuzzy AHP, the fuzzy number used $\tilde{1}$ - $\tilde{9}$ scales in Table 1.

Table 1. The Scale Of Importance Used In The Pairwise Comparison Matrix (Parung et al., 2018)

Linguistic Variables of one Criterion over another	Intensity of Importance	Fuzzy Number	Trigonometrical Fuzzy Number (TFN)
Equally Important	1	$\tilde{1}$	(1,1,3)
Moderately Important	3	$\tilde{3}$	(1,3,5)
Strongly Important	5	$\tilde{5}$	(3,5,7)
Very Strongly Important	7	$\tilde{7}$	(5,7,9)
Extremely Important	9	$\tilde{9}$	(7,9,1)

2. Construct a fuzzy comparison matrix

The individual judgment matrix represents the opinion of one decision-maker. If decision-makers more than one person, the aggregation is necessary to achieve group decision-makers using Equation 1. Consider a group of K decision-makers in this study, they make a pairwise comparison. The set of matrixes \tilde{A}_K (i.e. Equation 2) = $\{\tilde{a}_{ijk}$ where $\tilde{a}_{ijk} = (l_{ijk}, m_{ijk}, u_{ijk})$.

$$l_{ij} = \min(l_{ijk})$$

$$m_{ij} = \sqrt[k]{\prod_{k=1}^k m_{ijk}} \tag{1}$$

$$u_{ij} = \max(u_{ijk})$$

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{a}_{12} & \tilde{a}_{1n} \\ \tilde{a}_{21} & 1 & \tilde{a}_{2n} \\ \vdots & \vdots & \vdots \\ \tilde{a}_{n1} & \tilde{a}_{n2} & 1 \end{bmatrix} \tag{2}$$

3. Convert fuzzy comparison matrix into a crisp matrix using the α -cut method

First, l_{ij}^α is the lower element and u_{ij}^α is the upper element. Using Equation 3 and 4, we calculated the number of l_{ij}^α and u_{ij}^α . α means the uncertainty level of the decision-maker, the larger value than a higher index of consistency.

$$l_{ij}^\alpha = (m_{ij} - l_{ij}) \cdot \alpha + l_{ij} \tag{3}$$

$$u_{ij}^\alpha = u_{ij} - (u_{ij} - m_{ij}) \cdot \alpha \tag{4}$$

Second, a crisp number can be obtained by using Equation 5. μ means the optimism level of the decision-maker, the larger value then the higher assurance in their decision.

$$(a_{ij}^\alpha)^\mu = [\mu \cdot l_{ij}^\alpha + (1 - \mu) \cdot u_{ij}^\alpha] \quad (5)$$

4. Calculate consistency index and consistency ratio

The Consistency Ratio (CR) can calculate using Equation 7, where n is the size of the matrix then RI can be seen in Table 2. Before that, we must calculate Consistency Index (CI) using Equation 6, where λ_{\max} is the largest eigenvalue. If the matrix has $CR \leq 0.10$ then the matrix is consistent and the criteria are acceptable.

$$CI = \frac{\lambda_{\max} - n}{n - 1} \quad (6)$$

$$CR = \frac{CI}{RI(n)} \quad (7)$$

5. Calculate the weight of each criterion

The weight of each criterion can be calculated by normalizing the rows of the matrix.

Table 2. RI

(n)	2	3	4	5	6	7	8
RI	0	0.58	0.9	1.12	1.24	1.32	1.41

The results of the weighting of these criteria are then ranked and analyzed according to the literature and expert opinions. The existence of a threshold determines which criteria are the main priorities for OGD evaluation. Furthermore, recommendations are given based on the results of criteria that are included as top priorities for OGD evaluation

Step 4 – Conclusion: This stage will provide overall results and future suggestions regarding this research.

RESULT AND DISCUSSION

Identification Criteria for OGD Evaluation

The dimension and criteria are identified through a literature review and expert interview. This study, using the OGD evaluation model proposed by (Purwanto et al., 2017) as shown in Table 3 then validated through expert interviews.

