Towards an Open Government Data Success Model: A case study from Indonesia

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Abstract: Governments around the world are following the global open government movement by initiating Open Government Data (OGD) programs. They are motivated by the claim that it will generate economic and social value. However, the success of an OGD initiative will only be realized when OGD is used and when the use results in the creation of public value. Even though a plethora of academic research has examined various aspects of OGD initiatives, the question regarding how OGD generates public value remains unaddressed. This paper aims to develop an OGD success evaluation model that offers a systematic way of understanding how OGD creates public value. For this purpose, we first present and explore public value generation through an OGD initiative in the context of Indonesia's 2014 presidential election. Subsequently, we propose an OGD success evaluation model that explicates how service, information and system quality affect the intention to use OGD and user satisfaction, which in turn lead to the creation of public values. This paper contributes to the literature by applying the Information Systems Success Model of DeLone and McLean in the context of OGD. It extends their model by adding the concepts of social media quality. Since the model is conceptual, further empirical research is needed to test the model.

Keywords: open government data, e-government, public value, information systems success, evaluation, case study

1. Introduction

Governments at national and local level have invested in OGD infrastructures and in opening various datasets in different domains (Charalabidis, Loukis and Alexopoulos, 2014). It is noted that the investments are significant (Charalabidis, Loukis and Alexopoulos, 2014; Hossain, Dwivedi and Rana, 2016). Many studies already indicated that OGD may potentially bring political, social, economic and technical benefits (Huijboom and Van den Broek, 2011; Janssen, Charalabidis and Zuiderwijk, 2012). For example, when a Brazilian media published its investigation reports on questionable transactions using open government credit card data, it led to a change in better spending policy (Graft, Verhulst and Young, 2016a). Subsequently, benefits like transparency, efficiency and accountability can drive the generation of public value from opening data (Zuiderwijk et al., 2014). Although various types of OGD initiatives exist, their main goal is to create public value (Meijer, Conradie and Choenni, 2014). This aim will not be achieved immediately by simply opening data, as OGD has no value in itself, but value can be generated when the data used (Janssen, Charalabidis and Zuiderwijk, 2012).

However, the actual realization of the potential OGD benefits and whether they generate public value is not always clear (Charalabidis, Loukis and Alexopoulos, 2014; Hossain, Dwivedi and Rana, 2016). Little is known regarding the conversion of OGD into public value (Janssen, Charalabidis and Zuiderwijk, 2012) and the components of OGD success (Hossain, Dwivedi and Rana, 2016). As a result, researchers and international organizations, start to question the value of the investment in OGD (Charalabidis, Loukis and Alexopoulos, 2014). Furthermore, Jetzek, Avital and Bjørn-Andersen (2013b) claim that there is no encompassing framework which reveals how public value is generated by OGD. Moreover, several literature review studies show that OGD value and impact assessment is under-researched (Attard et al., 2015; Charalabidis, Alexopoulos and Loukis, 2016). This paper seeks to contribute to OGD value and impact assessment by developing an OGD success evaluation model that offers a systematic way of understanding how OGD creates public value.

2. Research approach

This section presents the approach that we used to develop the OGD success evaluation model. First, we sought for relevant publications of OGD success evaluation and public value in Scopus and Web of Science databases. The aim of the literature search was to establish the area of study and identify research addressing the area. We used combinations of the following keywords: "open government data", "public value", and "success model." The collected papers were skimmed to gather only relevant literature. The literature overview was used to determine which aspects would be investigated in a case study.

Second, we use a single case study approach. Eisenhardt (1989, p. 533) defines a case study as "a research strategy which focuses on understanding the dynamics present within single settings." This research relies on theoretical sampling as the selection criteria for replicating or extending emergent theory (Eisenhardt, 1989). We examine a case study of an OGD initiative performed in the 2014 presidential election in Indonesia. This case was selected since it addresses the public interest at national level and represents a success story of OGD (Graft, Verhulst and Young, 2016b). Furthermore, this case met the criterion that case study information was available and accessible, and it allowed us to obtain information regarding OGD public value creation. Information sources used in the case study include government reports, observations, and media news. Moreover, the main author of this paper was engaged in this initiative as one of the voluntary users of an application built on the OGD.

