Factors Influencing the Adoption of Open Government Data in The Public Sector: A Systematic Literature Review

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Abstract— **Open Government Data (OGD) adoption has been extensively studied; however, few have examined the success factors of OGD adoption in the public sector context. The benefits of leveraging data in enhancing public service delivery have been a significant concern to the top management of the public sector in providing them insight for strategic planning together with timely decision making. The aim of this paper is to review recent literature from the year 2010 to 2018 on OGD adoption at the organizational level in the public sector context. We systematically searched all English papers that were indexed in seven electronic journal databases (Scopus, Emerald, Web of Science, Science Direct, ACM, Springer and IEEE) which include journals, proceedings, books and book chapters. Few papers were acquired from snowballing techniques and ResearchGate webpage. A total of 886 publications were identified in this process and 25 papers have finally been selected which are deemed as relevant papers for the analysis stage. As derived from 25 selected papers, this study has identified 16 factors that influence the OGD adoption which has been categorized into three main dimensions: Technological, Organizational and Environmental (T-O-E). Policy, technological competence, top management support and organization culture are among the most influential factors of OGD adoption. Therefore, this study is expected to assist other researchers to understand the current stage of OGD adoption in terms of influential factors, research domains and research methodology.**

Keywords— **open data; open government data; adoption; public sector; factors.**

I. INTRODUCTION

Data is the current world most valuable resources. As an invaluable asset, data can be leveraged to make various data products, driven by creativity and innovation. Data is also considered as core prerequisite to acquire knowledge and to provide services. Thus, data ought to be acquired for free use by anyone and not to be kept [1]. The idea of open data that offers free data usage has received numerous attentions in recent years. The open data trend was believed to have started when President Barrack Obama issued Memorandum on Transparency and Open Government in 2009, which was followed by the UK government's transparency initiative in 2011 [2] and subsequently Open Government Partnership (OGP) was launched by eight other countries in the same year.

In general, open data is defined as data available online which can be freely used, accessible, re-used and redistributed for any purpose by anyone without technical restrictions and limitations [3]–[5]. The term of Open Government Data (OGD) or also acknowledged as open Public Sector Information (PSI) is defined as non-confidential government data, that is freely available in open format and been put on without any restrictions on the

Internet for free used, re-used and redistribution [3], [6]. OGD also comes from a combination of a specific subset from government data and open data.

The OGD innovation can increase transparency and accountability in government, empower the citizen participation in government service and stimulate economic growth through re-use of data [3]–[5], [7], [8]. Despite the enormous benefits of adopting OGD, there remains a paucity of evidence on governments' success of open data. Many government agencies are vigilant and reluctant to release their data [7]. In fact, developing countries still facing issues in OGD adoption [9]. OGD initiative is still at its infancy stage, which consequently creates numerous challenges at the implementation level [10], [11].

To date, few empirical studies have examined the association between OGD and adoption based on citizen perspective [12]–[16], stakeholder perspective [8], data user perspective [17]–[19], academician perspective [20], private organization [21] and public sector perspective [10], [22], [23]. Nevertheless, the adoption rate by the public sector in releasing OGD is growing very slowly. Only a limited number of factors influencing the adoption of OGD in the public sector have been identified in the prior studies. Most of those studies were conducted in the initial development

phase of OGD, thus the influential factors may change along the development process and could vary over time [10]. Hence, other factors that influence the OGD adoption must be examined [24] particularly in the public sector context.

In addition, OGD was also found as an understudied research domain in a local government context [25]. Therefore, in order to ensure the success of OGD adoption, the paper aims to investigate the other potential factors that can influence OGD adoption in the public sector by conducting the SLR. Then, these factors will be used to develop a new model of OGD adoption for the specific sector mentioned.

This paper is arranged as follows: It starts with a review of methodology and follows by a section describing the result and discussion of the influencing factors. Then the study is concluded by highlighting the research contribution together with suggestions for future research work.

II. MATERIAL AND METHODS

This paper is written based on the approach by [26], [27]. The purpose of conducting the SLR is to identify and recapitulate the present evidence regarding the OGD adoption in the public sector. There are three stages in SLR procedures which consist of planning, executing and reporting.

