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Why do Open Government Data initiatives fail in developing countries? A root cause analysis of the most prevalent barriers and problems

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Abstract

Open Government Data (OGD) include the provision of government data, which have so far been reserved for the provision of public utilities and services, wherein different stakeholders may create value out of the same source. Recently, OGD initiatives around the world have dampened or were found to be inadequate for one or other reasons. The present study seeks to underline the root causes behind these inadequate or stalled initiatives with a specific focus on the developing countries. This article undertakes a literature review of the most significant studies in this area, followed by a root cause analysis wherein the database across Scopus and Web of Science has been explored with the set inclusion and exclusion criteria being set in line with the research focusing on the hinderances and bottlenecks behind the failure of OGD initiatives (n~15), thus not only summarizing what has been revealed in previous studies but also identifying these “root-cause” relationships, which are responsible for the stalled OGD projects. A deep understanding of the literature on OGD shows that research of OGD barriers repeat each other. The results show that the main root causes include politico-administrative, social, technological, legal and organizational (inter- and intra) dimensions including aspects like state of the economy, infrastructural issues, the tendency to copy the OGD initiative without need to institutionalize the same, etc. Whereas a number of studies are available covering the barriers in the roll-out and implementation of OGD initiatives, the root causes behind the existence of these barriers have not been identified so far-the present study seeks to plug this gap. Besides being a contribution to the extant OGD literature in general, the study seeks to leave academic and practical implications for furthering up deliberations and discussions on the OGD themes with specific impetus upon the cause analysis of the failure in OGD initiatives and the manner in which the same may be corrected or preempted.

Key words: Open Government Data, OGD, Rootcause analysis, Barrier, Demand-side, Supply-side

Introduction

Open Government Data (OGD) initiatives are considered as the culmination of the digital government platforms provisioned by the governments on the premise that OGD initiatives shall further administrative transparency and citizen participation besides bringing about economy, effectiveness and efficiency in public service delivery formats (Piotrowski et al., 2009; Sadiq & Indulska, 2017). As such, OGD is the provision of government data for public use (Okamoto, 2017; Zuiderwijk et al., 2015). Since the call of President of the United States of America Barack Obama, the OGD initiatives have taken the reins around the world. Although a number of countries have been successful in launching OGD initiatives, there are many cases where initiatives have either been stalled or they do not pick up speed. There are many studies on barriers and impediments on OGD (Martin, 2014; Maseh & Katuu, 2017; Nam, 2015; Ohemeng & Ofosu-Adarkwa, 2015; Serra,

2014), and many of these papers repeat each other or take a slightly different approach without advancing this field. After more than a decade of OGD research, the same barriers are still mentioned, and research and practice has been slow in adapting to it. This article highlights the main concerns in the launch of OGD initiatives that lead to their eventual failure with a specific focus on the developing countries given that stalling of OGD initiatives in their initial stages is commonplace in the developing countries for various reasons. The quantity and nature of causes of failure and their roots prove that the launch and implementation of the OGD initiatives are easier to say than implementation.

The paper is structured as follows. After underlining the basics of OGD, a research methodology is thoroughly described to help improve reproducibility. Analysis of the barriers and problems associated with the OGD initiatives implementation, as identified in the existing literature, is provided in the following section. The identification of the root causes of the prevalence of these barriers and problems can be found in the next section. The paper concludes with the discussion and study limitations, theoretical and practical implications, and main conclusions and further research directions.

Background on OGD

What is OGD?

First, let us establish a common understanding of the OGD concept. Open Government Data (OGD) are government data so far reserved that have been released for public re-use (Hoxha & Brahaj, 2011; Shao & Saxena, 2019; Yu & Robinson, 2012). By opening the data, the numerous stakeholders, including but not limited to citizens, businesses, non-profit groups, journalists, academia, etc. may tap the OGD and create utilities for their use (Janssen, 2011; Kassan, 2018). OGD are typically provided via either OGD national portal or other government websites wherein the data are available in both human and machine-readable formats, which are sufficiently user-friendly and suitable for statistical analysis and interpretation (Mungai, 2013; Nikiforova & Lnenicka, 2021). OGD are license-free and are expected to be freely available, although in some cases exceptions in this respect are met, which, however, contradicts open data principles (Safarov, 2020). All in all, the OGD initiatives are nothing but the advanced stages of e-government initiatives, where public services are provided via the Internet and are available in different domains, such as agriculture, climate, business, economy, and others (Ubaldi, 2013).