Third, we use DeLone and McLean's (1992) taxonomy of Infomation Systems (IS) success to study the OGD value generation process. The elements of the case study are mapped based on the value creation process and corresponding success measurements are addressed. We propose a model for OGD success evaluation that extends the DeLone and McLean's (2003) IS Success Model to complement existing approaches on IS evaluation in the context of OGD.

3. Literature overview
3.1. OGD success evaluation

Various researchers have studied the success factors of OGD initiatives using a case study approach (e.g. Parycek, Höchtl and Ginner (2014); Susha et al. (2015); Zuiderwijk et al. (2015)). Although there are few exceptions, most of these studies focused on cases from developed countries. OGD success has barely been investigated in the less developed world, including Asian countries. As the success of an OGD initiative depends on contextual factors (Susha et al., 2015), it is unknown if those success factors also apply for developing countries.

There is no single definition of IS success. Moreover, the notion of IS success itself is multidimensional and ambiguous. Different stakeholders may have different expectations on the outcome of an IS implementation. Therefore, the interpretations of IS success might vary among stakeholders (Zhang, Dawes and Sarkis, 2005; Zuiderwijk et al., 2015). DeLone and McLean's (2003) IS success model can be used for investigating IS evaluation from a general user's perspective. Several scholars have encouraged the use of the model for investigating OGD success evaluation (Charalabidis, Loukis and Alexopoulos, 2014; Susha et al., 2015; Zuiderwijk et al., 2015; Hossain, Dwivedi and Rana, 2016).

The model, shown in Figure 1, is the updated version of the original IS success model (DeLone and McLean, 1992) and is both a process and causal model that can be categorized into three levels: (1) the output of IS, (2) the use of the IS output, and (3) the influence of the IS output. The output of IS is measured by system, information and service quality. System quality measures the quality of the system's information processing performance from the engineering-oriented perspective. Information quality measures the quality of the information produced by the system. Service quality measures the quality of the services provided by the IS support function. These dimensions will singularly or jointly affect the subsequent systems use or intention to use and user satisfaction. System use or intention to use measures the scale and characteristics in which the IS is used. User satisfaction measures the degree of the user's satisfaction when using the IS. The ultimate level of the model represents the effects of use or intention to use and user satisfaction: net benefits. Net benefits are the most important variable in this model since they assess to which extent IS contributes to the outcomes

for different stakeholders. Finally, certain net benefits will influence further use and user satisfaction. This influence path suggests that there is an iterative process between these measures.
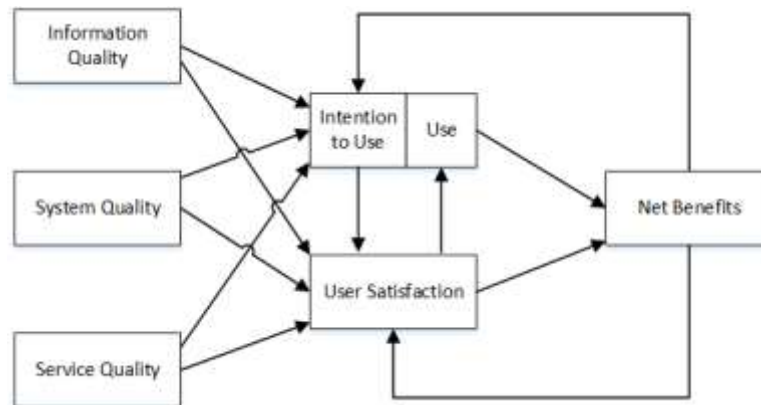

Figure 1: IS success model (DeLone and McLean, 2003).

Although this model arguably provides a sound basis for IS success measurement, it appears that only few studies have examined the model in its complete dimensions and researchers tend to focus on single or incomplete dimensions (Sedera and Gable, 2004; Petter, DeLone and McLean, 2008). Moreover, the literature shows that it is unclear whether the model can be applied for OGD evaluation.

Increasingly, researchers have started to adopt the public value perspective in the domain of electronic government (Zhang, Puron-Cid and Gil-Garcia, 2015). For example, Attard, Orlandi and Auer (2016) conceptualize the value dimensions of impacts of OGD related activities. Jetzek, Avital and Bjørn-Andersen (2013a) propose a OGD value generation model and test it at macro level.