A. Stage 1: Planning

There are three main activities conducted in this stage; identifying the need for a review, developing review protocol and thirdly developing research question. A research question has been formulated to begin the research based on the OGD adoption in the organizational context. The formulated question derived is as per written next - "What are the factors that can influence the adoption of OGD in the public sector?''.

B. Stage 2: Executing

Boolean "AND" and "OR" have been used to construct formulation of the search strategy at executing stage. The purpose of the search string was to trace the research that related to OGD adoption as indicated in Table 1.

TABLE I
SEARCH STRING FOR PAPER RETRIEVAL

("open data" OR "open government data" OR "government open data" OR "public open data" OR "public government data" OR "open public sector information" OR "open public sector data" OR "public sector open data") AND ("adoption" OR "acceptance")

The research steps continue by executing searching exercise for information from seven electronic journal databases such as Scopus, Emerald, Web of Science, Science Direct, ACM, Springer and IEEE which applied to the title, keywords, and abstracts of publications from the period of January 2010 to November 2018. Few papers were acquired from snowballing techniques and ResearchGate webpage. All retrieved papers in the digital libraries must be written in English. Any papers will be excluded if it did not abide by the inclusion criteria as stipulated.

The processes continue with analyzing and synthesizing the selected papers before coming out with a discussion on the findings and results. Then, the quality assessment (QA) screening was conducted to assess the credibility, relevance, advantages and completeness of the selected papers. The QA was completed by scoring technique to acquire pertinent studies that able to address each research question. There are three optional answers for each question: "Yes"=1; "Partially"=0.5; and "No"=0, and all questions from Q1 until Q4 are represented in Table 2.

TABLE II
QUALITY ASSESSMENT CRITERIA

No	Item	Answer
Q1	Can the full version of the publication be retrieved?	Yes/No
Q2	Does the paper explain the adoption factors of the open government data domain?	Yes/No/ Partially
Q3	Does the publication study on the organizational level?	Yes/No
Q4	Does the publication context involve the public sector?	Yes/No/ Partially

C. Stage3: Reporting

In this stage, discussion on findings and results are presented in Section 3.

III. RESULTS AND DISCUSSION

The process of the initial stage in the paper selection was conducted by referring to the search string (Table 1). A total of 886 publications regarded as pertinent to this topic were identified in this process. Then, the titles and abstracts of the papers were screened and evaluated. The unrelated and duplicated papers were excluded and subsequently, 54 potentially relevant papers were selected to be filtered by utilizing the QA criteria. As a result, 25 papers (46 percent out of 54 papers) have finally been selected which are deem as relevant papers for the analysis stage, namely data synthesis of evidence. In order to synthesize data, the 25 selected papers were examined by conducting exclusion criteria; followed by evaluating the detailed abstracts and contents of each paper as depicted in Table 4. Meanwhile, Table 3 listed the quality assessment summary of the twenty-five (25) selected papers (P1-P25) for this review.

TABLE III
QUALITY ASSESSMENT SUMMARY

ID	Q1	Q2	Q3	Q4	Total
P1	1	1	1	0.5	3.5
P2	1	0.5	1	1	3.5
P3	1	1	1	1	4
P4	1	1	1	1	4
P5	1	1	1	0.5	3.5
P6	1	0	1	1	3
P7	1	1	1	1	4
P8	1	0	1	1	3
P9	1	0.5	1	1	3.5
P10	1	1	1	1	4
P11	1	1	1	1	4
P12	1	0.5	1	1	3.5
P13	1	1	1	1	4

P14	1	1	1	1	4
P15	1	1	1	0.5	3.5
P16	1	1	1	0.5	3.5
P17	1	1	1	1	4
P18	1	0.5	1	0.5	3
P19	1	0.5	1	1	3.5
P20	1	0.5	1	0.5	3
P21	1	0.5	1	1	3.5
P22	1	0.5	1	1	3.5
P23	1	0.5	1	0.5	3
P24	1	1	1	0.5	3.5
P25	1	1	1	1	4

The quality scales of assessment for all these selected papers consist of four (4) filtering classifications enumerated as follows: very poor, poor, good and very good as shown in Table 4. The quality scores for these papers were computed from the QA answers. Consequently, the findings show that the score of all selected papers achieved the acceptable quality rate, which 20 papers have scored very good quality (80 percent) and five (5) papers have scored good quality (20 percent).