The Purwanto et al., (2017) proposed the OGD evaluation model in the context of Indonesia with a simplified version by applying the Information System success model, OGD process, and public value concept (Purwanto et al., 2017). This model extends

the DeLone McLean IS Success Model in the context of OGD by adding the concept of social media quality. OGD evaluation model divided into four dimensions i.e. data quality, web quality, service quality, and social media quality. In Table 3, we have summarized several criteria for each dimension based on references. There are nineteen criteria in four dimensions to evaluate OGD.

Tabel 3. OGD Evaluation Model based on Literature Review

Dimensions	Criteria	Definition	References
Data Quality (DQ)	DQ1-Timeliness	To preserve the value of data that is made available quickly. This criteria checking if there are any update frequency data and data freshness	(Li, Zhai, Zheng, & Yuan, 2018),(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Kubler, Robert, Neumaier, Umbrich, & Le Traon, 2018),(Vetrò et al., 2016),(Lee, Rha, Kim, Jang, & Gim, 2018),(Renata Máchová & Lněnička, 2017),(Saxena, 2018a),(Kubler et al., 2016)
	DQ2-Accuracy	The available metadata values accurately describe the actual data. These criteria require to inspect the content of data to verify the specified file format and size are accurate	(Li et al., 2018),(Umbrich, Neumaier, & Polleres, 2015),(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Vetrò et al., 2016),(Lee et al., 2018), (Saxena, 2018a) ,(Neumaier, Umbrich, & Polleres, 2016)
	DQ3-Relevance	The dataset's title and description should be precise and relevant to the dataset's content	(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Saxena, 2018a)
	DQ4-Completeness	The completeness of datasets description is a widely used and important measure to provide an indication of how much information in cells or rows is available for given datasets	(Kubler et al., 2016),(Li et al., 2018),(Umbrich et al., 2015),(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Kubler et al., 2018),(Vetrò et al., 2016),(Ferney, Beltran Nicolas Estefan, & Alexander, 2018),(Yi, 2019)
	DQ5-Understandability	Each column of data is clear and not ambiguous	(Li et al., 2018),(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Vetrò et al., 2016)
	DQ6-Currency	The available data is up-to-date	(Purwanto et al., 2017)
Web Quality (WQ)	WQ1-Functionality	Degree to which website provides functions that meet needs and can be used under certain conditions	(Fath-allah, Cheikhi, Idri, & Al-qutaish, 2018),(Kubler et al., 2016),(Umbrich et al., 2015),(Purwanto et al., 2017),(Saxena, 2018a)
	WQ2-Download Time	Easily downloaded datasets over a certain period for monitoring datasets	(Li et al., 2018),(Purwanto et al., 2017), (Yi, 2019)
	WQ3-Reliability	Related to the reliability of open data when citizen follow dataset to find out any update datasets and/or relationship with other related data	(Lee et al., 2018),(Purwanto et al., 2017),(Renata Máchová & Lněnička, 2017)
	WQ4-Interactivity	Website provided communication channel through discussion forum or messaging	(Saxena & Janssen, 2017),(Purwanto et al., 2017),(Lee et al., 2018)
	WQ5-Ease of Navigation	The website should be easy to operate and navigate for finding and downloading data	(Purwanto et al., 2017),(Lee et al., 2018), (Sá, Rocha, & Pérez, 2016)
	WQ6-Accessibility	The website provides access to all necessary data and speedily accessing data	(Sá et al., 2016),(Purwanto et al., 2017),(Utamachant & Anutariya, 2018),(Kubler et al., 2018),(Vetrò et al., 2016),(Renata Máchová & Lněnička, 2017),(Ferney et al., 2018),(Giacobbe, Di Pietro, Longo Minnolo, & Puliafito, 2018)
Service Quality (SQ)	SQ1-Reliability	The ability to offered and promised delivery data accurately, consistently dan timely manner	(Purwanto et al., 2017),(Lee et al., 2018),(Renata Máchová & Lněnička, 2017)
	SQ2-Responsiveness	The ability to help and respond to citizen requests for data effectively and positively	(Purwanto et al., 2017),(Renata Máchová & Lněnička, 2017),(Giacobbe et al., 2018)
	SQ3-Assurance	The ability to assurance trust, security, and technical quality when government provide service	(Purwanto et al., 2017)
	SQ4-Empathy	The ability to offer assistance to citizens according to their individual needs	(Purwanto et al., 2017)
	SQ5-Tangible	Physical appearance, equipment, and staff involved in providing services	(Purwanto et al., 2017)
Social Quality (SMQ)	SMQ1-Communicating	There is a forum to discuss datasets or conclusions based on data use throughout social media. Each message visible who posted it and there was some basic information about the background of the user	(Purwanto et al., 2017),(Manocha et al., 2018)
	SMQ2-Shareability	Sharing the datasets in the portal from data use via social media. OGD users can inform each other about what they learn from the datasets	(Purwanto et al., 2017),(Manocha et al., 2018)