Why OGD?

OGD initiatives indicate a country's inclination towards transparency, accountability, efficiency, economy and effectiveness (Lnenicka & Nikiforova, 2021). By opening the governmental data for their public re-use, governments build up ties with the public and create an atmosphere of harmony and transparency in their dealings (Saxena & Janssen, 2017). By opening the government data, governments bring to the surface the precise numbers, statistical figures or other types of real-world data that can be relevant to understanding the functioning of government. This is particularly the case today, when we live in times of COVID-19 pandemic and governments are forced to act by introducing and changing, i.e. either softening or hardening, restrictions.

By opening the data, governments become accountable to taxpayers. Citizens need to know how their taxes are used for the growth and development of the country. Governments make it a point to provide government data on a regular basis. This leads to building confidence and trust in the minds of citizens in government's activities.

Governments become more efficient by opening up the data because they are better equipped to expand their activities and perform improvisation wherever needed (Charalabidis et al., 2016). By being more responsive to the needs of the citizens, governments are on the tenterhooks while serving the citizens.

OGD initiatives also help to economize day-to-day activities. As a result of opening data, accurate and complete data are regularly published, which means costs can be saved by acting as a clearing house for the OGD, as the "only-once" principle suggests.

Finally, governments are becoming more effective when implementing the OGD initiatives. As they publish data on a regular basis, they can better provide services to their citizens in a user-friendly and customized manner (Wirtz & Birkmeyer, 2015).

Research methodology

This paper presents an exploratory study, investigating the barriers and problems that cause OGD initiatives to fail. The study follows an approach consisting of a literature review of most relevant studies to identify the most common barriers and problems and then applies a Root Cause Analysis (RCA) that should shed light on what could cause these failures in a more detailed and systematic way. Literature scan was attempted in the study to sketch the trajectory of OGD initiatives right from their point of being conceptualized in terms of the barriers and hinderances. Furthermore, it was important to finetune the scanning criteria as per the overarching aims of the research paper.



This study employs selected studies that we identified through a systematic search in Scopus and Web of Science databases and the selection of the two databases was done on account of two reasons: first, these are the most relevant and popular databases for scientific publication across digital government and OGD themes, and, secondly, the limitation to these two databases falls in line with the principle of parsimony to be adopted as per the scientific research rigor (Vom Brocke et al., 2009). Across the databases, the combinations of the following keywords were used: open (government) data, OGD, initiative(s), barrier(s), problem(s), and failure(s). These search terms were applied to both paper titles, abstracts, and bodies. Only papers written in English were addressed. In terms of the scope, both journal articles, conference papers, and chapters were studied. We covered the period of the last 15 years, to 2007, in which a set of eight principles of OGD was introduced. This led us to more than 117 papers to be further processed. We excluded papers that did not provide any list or summary of barriers, problems or failures. Inter alia, the inclusion criteria for the search comprised of the research papers focusing on the failures of the OGD Initiatives across time and space and the exclusion criteria for the search was based on the research excluded from the time frame or being in languages other than those in English or the non-coverage of the themes under scan. This resulted in 15 papers to be used as an input for our exploratory study.

Two prevalent types of studies can be identified from these papers: 1) global (review) studies and 2) region- and country-related studies. We included both types in the analysis to get a comprehensive view on the topic and define categories that could be explored in more detail in further research. This step enabled us to categorize the barriers and problems of OGD initiatives. We followed the approach of the RCA to find the deeper explanations behind failures of OGD initiatives and help to prevent their reoccurrence. The steps of the research methodology are displayed in Figure 1. It is clear from the steps provided in the figure that the first step to undertake this study was in doing the literature scan wherein the databases were ferreted out for the literature available across OGD domain based on the inclusion and exclusion criteria besides the keywords selected for the purpose. Thereafter, the root cause analysis was conducted wherein the selected papers were scanned by the researchers in terms of the barriers and hinderances outlined in the papers and a final rounding off of the three-step process was done with the analysis of the demand-supply root causes analyses to arrive at the final pool of recommendations for the academia and the practitioners.