TABLE IV
QUALITY SCORES

Quality Scale	Very Poor (<1)	Poor (1 - <2)	Good (2 - <3)	Very Good (3 - 4)	Total
Number of papers	0	0	5	20	25
Percentage (%)	0	0	20	80	100

Overall, as mentioned previously, 25 relevant papers were selected for this research, which consists of 18 journal articles (72%), 6 conference articles (24%) and 1 book chapter (4%). Each percentage and numbers of the selected papers is illustrated in Fig. 1.
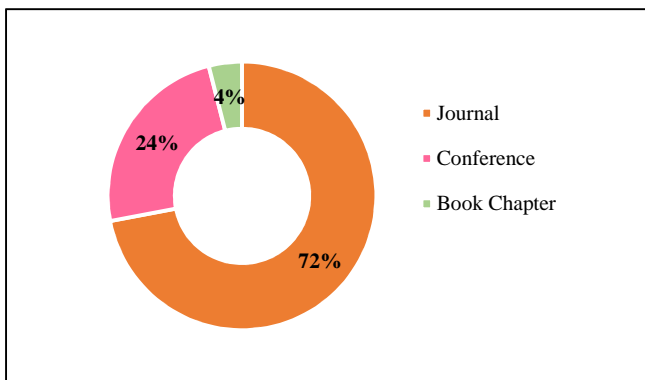

Fig. 1 Numbers and percentage of selected papers

The trend of publications on OGD adoption in the public sector is represented in Fig. 2. Interestingly, the graph shows the fluctuated trend on the number of papers from year 2010 until November 2018.
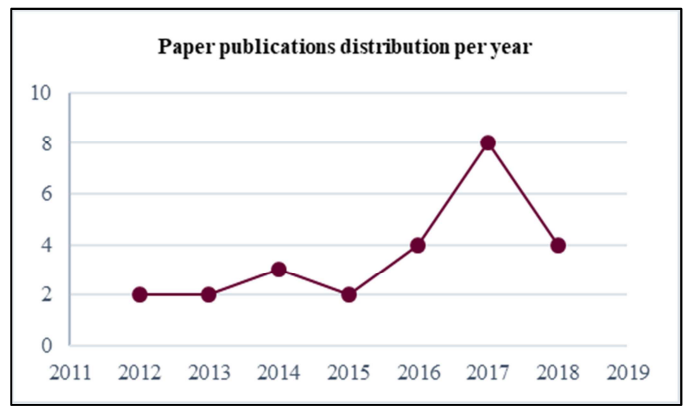

Fig. 2 Number of papers by year of publication

Fig. 3 on the other hand, has examined the selected papers and grouped it into five (5) categories of research method, namely empirical, case study, content analysis, event history analysis and fuzzy analytical hierarchy process (AHP). Findings revealed that the most method widely applied is empirical, followed by content analysis, case study, event history analysis and fuzzy AHP. Subsequently, there were two (2) published papers of empirical study in 2012, 2013, 2014 and 2018 and one (1) published paper in 2015. Nevertheless, the number of publications has increased in 2016 (four (4) papers) and 2017 (five (5) papers). There was only one (1) publication of case study which published in 2014 and 2015, followed by two (2) content analysis in 2017 and one (1) in 2018, one (1) publication of event history analysis in 2017 and one (1) publication of fuzzy AHP in 2018.
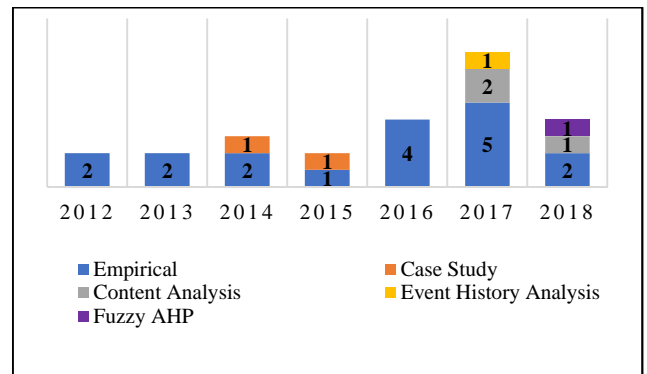