In expert validation, there are two experts who have worked for more than four years and hold a higher position in the development of the Jakarta Open Data portal from the beginning of implementation until now. As a result of the expert validation, two criteria were eliminated and three criteria were added. For the omitted criteria, namely

the currency criteria in the data quality dimension, the meaning is combined with the timeliness criteria on the same dimension because the definitions are equally related to data updates. Then tangible criteria are eliminated because services are provided to the public through the website and also in this study shows the ranking of each criterion,

while tangible criteria are conceptual and future research is not needed in calculating the index.

Expert interviews were conducted at PIC of Data Processing as Expert1 (E1) and PIC of Data Verifier as Expert2 (E2). Based on the interview, the two experts argued the need to add criteria to the data quality dimensions, namely credibility, compliance, and openness criteria. Definition of each added criteria can be seen in Table 4.

Table 4. Additional Criteria

Criteria	E1	E2	Definition	References
DQ6- Credibility*	√	√	The datasets in portal provide contact information i.e. an email address or HTTP URL about data publisher	(Kubler et al., 2016),(Umbrich et al., 2015),(Utamachant & Anutariya, 2018),(Renata Máchová & Lněnička, 2017),(Neumaier et al., 2016)
DQ7- Compliance*	√	√	The compliance criteria is the ability of data to follow standard or regulation	(Utamachant & Anutariya, 2018),(Vetrò et al., 2016),(Ferney et al., 2018),(Pawelozsek & Wieczorkowski, 2018)
DQ8- Openness*	√	√	Datasets provide open license and resource are available in an open data format and also machine processable	(Kubler et al., 2016),(Li et al., 2018),(Umbrich et al., 2015),(Kubler et al., 2018),(Renata Máchová & Lněnička, 2017),(Neumaier et al., 2016),(Giacobbe et al., 2018), (Gunawan & Amalia, 2016),(Renáta Máchová, Hub, & Lnenicka, 2018)