Table 1: IS Success Model dimensions and constructs.

Dimension	Constructs	Authors
Information Quality	Timeliness; accuracy; relevance; completeness, understandability; currency	Bailey and Pearson (1983); DeLone and McLean (1992)
System Quality	Functionality; reliability; download time; interactivity; ease of navigation; accessibility	Bailey and Pearson (1983); DeLone and McLean (1992); Molla and Licker (2001)
Service Quality	Tangibles; reliability; responsiveness; assurance; empathy	Parasuraman, Zeithaml and Berry (1985); Kettinger and Lee (1997)
Use	Duration of use; nature of use	DeLone and McLean (1992)
User Satisfaction	Overall satisfaction	DeLone and McLean (1992)
Net Benefits	Trust; well-informedness; participation	Scott, DeLone and Golden (2016)

3.2. Factors to examine in the case study

From the literature overview, we derived factors to investigate in our case study as summarised in Table 1. Though a plethora of information and systems quality research exists, the root of most of the studies can be traced back to Bailey and Pearson's (1983) work. However, exception was applied for some system quality constructs derived from e-commerce study (Molla and Licker, 2001). Service quality constructs are adopted from marketing study (Parasuraman, Zeithaml and Berry, 1985). Net benefits constructs encompass all levels of influence or impact caused by the information use (DeLone and McLean, 2003). The net benefits constructs included in Table 1 are derived from Scott, DeLone and Golden's (2016) study on e-government success measurement using public value approach.

4. Case study: Indonesia's 2014 presidential election

This section presents the findings from our case study. We study public value generation in the context of the Indonesian presidential elections in 2014. We start with a case description, followed by the case study results.

4.1. Case description

After the collapsed of the New Order regime, the government of Indonesia instituted a democratic election system. A national election committee, Komisi Pemilihan Umum (KPU), was established for managing the election system. The system involves voting for members of the legislative and the heads of the executives at the national, provincial and regency/municipality level. Provincial and regency/municipality branches and ad hoc committees at district, sub-district, and polling station level were founded for achieving KPU's objectives.
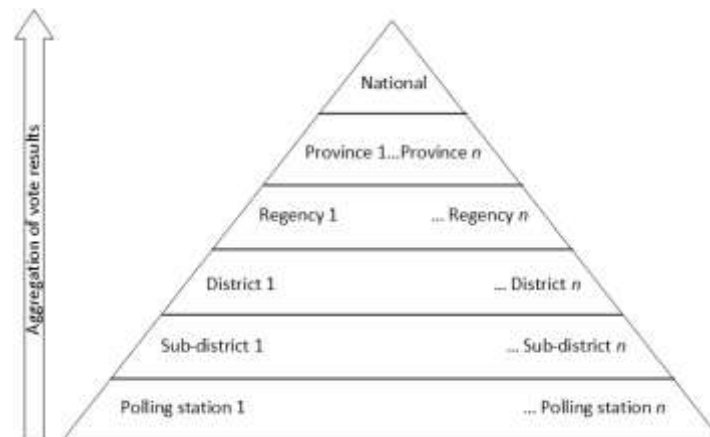

Figure 2: Levels of hierarchy in the vote counting process.

Counting the vote results is complex. This is partly due to the KPU's hierarchy combined with manual voting and geographically distributed vast voting areas. This complexity leads the vote results to be susceptible to frauds and require significant time to reach the public (Brajawidagda and Chatfield, 2014). The vote count begins at the polling station, where the actual votes are cast, and ends at national level through the KPU's hierarchy (Komisi Pemilihan Umum, 2014c). The counting results at polling stations, serve as the primary data source, are manually written by the committee in an official form named C1. Results in C1 are aggregated to the subsequent higher levels of bureaucracy until they finally arrive at national level as shown in Figure 2.

4.2. Case study findings

In the 2014 election, driven by intense competition between two candidates that created polarized society, civil society organisations and activists demanded openness in vote results publication (Graft, Verhulst and Young, 2016b). As a result, KPU made the election data, including vote results, available on its web portal. These efforts were performed at the regency level by digitizing the C1 forms as JPEG image files and uploading them to KPU's server (Komisi Pemilihan Umum, 2014b). In addition, KPU provided social media channels for the citizens to report anomalous C1 images.