Fig. 3 Research Method Categories by Year

The frequency of research method type in OGD adoption is depicted in Fig. 4. Generally, the total of published papers consists of eighteen (18) empirical papers, followed by three (3) papers applied content analysis method, two (2) case study papers, one (1) event history analysis paper and one (1) paper using fuzzy AHP technique.
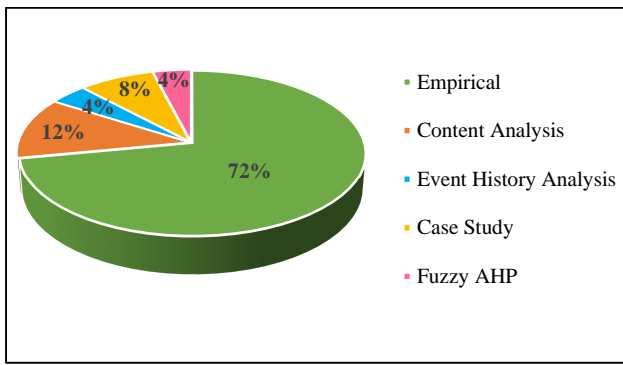
Fig. 4 Frequency of research method type in OGD adoption

Fig. 5 below illustrates the studies of OGD adoption according to domain specific and non-domain specific. The studies of domain consist of nine (9) papers from a context of various government agencies, three (3) papers from the specific government department, two (2) papers of content analysis studies on the government portal, and one (1) paper for each domain in local government, state government and semi-government. The remaining eight (8) papers are classified as non-domain, involving studies in various types of organizations.
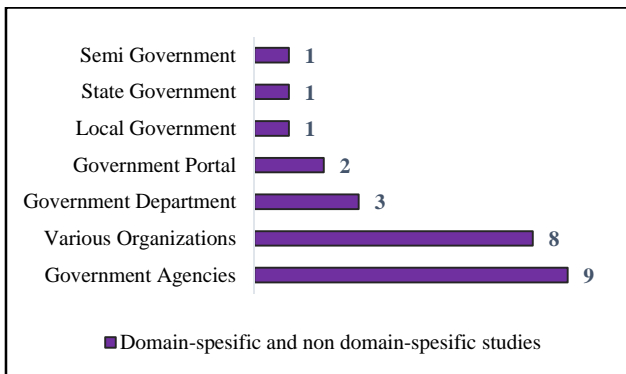

Fig. 5 Studies on domain and non-domain

The systematic review on the adoption of OGD in the public sector has revealed sixteen (16) influential factors as indicated in Table 5. In addition, Fig. 6 that follows highlighted the frequency of factors influencing the OGD adoption. These factors are classified into respective dimensions based on the theory of Technology-Organization-Environment (TOE) framework [23]. The TOE framework proposed that key adoption factors at the organizational level mainly categorized into the technological dimension, organizational dimension, and environmental dimension [18], [24].

Technological dimension comprises of five (5) factors; perceived benefit (6 papers), complexity (8 papers), infrastructure (5 papers), security (1 paper) and data quality (8 papers). The other seven (7) factors are considered to be organizational dimension, namely technological competence (12 papers), top management support (9 papers), organization culture (9 papers), trust (6 papers), data governance (5 papers), reward (4 papers) and financial resources (1 paper). Subsequently, the rest four (4) factors represent the environmental dimension; government policy

(17 papers), external pressure (7 papers), stakeholder demand (7 papers) and citizen demand (7 papers).