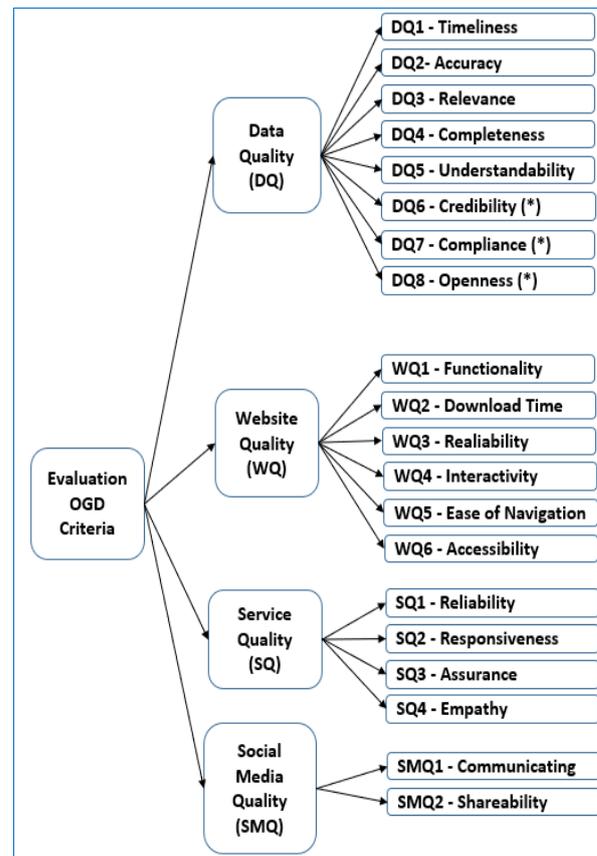


Figure 3. The Hierarchy for Prioritizing Criteria of OGD Evaluation

As shown in Figure 3, in evaluating the quality of OGD there are four dimensions: data quality, website quality, service quality, and social media quality. Each dimension has several factors or criteria where data quality has eight criteria, website quality has six criteria, service quality has four criteria and social media quality has two criteria. The total criteria for prioritizing OGD quality evaluation are 20 criteria.

Weight Measurement using fuzzy AHP

After knowing the dimensions and criteria for evaluating the quality of OGD, we calculated the weights for each dimension, each criterion, and the overall criteria using fuzzy AHP. As shown in Figure 2, we distribute the questionnaires to the experts into three groups based on the task they manage Open Data Portal and at least one year of work. There are eleven experts whose profile of each expert can be found in Table 5.

Table 5. Expert Profile

Expert	Work Unit	Role	Year of Working
1	Department of Population and Civil Registration	LO Data	2 Year 11 Month
2	Department of Education	LO Data	2 Year 2 Month
3	Department of Transportation	LO Data	3 Year 8 Month
4	Development Planning Agency at Sub-National Level of DKI Jakarta Province	LO Data	1 Year 6 Month
5	Development Planning Agency at Sub-National Level of DKI Jakarta Province	Data Verificator	4 Year
6	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	LO Data	2 Year
7	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	Data Processing Officer	1 Year
8	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	Data Processing Officer	4 Year 11 Month
9	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	Data Processing Officer	4 Year 11 Month
10	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	Data Processing Officer	4 Year 7 Month
11	Department of Statistics, Information and Communication Offices of DKI Jakarta Province	Data Processing Officer	1 Year

In this phase, we made pairwise comparisons of four dimensions and twenty criteria by using the scale of comparison in Table 2. The eleven expert respondents were asked to compare the level of importance between two criteria and between two dimensions. The answers of each expert are represented in the form of Trigonometrical Fuzzy Numbers (TFN) which then construct a fuzzy comparison matrix by aggregating into group decision-makers using Equation 1. There are four fuzzy comparison matrix based on four dimensions and a fuzzy comparison matrix between dimensions that can be seen in Table 6, Table 7, Table 8, Table 9, and Table 10.

Table 6. Fuzzy Comparison Matrix on Data Quality Dimensions

	DQ1	DQ2	DQ3	DQ4	DQ5	DQ6	DQ7	DQ8
DQ1	1.00	1.00	0.09	0.58	11.00	0.11	1.45	11.00
DQ2	0.09	1.73	11.00	1.00	1.00	2.98	11.00	1.00
DQ3	0.09	0.69	9.00	0.09	0.34	1.00	1.00	1.00
DQ4	0.09	1.19	9.00	0.09	0.37	1.00	0.33	2.16
DQ5	0.09	0.91	11.00	0.09	0.74	11.00	0.20	1.41
DQ6	0.09	0.72	9.00	0.09	0.38	11.00	0.14	0.95
DQ7	0.09	1.02	11.00	0.09	0.71	11.00	0.20	1.48
DQ8	0.09	1.09	11.00	0.09	1.09	11.00	0.20	1.28

Table 7. Fuzzy Comparison Matrix on Web Quality Dimensions

	WQ1	WQ2	WQ3	WQ4	WQ5	WQ6
WQ1	1.00	1.00	1.00	1.00	2.33	11.00
WQ2	0.09	0.43	1.00	1.00	1.00	0.09
WQ3	0.09	0.56	11.00	0.09	1.05	11.00
WQ4	0.09	0.41	5.00	0.09	0.68	5.00
WQ5	0.09	0.52	11.00	0.09	1.16	11.00
WQ6	0.09	0.56	1.00	0.09	0.94	7.00