LITERATURE REVIEW

ROOT CAUSE ANALYSIS

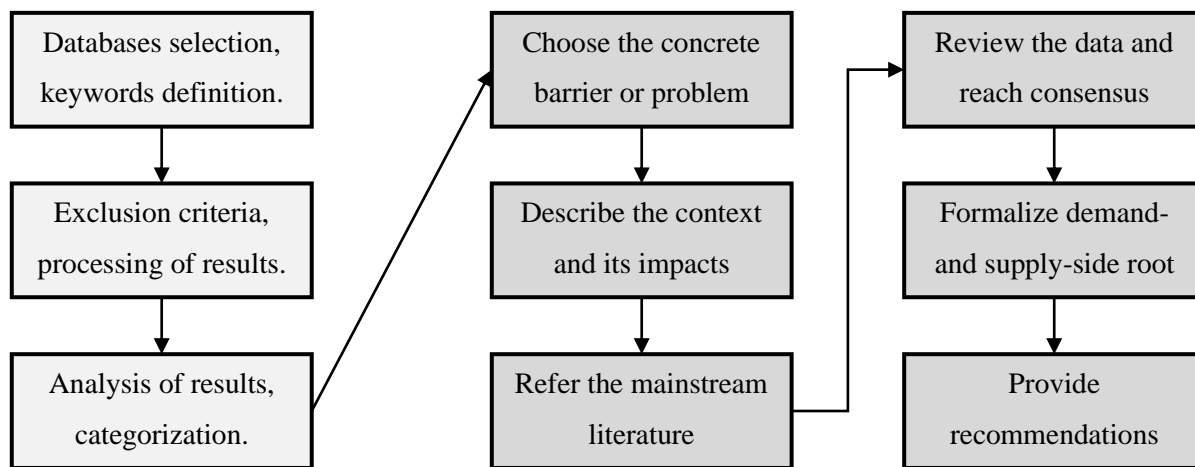


Figure 1: Steps of the research methodology

Results: Execution of the research methodology

Analysis of barriers for OGD initiatives

The determination of barriers in the context of the OGD became a very topical area. However, most studies refer to the determination of barriers and problems of either OGD re-use or their adoption, with only a partial focus on barriers closely associated with the implementation of the OGD as a whole. However, such studies are, definitely, popular. More precisely, the current literature has underlined a number of barriers for the roll-out and implementation of OGD initiatives. While some of them are rather particular country specific such as Tanzania (Shao & Saxena, 2019), India (Lnenicka et al., 2022); China (Huang et al., 2017; Li & Chen, 2017), Saudi Arabia (Mutambik et al., 2021) or Philippines (Saxena, 2018), there are some studies attempting to identify the most universal barriers (Table 1).

INSERT TABLE 1 ABOUT HERE

It may be deduced from Table 1 that these barriers have been classified in a number of categories which tend to recur during a period of time. These deductions show that despite gaining currency over time, OGD initiatives have failed to get rid of these barriers. Furthermore, it may be inferred from the Table that as far as the politico-administrative root-causes are concerned, there is complexity and fragmentation and this requires coordination; regarding the social root-causes, the government itself is unaware and unable to recognize the need for OGD; regarding the technological root-causes, there is lack of good systems on account of policy lacuna; regarding the legal root-causes, there is problem associated with the absence of a robust legal framework to

govern the roll-out and institutionalization of OGD initiatives and regarding the organizational (inter- and intra-) root-causes, it may be inferred that there is no vision and motivation of the management. Such root-causes are rampant in the context of developing countries that lead to eventual forestalling of OGD initiatives.

If these root-causes are broadly categorized, we identify two groups: namely (1) demand- side root causes and (2) supply- side root causes. By demand-side root causes is implied the unmet needs and requirements of the users and different entities involved in the OGD value chain pipeline. By supply-side root causes are the impediments related with the provisioning of OGD in qualitatively and quantitatively advanced versions. In total, 6 demand- and 16 supply- side root causes are identified along with the pointers for tackling these impediments especially in the developing countries (Table 2).