Soon after the publication of C1, some independent citizen-sourcing applications were built on top of it, including Kawal Pemilu (Brajawidagda and Chatfield, 2014). It recruited 700 volunteers around the world through a secret Facebook group, in three days after the voting date. The volunteers were provided a collaborative site for examining the C1 and keying the vote results into a database to enrich the opened data. While citizens can access the front-end site for viewing the C1 and the results in national level which then can be drilled down into lower levels of the hierarchy. Ten days after the voting date, the volunteers had successfully keyed in 97% of the opened C1. Whereas the final result deviated only 0.01% from KPU's official announcement.

The KPU's OGD initiative in 2014 presidential election was successful and selected as an important study case by several global communities (Graft, Verhulst and Young, 2016b; ACE Electoral Knowledge Network, 2014),

because it provided a real life example of OGD impacts to the society. This initiative shows that OGD might be used collaboratively to solve societal problems. However, emergent challenges might hinder the sustainability of the initiative. These problems are related to technological capabilities and organizational performance of KPU and the interests of the politicians at stake. Firstly, the primary data was published in JPEG format and therefore did not conform the machine processable standard of the eight OGD principles (Tauberer, 2014). Secondly, KPU's branches in Papua and Papua Barat provinces could only scan and upload 68.36% and 95.33% C1 forms respectively, while other provinces achieved more than 98% (Komisi Pemilihan Umum, 2014b). Thirdly, politicians might exploit the negative impacts of the IT use in the election when the results counted move against them (Graft, Verhulst and Young, 2016b).

5. Proposed model

To develop the model, it is important to understand how the OGD initiative was performed and what aspects should be evaluated. While the latter question has been addressed in Section 3.2, the former can be answered using DeLone and McLean's (1992) taxonomy and Janssen, Charalabidis and Zuiderwijk's (2012). DeLone and McLean's (1992) taxonomy explains the flow of information, from the production of information to its use to its influence on the recipients. Similarly, Janssen, Charalabidis and Zuiderwijk (2012) describe a generic process of value generation in OGD, from the data to its use to value it creates. Figure 3 shows how the process of OGD public value generation process relates to these studies.
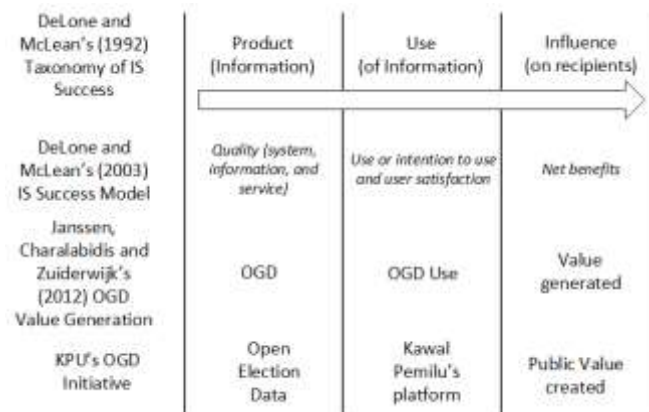

Figure 3: Success generation in OGD initiatives compared to DeLone and McLean's Taxonomy (1992) and their IS Success Model (2003).

The proposed OGD success model is a simplified version of a composition of IS success model, OGD process, and Public Value concepts to explain the OGD initiative evaluation process. In our case study, public value generation starts when the product of the election systems, the open election data, is communicated to the public through a web portal. Then, the data is used by Kawal Pemilu's crowd-sourced and election results platform. Finally, the platform influences the creation of public values. The development of the model will be discussed as follows.

The product of the OGD under study is the election raw data including the C1 images, location of polling stations and government administrations at all levels. A user may not key the vote results in C1 into Kawal Pemilu's database if one encounters poor data quality. As the C1 image was a result of the scanning of manually written form, it was prone to errors caused by writing mistakes, unreadable writing and scanning mistakes (e.g. low resolution setting, contaminations on the scanner's flatbed or glass). Other type of quality problems may emerge, for instance, when KPU did not publish the data in a timely manner (e.g. months after the voting date). Hence, poor data quality may create barriers on data use. Data quality constructs, shown in Table 1, can be used for evaluating the quality of the data. We use data quality, instead of information quality, because it is clear that further processing is required for converting data to information.