Table 8. Fuzzy Comparison Matrix on Service Quality Dimensions

	SQ1	SQ2	SQ3	SQ4
SQ1	1.00	1.00	1.00	1.00
SQ2	0.09	0.39	1.00	1.00
SQ3	0.09	0.90	7.00	0.09
SQ4	0.09	0.41	1.00	0.09

Table 9. Fuzzy Comparison Matrix on Social Media Quality Dimensions

	SMQ1	SMQ2
SMQ1	1.00	1.00
SMQ2	0.09	0.84

Table 10. Fuzzy Comparison Matrix on the Dimensions

	DQ	WQ	SQ	SMQ
DQ	1.00	1.00	1.00	1.00
WQ	0.09	0.21	1.00	1.00
SQ	0.09	0.28	1.00	0.09
SMQ	0.09	0.18	1.00	0.09

The next step we convert the fuzzy matrix in the form of a crisp matrix according to Equation 5 with α is 1 and μ is 0.5. The consistency ratio check of the crisp matrix shows that all criteria are accepted because the matrix is consistent with a CR value ≤ 0.10 . The matrix is then normalized and weighted each dimension, each criterion and global criterion as shown in Table 11. According to the result, it can be seen that the dimensions that have the highest importance are data quality of 57.6%, followed by web quality of 19.9%, service quality of 14.3% and social media quality of 8.2%. The Accuracy criteria is in the highest priority in OGD quality evaluation, followed by the Completeness criteria.

Table 11. Final Priority Of Criteria In OGD Evaluation

Dimension	Dimension Weight (DW)	Dimension Rank	Criteria	Criteria Weight (CW)	Final Weight (DWxCW)	Criteria Rank	Global Rank
Data Quality (DQ)	0.576	1	DQ1	0.115	0.066	5	5
			DQ2	0.222	0.128	1	1
			DQ3	0.077	0.044	8	10
			DQ4	0.154	0.089	2	2
			DQ5	0.121	0.070	4	4
			DQ6	0.079	0.045	7	9
			DQ7	0.122	0.070	3	3
			DQ8	0.110	0.064	6	6
Web Quality (WQ)	0.199	2	WQ1	0.289	0.058	1	7
			WQ2	0.145	0.029	4	17
			WQ3	0.165	0.033	2	15
			WQ4	0.112	0.022	6	19
			WQ5	0.158	0.032	3	16
			WQ6	0.131	0.026	5	18
Service Quality (SQ)	0.143	3	SQ1	0.376	0.054	1	8
			SQ2	0.257	0.037	2	13
			SQ3	0.245	0.035	3	14
			SQ4	0.123	0.018	4	20
Social Media Quality (SMQ)	0.082	4	SMQ1	0.542	0.044	1	11
			SMQ2	0.458	0.037	2	12

Implications of Priority Evaluation of OGD for Jakarta Open Data

In the results of priority criteria, there are eight criteria that are the top priority for OGD evaluation based on a threshold value of 0.05 as shown in Figure 4. Based on Wen & Hwang (2019), the threshold value is obtained from the aggregation of each criterion value according to the number of dimensions available (Wen & Hwang, 2019). These criteria are Accuracy, Completeness, Understandability, Compliance, Timeliness, Openness, Functionality and Reliability. There are five criteria from the dimension of data quality, one criterion from the dimension of web quality and one criterion from the dimension of service quality.

Internally, OGD evaluations can be conducted in the short term based on eight main priority criteria which can then be evaluated based on overall criteria. Documenting OGD evaluation criteria by focusing on assessments according to weights can be done by making standard operating procedures (SOPs) that are mutually agreed upon. Through the SOP, it is expected to be able to assist LO Data in conducting data collection in accordance with the data criteria that are suitable for publication. It can also

speed up data processing, verification and validation so that data is available quickly and minimize the workload borne by the processor and verifier to manage data from 51 work units in DKI Jakarta. Data forums held annually can focus on discussions based on OGD evaluation criteria. This is so that discussions can be carried out effectively and efficiently given the possibility of new employees being assigned due to mutations.