INSERT TABLE 2 ABOUT HERE

Discussion and study limitations

It may be inferred from the analysis that whilst the present study's findings are a compendium of the barriers and hinderances identified in the extant literature with a particular emphasis upon the root-causes of the same, none of the previous research publications have underlined the latter dimension which is important to understand in order to preempt or curb it altogether. For instance, the underlining of the failure of OGD initiatives in theoretical frames (Janssen et al., 2012; Zuiderwijk & de Reuver, 2021) is insufficient to draw a nuanced understanding of the root causes prevalent in different contexts. Inferences from the present study are unique in terms of pitching forth a threadbare edifice wherein rootcauses of OGD initiatives' failures have been identified in contrast with the scarce studies attempting a review of the reasons for failure of OGD initiatives- case in point being the work of Zuiderwijk and de Reuver (2021). It may be inferred from the study that the OGD failure rootcauses are mainly associated with the structural and functional dimensions of the administrative entities apart from the individual factors that may be related with the behavioral or resource-centric. For instance, the structural and functional rootcauses are linked with the administrative failures and lackings and the individual-centric rootcauses may be attributed to the unavailability of the requisite resources or the lack of intrinsic motivation, for instance. Furthermore, the assessment of the drawbacks in the OGD publishing processes by the government entities and the bottlenecks for the users in terms of the reuse of the OGD are overemphasised without exploring the fundamental reasons behind the existence of these: this is the *raison d'être* for

understanding the root causes analyses in the context of OGD research. In line with the research aims, the root causes' analysis of the study has shown the broad dimensions related therewith thereby providing an understanding of the fundamental reasons for the failed or the preemptive failures of OGD initiatives.

The purport of the study was to underscore the rootcauses associated with the failure of the OGD initiatives in the developing countries. While the barriers identified with the OGD initiatives have been plenty across the academic research, the rootcauses for the existence of these barriers have not been identified in extant research. The study sought to identify the rootcauses and besides identifying the individual rootcauses as politico-administrative, social, economic, legal and technological, the overarching categories of demand-side and supply-side rootcauses were identified in the context of developing countries given the differential economic status of these countries in contrast with the developed ones and the challenges encountered by them in terms of the institutionalization of OGD initiatives. Besides identifying the rootcauses, the ways to ameliorate and weed out the rootcauses for OGD failure were provided. As a study focused on the developing countries, the present study is a significant contribution to the extant literature to understand the nuances involved in the OGD initiatives' institutionalization and sustainability. It is important that the OGD initiatives in the developing countries adopt a strategic approach towards OGD initiatives with the involvement of all the stakeholders concerned and the use of green and cost-effective technologies, wherever possible (Anthony Jr., Majid & Romli, 2019).

Our study has certain limitations. Meanwhile, since this study is the first step in our more comprehensive study, we conducted an exploratory study and were more descriptive by nature and scope. Such a study should be accompanied by an empirical investigation into the root causes responsible for the doom of OGD initiatives by the governments.

Practical implications

In addition to the above insights, there are several insights, which can be especially valuable for practitioners. Departments and ministries should be forthcoming in contributing towards the OGD initiatives. The role of the government is to develop a well-aligned policy for the roll-out and implementation of OGD initiative. There should be a proper strategy for the same. Datasets should be complete, timely, free, accurate, adequate and user-friendly. The stakeholder responsible for this should be acknowledged and made known to all stakeholders. This would resolve the supply-side root causes that have been identified in the present study. Although they are compliant with open data principles, the practice prove that this remains a challenge for most OGD initiatives. Technical



aspects such as the availability of statistical tools on the portal as well as feedback- and support-related mechanisms should be in place. Proper manpower training should be provided to the personnel. The training needs of government officials related to the OGD initiative as well as the potential stakeholders should be met. Information Technology infrastructure should be stable and sound. Modern tools and technologies should be in place to ensure real-time data availability.

Conclusions

There are many studies on barriers to the deployment and implementation of OGD initiatives. Despite a decade of research, the same barriers are still mentioned and studied with very limited attempt to go deeper and determine their root causes. In this paper, we made an attempt to identify the underlying reasons why these barriers have not been resolved. The major arguments in this article highlighted the problems of rolling out and implementing OGD initiatives by the governments and what are their root causes responsible for the existence of barriers for OGD initiatives. A broad categorization of the root causes was carried out, dividing them into (a) demand-side and (b) supply-side root causes with a more detailed classification into 21 elements. It can be deduced from these root causes that, without a robustly designed targeted policy for instituting the OGD, it is not possible to implement a successful and sustainable OGD initiative. There is a need to tackle the demand-side and supply-side root causes to resolve the barriers to the proper roll-out and implementation of OGD initiatives.