The election data were published through an Application Programming Interface (API) mechanism on KPU's web portal at http://pilpres2014.kpu.go.id. The web portal routes the users' requests, and fetches the data

upon the requests. Technical performance of the web portal is evaluated by web quality measures, instead of system quality, since the web only provides interface and does not produce the datasets. This performance is perceived by the users when trying to find, locate and download the data in the web portal. Low system performance (e.g. slow response time) may hinder users from keying in more C1.

In order to use the data, the user needs to understand the API usage for retrieving the right data and understanding the content of the data. KPU's web portal provided guidelines and examples of API usage and metadata. Although it was Kawal Pemilu that dealt with technological complexity in accessing and using the API, it can be seen that KPU's efforts reflect the supports provided for users. These supports also subsume the KPU's social media channels for communicating anomalous C1. The quality of supports can be evaluated by service quality measures. Users expect KPU staff to be responsive whenever they provide feedbacks regarding the quality of the data. A lack of responsiveness may lead to user's distrust, which in turn hinders the sustainable use of data.

The use of OGD is evaluated by the nature and duration of use. The nature of OGD use in our case study was to provide collaboration platform for data enrichment. Though the users were not KPU's staffs, they voluntarily involved in the collaboration aimed at accomplishing their tasks in counting the vote. They were driven by intrinsic motivation to provide a way for other citizens to participate in the election monitoring and express their concerns to the nation's future (Wahyudi, 2014). The faster the results keyed into the database, the more satisfied the users. The duration of OGD use includes these measures: the volume of data downloaded, number of queries, frequency of access, number of applications and visualizations generated, number of data accessed (DeLone and McLean, 1992), and number of (unique) visitors (Lee and Kwak, 2012).

The OGD user satisfaction can be evaluated by overall satisfaction (DeLone and McLean, 1992), the amount of feedback, number of comments on the data, and data rating (Lee and Kwak, 2012). The latter measures are introduced by the rise of Web 2.0 technology. Thereafter, question emerges whether meeting the quality constructs or the aggregation of 700 volunteers' use of data and their satisfactions lead to public value creation. We argue that public values are unattainable inasmuch the use of data does not gain broader public engagement. Hence, there is a need to introduce a dependent variable as the intermediate factor between the use of data and user satisfaction and creation of public values.

Category	Value Identified
Efficiency (Scott, DeLone and Golden, 2016)	Increasing the speed of the information production of the election results (Brajawidagda and Chatfield, 2014)
Transparency / well-informedness (Harrison et al., 2012; Scott, DeLone and Golden, 2016)	Raising the level of openness and accountability of the government processes in the election system (Graft, Verhulst and Young, 2016b)
Engagement / participation (Harrison et al., 2012)	Enhancing public engagement by opening high-value data and providing social media channels (Brajawidagda and Chatfield, 2014)
Collaboration (Harrison et al., 2012)	Promoting data collaboration between government and citizens (ACE Electoral Knowledge Network, 2014)
Trust (Scott, DeLone and Golden, 2016)	Increasing citizens' trust in the government (ACE Electoral Knowledge Network, 2014)

Figure 4: Public Values generated in KPU's OGD initiative.

The case study showed that the advent of social media technology has levelled up the engagement between KPU and potential users of the OGD. By opening up social media channels (e.g. Facebook, Tumblr) and further institutionalizing them into its operating procedure (Komisi Pemilihan Umum, 2014a). This procedure encouraged KPU's staffs to actively monitor anomalous C1 reported by the citizens and performing follow-up actions. As a result, public engagement in election monitoring was significantly increased (Brajawidagda and Chatfield, 2014). Social media provides capability to amplify information sharing by creating many-to-many interactions among users and enact as a tool for promoting transparency and government's initiatives (Bertot, Jaeger and Grimes, 2012; Lee and Kwak, 2012). Though the use of social media channels subsume the service quality measures, they only evaluate the service of KPU's staffs. In response to this discussion, we argue that the quality of the social media channels itself needs to be evaluated. Therefore, we introduce the social media

quality as one of the quality constructs. It can be measured by: number of (real) followers, number of shares or retweets, number of likes and number of mentions (Lee and Kwak, 2012).