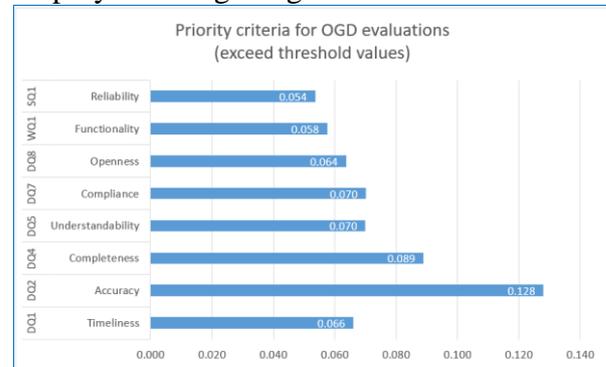


Figure 4. Top Priority Criteria for OGD Evaluations

The measurement of the eight main priority criteria can be done by the Jakarta Open Data team with a threshold value based on experts or best practices. Explanation of measurement of each criterion as follows:

1. **Accuracy** criteria, in line with research by Zhang & Xiao (2020), Li et al. (2018), Renata Máchová & Lněnička (2017), and Ferney et al. (2018) is the most important criterion in the dimension of data quality. As many as 12.8% think that the accuracy criteria are the top priority related to public trust that the data is valid and can be accounted for. This is in accordance with the Regulation of the President of the Republic of Indonesia Number 39 Year 2019 concerning One Indonesian Data (Presiden Republik Indonesia, 2019) and Regulation of the Governor of the Special Capital Province of Jakarta Number 181 of 2014 concerning Systems and Procedures for Management of Development Data and Information (Gubernur Provinsi DKI Jakarta, 2014). Based on "ISO/IEC 25012" (2019), Utamachant & Anutariya

(2018), and Vetrò et al. (2016), evaluation of this criterion can be done by measuring the percentage based on syntactically accurate cells and accurate aggregate cells. Syntactically accurate cells is the number of cells that have the correct value according to the domain and type of information in the dataset of the total cells. Accurate aggregate cells are the number of cells that have the correct aggregation column of the total aggregation cells.

2. **Completeness** criteria, according to research by Ferney et al. (2018) and Yi (2019), became one of the main criteria for measuring data quality in the case of OGD. 8.9% of completeness criteria as a second priority where the completeness of the data affects the use of the data by the public. This is in accordance with Regulation of the Governor of the Special Capital Province of Jakarta Number 181 of 2014 concerning Systems and Procedures for Management of Development Data and Information (Gubernur Provinsi DKI Jakarta, 2014) where the data collection process needs to be complete with metadata in order to facilitate searching, managing, adjusting and archiving data. Completeness criteria can be evaluated through entities that have values or are not empty in cells or rows (“ISO/IEC 25012,” 2019; Utamachant & Anutariya, 2018). Complete cells can be measured through the percentage of cells that are not empty and have a predetermined value of the total cells measured. Complete rows is the percentage of rows in a dataset that does not have incomplete cells (Utamachant & Anutariya, 2018; Vetrò et al., 2016).
3. The **Compliance and Understandability** criteria become the third priority that has the same final score of 7%. Parung et al. (2018) makes compliance criteria a priority because the Government needs to

develop mechanisms to identify related legal issues before the data is published. Measurement of compliance criteria can be done based on the percentage of standardized columns can be measured through columns that represent several types of information with applicable standards or regulation (Vetrò et al., 2016) such as Law Number 14 Year 2008 concerning Openness of Public Information (Presiden Republik Indonesia, 2008b) and its derivative regulations, and the Regulation of the President of the Republic of Indonesia Number 39 Year 2019 concerning One Indonesian Data (Presiden Republik Indonesia, 2019). In addition, this criterion can also be measured by values in the dataset Ber Berners-Lee's open file scheme of the 5-star open data scheme: 1-Star for dataset formats with PDF, JPG, or DOC; 2-Star for dataset formats that can be read by machines such as Microsoft Excel; 3-Star for machine-readable dataset formats, data structures and non-proprietary such as Comma-Separated Version (CSV); 4-Star for dataset formats that can also be used open standards such as the Resource Description Framework (RDF); and 5-Star for dataset formats that meet 4-Star with datasets connected to other data (Gunawan & Amalia, 2016; Utamachant & Anutariya, 2018).