The article opens up further directions, such as: an empirical investigation can be conducted involving different stakeholders regarding the efficacy of the OGD initiatives of the government. For instance, a study on the OGD adoption and engagement of journalists, students and entrepreneurs can complement our insights into the supply-side root causes associated with the OGD barriers. Likewise, seeking perspectives from the politicians and bureaucrats can strengthen an understanding of the demand-side root causes. Feasibility analysis may be done at a regional level to gauge bottlenecks associated with the rollout and implementation of the OGD initiative, in line with the factors identified in this article. For instance, it would be worthwhile to understand the root causes related to the OGD barriers at the local and regional levels. In a developing country like India, it may be appreciated if the rural areas are able to realize the potential of the OGD initiatives. A comparative assessment of developed, developing and underdeveloped economies can be carried out to ascertain the variations of the root causes (Styrin, Luna-Reyes & Harrison, 2017). For instance, for developing a sustainable OGD ecosystem, it can be appreciated whether the demand-side and supply-side root causes are universal or rather specific.



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Root causes as identified by the authors	Explanation for root cause/s	Barriers identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
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Root causes as identified by the authors	Explanation for root cause/s	Barriers as identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
Politico-administrative	<p>Government is not keen or unable to invest in OGD initiative owing to a lack of vision</p> <p>Government form and structure</p> <p>Conservative and insular politico-bureaucratic culture</p> <p>Political parties are averse or neglecting the benefits of OGD initiatives</p> <p>Governments are averse to publishing complete, updated and accurate datasets for a number of reasons (motivational and structural-functional reasons)</p> <p>Governments are wary of instituting OGD initiatives in the first place or if at all, they are in place, they are in a rudimentary stage</p> <p>Lack of inter-ministerial coordination</p> <p>Legal wrangling involved in the re-use of datasets by the stakeholders</p> <p>Government does not wish to be liable for the manner in which the datasets may be misused/mis-interpreted by the stakeholders</p> <p>Governments are also reluctant of publishing datasets that may be faulty or incomplete thereby resulting in misinformation and this may hold the government liable in case of any untoward re-use of datasets</p> <p>Governments do not have the necessary wherewithal to determine the overarching guidelines for OGD initiative project management;</p> <p>Undecided as to who should regulate, monitor and control the progress of the OGD initiative;</p> <p>No provision for training and development of officials for OGD initiative</p>	<p>Legislation;</p> <p>Technical; Policies;</p> <p>Processes;</p> <p>Institutional;</p> <p>Sustainability</p>	<p>OGD initiative is a one-time pilot and lacks sustainability; Privacy violation; Security; Unawareness among the government departments as to what OGD is all about; Determining what information should, can and how it is to be published given the lack of resources; There is lack of demand and awareness from internal and external stakeholders; Lack of support, guidance and interest among the senior management officials and national level OGD representatives; No experience on the part of the officials regarding the online publishing of datasets vis-a-vis the processing, management and display of OGD; No standardized metadata schema; Volume and variety of datasets; Data security breaches; Reluctance of scrutiny of the OGD work that has been done; Bipartisanship competition; Lack of involvement of stakeholders; Lack of incentives or desire of local leaders to participate in open data movement; Conflicts between traditional bureaucracy and OGD; Risk-averse culture and OGD resistance; Data as a private resource, benefit and source of power; Social media accounts of the government pertaining to the OGD initiative are not proactive</p>	Supply	<p>Zuiderwijk & de Reuver (2021) ;</p> <p>Janssen et al. (2012);</p> <p>Chorley (2017);</p> <p>Kassen (2018);</p> <p>Huang et al. (2017);</p> <p>Machova et al. (2018); Attard et al (2015); Saxena (2018)</p>