The amplification of both KPU's initiative and Kawal Pemilu's collaboration platform through social media has led to broader engagement impact of election monitoring by citizens. The social media channels and the platform enabled citizen to check the uploaded C1, compare it with the actual results counted and witnessed at polling station, and further report it when confronting error. Citizens were empowered to scrutinize the performance of KPU and actively combat corruptive behaviour of its committee members (Graft, Verhulst and Young, 2016b). The engagement insofar has pushed KPU to be more responsive and open to citizen's feedbacks even further to improve its performance. Altogether, the initiative has generated public values as identified in Figure 4.
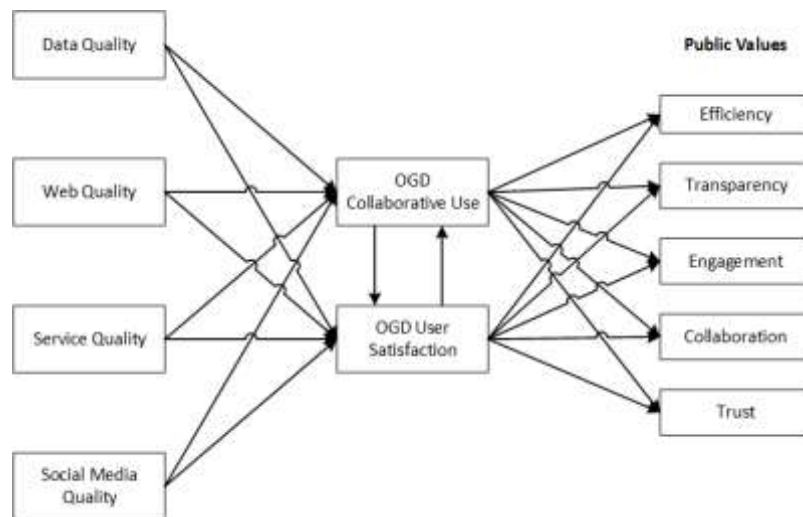

Figure 5: The proposed OGD success evaluation model (adapted from DeLone & McLean, 2003).

The proposed model is drawn in Figure 5. Data, web, service and social media quality affect the collaborative use of OGD and OGD user satisfaction. We exclude the intention to use dimension since it is not clear how it transforms into actual use. Moreover, the key tenet required in OGD value generation is the use itself. When using OGD, users may experience poor data quality. User satisfaction is achieved only after preceded use and higher user satisfaction further leads to further use. This amplification leads to the creation of public values: efficiency, transparency, engagement, collaboration, and trust in the government. All measures, except social media quality and certain parts of OGD use, can be evaluated using survey instruments that require respondents to express their perception on them. While unobtrusive measures (e.g. server logs and social media analytics) can be used for evaluating social media quality and OGD use.

6. Conclusion

This paper aims to develop a model for measuring OGD success through a public value perspective. Factors influencing OGD public value creation were derived from IS success and public value literature and investigated in the case of Indonesia's 2014 presidential election. Based on this case, this paper developed an OGD success evaluation model that offers a systematic way of understanding how OGD creates public value.

The model extends existing IS success models by adding concepts of social media sharing and public value identification. This study is among the first to apply the IS success model to OGD success evaluation, and to create a model for OGD success in developing countries. It showed that OGD success in developing countries differs from OGD value generation in developed countries in the sense that the former needs collective efforts to succeed. Cultural dimension may drive the emergence of this factor. In developing countries, OGD success depends on the collective actions of the citizens, as shown in the data collaborative use and social media sharing in the case study. Contrary, OGD success in developed countries depends on the capability and expertise of the individuals using the OGD.

This study has a number of limitations. First, since the model is conceptual, it views the OGD evaluation from a high-level perspective and requires validation through empirical studies. Further research is needed to define the model specification and test it using quantitative approach. Second, this study used a single-case study approach that may suffer from generalization. We suggest further research to examine whether the findings also apply in other OGD cases. Third, the case study involves OGD initiatives in the Indonesian election context. Hence, it may not be applicable in other OGD contexts considering different domain and regional settings (e.g. urban planning in the Netherlands).

In conclusion, as more government data is being opened and more OGD infrastuctures are being developed, the question of what public value OGD can generate remains to be answered.

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