TABLE V
LIST OF FACTORS INFLUENCING THE OGD ADOPTION

| No	Factors	Articles
1	Government Policy	P1, P2, P4, P6, P7, P9, P10, P11, P12, P15, P16, P18, P20, P22, P23, P24, P25
2	Technological Competence	P1, P4, P9, P11, P12, P13, P14, P15, P17, P18, P20, P24
3	Top Management Support	P1, P2, P7, P5, P6, P9, P10, P17, P18
4	Organization Culture	P1, P4, P5, P9, P12, P14, P18, P21, P23
5	Complexity	P5, P7, P14, P17, P19, P20, P23, P24
6	Data Quality	P2, P8, P9, P12, P18, P19, P23, P24
7	External Pressure	P3, P9, P13, P14, P15, P16, P22
8	Stakeholder Demand	P1, P2, P4, P7, P9, P16, P17
9	Citizen Demand	P1, P2, P3, P6, P11, P12, P25
10	Perceived Benefit	P3, P5, P6, P13, P14, P24
11	Trust	P10, P11, P12, P14, P21, P24
12	Data Governance	P5, P6, P10, P18, P21
13	Infrastructure	P6, P9, P11, P14, P17
14	Reward	P2, P4, P16, P18
15	Security	P10
16	Financial Resources	P4
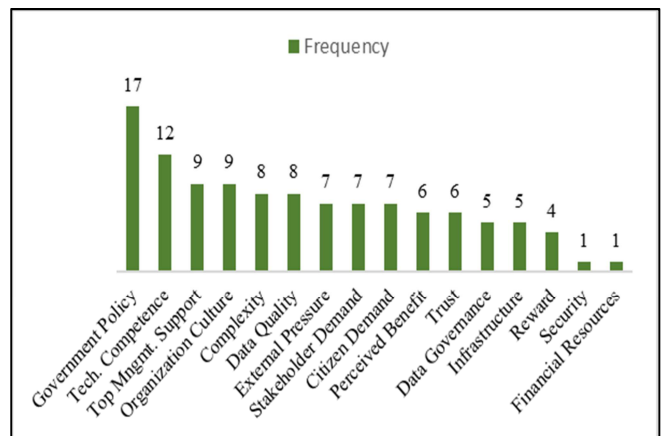
Fig. 6 Frequency of factors influencing the OGD adoption

Illustrated in Table 6, list of selected papers represents the summary of each paper comprises of domain, method, studied country and reference.

TABLE VI
SUMMARY OF FACTORS INFLUENCING THE OGD ADOPTION

ID	Domain	Method	Studied Country	Ref.
P1	Various Organizations	Empirical	Netherland Sweden	[28]
P2	Government Portal	Content Analysis	Asian	[29]
P3	Government Agencies	Empirical	Saudi Arabia	[30]
P4	Government Agencies	Fuzzy AHP	Indonesia	[31]
P5	Various	Empirical	Austria	[32]

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	Organizations			
P6	Government Agencies	Empirical	India	[33]
P7	Government Department	Empirical	United State	[34]
P8	Local Government	Content Analysis	Australia	[35]
P9	Government Agencies	Empirical	China	[36]
P10	Government Department	Empirical	Belgium	[37]
P11	Government Agencies	Event History Analysis	Australia	[38]
P12	Government Portal	Content Analysis	Gulf Cooperation Council	[39]
P13	Government Agencies	Empirical	Taiwan	[10]
P14	Government Agencies	Empirical	Taiwan	[23]
P15	Various Organizations	Empirical	United State	[40]
P16	Various Organizations	Empirical	Brazil, Kenya, Moldova, Morocco, and Philippines.	[41]
P17	Government Agencies	Empirical	Australia	[11]
P18	Various Organizations	Case study	Europe, United State and Vienna	[42]
P19	Government Department	Case study	United State	[43]
P20	Various Organizations	Empirical	Brazil	[44]
P21	Government Agencies	Empirical	Netherland	[2]
P22	Various Organizations	Empirical	United State	[45]
P23	Semi Public Organization	Empirical	Netherland	[46]
P24	Various Organizations	Empirical	Netherland	[3]
P25	State Government	Empirical	United State	[47]

The description for each factor in the three TOE framework dimensions is as follows:

A. Technological Dimension

The technology context comprises of infrastructure, processes, techniques, and expertise which drives decision making of adoption [48]. For instance, data quality which described as a critical element of users' needs in big data study [49], must also be considered as the main success factor of OGD implementation in the public sector. There are five (5) technological factors in relation to this study;

- Perceived benefits (P3, P5, P6, P13, P14, P24): the extent of management recognition that OGD adoption is beneficial to the organization.
- Complexity (P5, P7, P14, P17, P19, P20, P23, P24): the difficulties to adopt OGD.