In line with research by Li et al. (2018), the Understandability criteria is one of the criteria that needs to be checked and evaluated before the data is used. This criterion needs to be measured to find out whether the dataset described and published by experts can be understood by non-experts (Kubler et al., 2018), can be read and interpreted by the public, and language, symbols, and units in accordance with the context of its use (“ISO/IEC 25012,” 2019). In accordance with Law Number 14 Year 2008 concerning Openness of Public Information (Presiden Republik

Indonesia, 2008b), information must be disseminated in a way that is easily understood by the public. The measurement of these criteria is through clear definition of columns, columns in an easily understood format, and definite reference codes. Clarity of column definition can be measured through the percentage of the number of columns that have unambiguous metadata and the existence of metadata explanation of the total column measured. Columns in an easily understood format can be measured through the percentage of the number of columns in the dataset in a valid format and in accordance with the unit of measurement of the total column measured. The exact reference code can be measured through the percentage of reference codes that have a clear definition of all the codes presented (Utamachant & Anutariya, 2018).

4. **Timeliness** criteria, according to “ISO/IEC 25012” (2019), Kubler et al. (2018), Utamachant & Anutariya (2018), and Vetrò et al. (2016) whose function is to determine the period of data usage, as well as the frequency of data created, modified, and published. 6.6% found this criterion to be the main criterion in data quality related to LO Data workload to meet KPIs, there were periodic data, renewal data (quarterly), and consolidated data (every six months). In line with Presidential Regulation of the Republic of Indonesia Number 39 of 2019 concerning One Indonesian Data, the data collected needs to contain a schedule for release and/or updating of data. In addition to avoiding duplication, this is also a basis for planning and budgeting for central and regional agencies (Presiden Republik Indonesia, 2019). Timeliness criteria, according to Vetrò et al. (2016), can be measured by considering the percentage of row renewal from the dataset that has no previous time period value, the ratio of

publication delay to the frequency of published data, and the ratio of publishing delay of the end of the previous dataset version to the publication period of the dataset.

5. **Openness** of data affects the quality of government in promoting economic growth and creates good governance through transparency and high accountability to prevent the practice of corruption, collusion and nepotism (Fitriani, Hidayanto, Purwandari, Nazief, & Hardian, 2017; Presiden Republik Indonesia, 2008a). 6.4% think openness criteria is not only related to data provided to the public but also the transparent data processing flow from the LO Data team, verification team, and data validation team. In accordance with Presidential Regulation of the Republic of Indonesia Number 39 of 2019 concerning One Data Indonesia, the openness and transparency of data creates planning and formulation of development policies based on data (Presiden Republik Indonesia, 2019). According to the research of Kubler et al. (2018) and Renáta Máchová et al. (2018), evaluation of data disclosure can be done by taking into account the percentage of file formats that meet the open standard (Open Format), the file format that can be read, analyzed, and modified by machine (Machine Read), and user licenses that are explicitly granted in relation to the use of datasets issued (Open License) (Kubler et al., 2018; Renáta Máchová et al., 2018).
6. The **Functionality** criteria on web quality are in line with research by Fath-allah et al. (2018) and Saxena (2018b) where expanding the features will facilitate the accuracy of the use of the OGD portal. 5.8% think that having the right functions to support the Jakarta Open Data portal will make it easier for the public to get data, for example, the accuracy of data

searching based on the intended keywords and the authority of the parties in the data portal. In Presidential Regulation Number 95 Year 2018 concerning Electronic Based Government System (SPBE), the output produced from one or several functions of SPBE and has benefits is a form of SPBE service (Presiden Republik Indonesia, 2018). This criterion can be measured in accordance with government renewal or innovation in the characteristics of data portal functions aimed at meeting public needs. In Saxena's Research (2018b), the characteristics of functionality in the OGD portal are in the data search by facilitating users to get access to selected datasets, the availability of social media plug-ins that facilitate discussion between users about experiences using the OGD portal, and data visualization where users can be onsite analysis using maps, graphs, tables, and others.