- Data Quality (P2, P8, P9, P12, P18, P19, P23, P24): the quality of published data to be accessed by the public.
- Infrastructure (P6, P9, P11, P14, P17): the degree of ICT infrastructure available to support the OGD adoption.
- Security (P10): the degree of technology to safeguard the data confidentiality and privacy.

B. Organizational Dimension

The organizational context represents the internal factors to an organization in influencing an innovation adoption and implementation [48]. Organizational factors are extremely relevant and should not be left out in any organizational adoption research. This study proposed seven (7) organizational factors;

- Trust (P10, P11, P12, P14, P21, P24): refer to the degree of organization's concern and trustworthiness to adopt OGD.
- Top Management Support (P1, P2, P7, P5, P6, P9, P10, P17, P18): the degree to which top management understands the importance of OGD innovation and the extent to which it is involved in related initiatives.
- Technological Competence (P1, P4, P9, P11, P12, P13, P14, P15, P17, P18, P20, P24): important organizational factors which related to technological readiness that consist of IT infrastructure and IT human resources.
- Data Governance (P5, P6, P10, P18, P21): the degree of data governance in the organization to adopt OGD.
- Organizational Culture (P1, P4, P5, P9, P12, P14, P18, P21, P23): the organization's willingness together with the organization's readiness of positive condition to share data with others.
- Reward (P2, P4, P16, P18): the reward system or incentive policies provided by top management to encourage the adoption of OGD initiative.
- Financial Resources (P4): the degree of financial support from management and external parties.

C. Environmental Dimension

TOE distinguishes how the industry, competitors, government and other near and far institutions can influence the adoption decision [48]. This study proposed four (4) environmental factors;

- Government Policy (P1, P2, P4, P6, P7, P9, P10, P11, P12, P15, P16, P18, P20, P22, P23, P24, P25): the existence of policy and regulation will certainly affect adoption of OGD.
- External Pressure (P3, P9, P13, P14, P15, P16, P22): the characteristics of coercive and mimetic pressure which influence organization decisions to adopt OGD.
- Stakeholder Demand (P1, P2, P4, P7, P9, P16, P17): the extent of stakeholder demand to the OGD adoption.
- Citizen Demand (P1, P2, P3, P6, P11, P12, P25): the extent of citizen demand to the OGD adoption.

IV. CONCLUSION

This study has been one of the first attempts to systematically review the literature on OGD adoption in the public sector context from the year 2010 to 2018.This paper

also contributes to research by providing a systematic overview of the existing research area. The analysis was conducted by filtering and reviewing papers related to the study. A total of twenty-five (25) selected papers were thoroughly reviewed and analyzed. The review process has identified sixteen (16) factors that may influence OGD adoption and categorized the factors into three main dimensions which are Technological, Organizational and Environmental (T-O-E). Policy, technological competence, top management support and organization culture are among the most influential factors of OGD adoption.

On the other hand, the review shows that there are some potential areas and domains on OGD adoption that could be studied further; for instance, local government, state government and semi-government domains. In addition, this study has examined the factors which are deem to contribute to the success of OGD adoption. Nonetheless, all identified factors are not deliberated in depth, thus it needs to be explored more on that particular research area. These findings could be used to assist other researchers to understand the current stage of OGD adoption in the public sector context specifically on influential factors, research domains, and research methodology. It will also provide insight for public sector leaders to enhance the quality of service delivery.

To achieve the objective of this study, these factors will be used to develop a conceptual model of OGD adoption in the public sector. Then, the follow-up research activity will be conducted which comprises of survey instrument development, content validation, a pilot study and to be followed thereafter by the actual study. Finally, the model will then be validated using statistical tools.

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