7. **Reliability** criteria on service quality, accordingly Lee et al. (2018) and Renata Máchová & Lněnička (2017), have an influence on ease of use as well as the public intention to use the open data portal. 5.4% believe that there is a need for reliable and appropriate services through the open data portal given the change of team personnel due to mutations and other work obligations. This criterion is in line with the Governor Regulation of the Special Capital Province of Jakarta Number 181 Year 2014 concerning Development Data and Information Management Systems and Procedures whereby reliable services can realize reliable development control, monitoring, evaluation and reporting (Gubernur Provinsi DKI Jakarta, 2014), Regulations President Number 95 of 2018 concerning Electronic-Based Government System where the purpose of the SPBE is to realize quality and reliable public services (Presiden Republik Indonesia, 2018), and

Presidential Instruction of the Republic of Indonesia Number 3 of 2003 concerning National E-Government Development Policies and Strategies where the need for reliable and trusted public services to meet the interests of the community (Presiden Republik Indonesia, 2003). This criterion can be measured by knowing through services provided by the government through an open data portal where the public can register and get updates on certain data for the benefit of their duties (Lee et al., 2018).

Externally, OGD evaluations need to pay attention to community needs and the existence of data exchange cooperation with relevant Ministries or Institutions. OGD evaluation by involving the community, according to Mishra et al. (2017), by adapting a citizen centric model to understand the data needs of open from the point of view itself. Research Purwanto, Zuiderwijk, & Janssen (2020) added that the urgency of community needs, approval of OGD implementation by involving the community, diversity of community abilities, and the use of social media are conditions in citizen engagement with OGD. In terms of data exchange, the need for an effective and efficient process where the data managed often intersects data with related Ministries or Institutions through a Memorandum of Understanding (MoU) on data exchange between government agencies. As for the Presidential Regulation of the Republic of Indonesia Number 39/2019 concerning One Indonesian Data (Presiden Republik Indonesia, 2019), both central and regional agencies do not need a Memorandum of Understanding (MoU) if there is a data officer (*walidata*) and information and documentation management officer (PPID).

CONCLUSION

This study aims to determine priority criteria and provide recommendations in evaluating the implementation of open government data in the Provincial

Government of DKI Jakarta. The criteria weighting method uses the fuzzy AHP approach with eleven expert respondents. There are twenty criteria defined, which are divided into four dimensions, namely data quality, web quality, service quality, and social media quality. Based on the dimension priority results it is known that data quality has the highest importance weight, followed by web quality, service quality, and social media quality. Overall weighting of criteria with a threshold value ≥ 0.05 is known that there are eight criteria that are the top priority, namely DQ2> DQ4> DQ7> DQ5> DQ1> DQ8> WQ1> SQ1.

In the short term, the implication of this study for the provincial government of DKI Jakarta is an internal evaluation based on the eight main priority criteria mentioned earlier which can then be evaluated based on overall criteria. The results of the evaluation can be discussed by the data processing team, the data verification team, and the data entry team at the Jakarta Open Data in the data forum as well as the basis for preparing the Standard Operating Procedure (SOP). Externally, the team of Jakarta Open Data needs to consider the needs of the public through citizen engagement conditions and the integration of data as needed through data exchange MoU with the relevant Ministry or Institute if there is no *walidata* or PPID that the data processing more effectively and efficiently.

This study has limitations because it only involved five departments as expert respondents from a total of 51 departments in the DKI Jakarta Provincial Government. In the future, this could involve external parties such as the Central Information Commission and OGI. Another limitation in this study focuses on the priority criteria of the OGD evaluation model. In the future, measurement of OGD evaluation can be continued by ranking the importance of public value through other Multi Criteria Decision Making (MCDM) approaches such as fuzzy-TOPSIS. Accuracy criteria on the dimensions of data quality are the main priorities to be evaluated

so that further research can measure and discuss more deeply on 51 regional work units in the DKI Jakarta Provincial Government or in governments that have implemented OGD in Indonesia.

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