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Root causes as identified by the authors	Explanation for root cause/s	Barriers as identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
Social	<p>Trust issues as far as the target audience is concerned</p> <p>Lack of the understanding of the potential to be derived from the information society market</p> <p>No training or hands-on experience (via modules, lectures, video tutorials, case studies of successful value creation/innovation by stakeholders) regarding the potential benefits and re-use of datasets</p> <p>Lack of motivation or interest in OGD initiative given that delving into OGD is time-consuming and resource-consuming</p> <p>Lack of training and knowledge about the re-use of statistical data</p> <p>Inefficiency in dealing with numbers and drawing interpretation therefrom</p> <p>Fear of government laws and regulations</p> <p>Soliciting feedback from stakeholders/users is the link when it comes to the implementation of an OGD initiative apart from the ineffective or faulty OGD platform/s</p> <p>Government has not taken initiatives to make the OGD re-use inclusive cutting across socio-demographic divides</p>	<p>Task complexity;</p> <p>Use and participation;</p> <p>Information quality;</p> <p>Cultural;</p> <p>Inclusiveness; Data interpretation</p>	<p>Linked with use, understandability and metadata interpretation; Lack of ability to discover the appropriate data; Contradicting outcomes based on the use of the same data; Invalid conclusions; Frustration at there being too many data initiatives; No time to delve into the details or no time at all; Having to pay a fee for the data; Registration required before being able to download the data; Unexpected escalated costs; No time to make use of the open data; Lack of knowledge to make use of or to make sense of data; Lack of the necessary capability to use the information; No statistical knowledge or understanding of the potential and limitations of statistics; Threat of lawsuits or other violations; Too much information to process and not sure what to look at; (Essential) Information is missing; Similar data stored in different systems yields different results; No culture of openness from the social norm side and information society market is of little relevance</p>	<p>Demand</p> <p>Supply</p>	<p>Janssen et al. (2012); Huang et al. (2017); Zuiderwijk & de Reuver (2021); Mutambik et al. (2021); Saxena (2018)</p>



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Root causes as identified by the authors	Explanation for root cause/s	Barriers as identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
Technological	<p>OGD platforms are not user-friendly or comprehensive</p> <p>Lack of requisite Information Technology (IT) infrastructure</p> <p>Datasets in the form of information deluge and information flood operate counter-productive for the users</p> <ul style="list-style-type: none"> • 	<p>Information quality;</p> <p>Technical; Data integrity and quality;</p> <p>Functionality and support</p>	<p>Lack of information; Lack of accuracy of the information; Incomplete information, only part of the total picture shown or only a certain range; Obsolete and non-valid data; Unclear value; information may appear to be irrelevant or benign when viewed in isolation, but when linked and analyzed collectively it can result in new insights; Data must be in a well-defined format that is easily accessible: while the format of data is arbitrary, the format of data definitions needs to be rigorously defined; Absence of standards; No central portal or architecture; No support for making data available; Lack of meta standards; No standard software for processing open data; Fragmentation of software and applications; Lack of concrete regulatory measures to institute the technological infrastructure (such as repositories, processes and documentation systems); Data fragmentation, scatteration and duplication; Poor quality of datasets in terms of discoverability, accessibility and usability; Lack of data visualization and interpretation tools; Lack of interaction media on the platform; Lack of a helpdesk</p>	Supply	<p>Janssen et al. (2012); Tsiavos et al. (2013); Kassen (2018); Huang et al. (2017); Machova et al. (2018); Zuiderwijk & de Reuver (2021); Mutambik et al. (2021)</p>



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Root causes as identified by the authors	Explanation for root cause/s	Barriers as identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
Legal	Legal regulations with reference to Information Technology (IT) are missing or inadequate and the requisite personnel to frame such regulations are not motivated to draft such regulations for a number of reasons (personal, kind of governmental regime, officialdom, etc.) Freedom to information legislations are yet to emerge the stage where “openness” and “participation of stakeholders” are being optimally realised Percolation of legal regulations down to the lower levels (regional/state and local levels) is missing or inadequate Improper and inchoate legal framework pertaining to the OGD initiative Comprehension of legal norms to tap OGD is difficult owing to the complexity or ambiguous legal terminology	Legislation/regulatory	No license for using data; Limited conditions for using data; Dispute and litigations; Prior written permission required to gain access to and reproduce data; Reuse of contracts/agreements; Legal regulatory elements: Lack of clarity regarding the implementation of the ministerial decrees	Demand Supply	Janssen et al. (2012); Tsiavos et al. (2013); Mutambik et al. (2021)
Economic	Poor economic state of the country No or limited interest to invest in OGD initiatives	Economic	Lack of financial resources	Supply	Janssen et al. (2012); Zuiderwijk & de Reuver (2021); Attard et al (2015)



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Root causes as identified by the authors	Explanation for root cause/s	Barriers as identified in the literature	Sub-categories of the barriers	Demand/Supply categorization	References for barriers
Organizational (inter- and/or intra-)	<p>Lack of organizational vision and leadership</p> <p>Insular public policy and officials</p> <p>Official secrecy</p> <p>Privacy concerns</p> <p>Quality issues with the provision of OGD</p> <p>No motivation in the government to publish the requisite datasets</p> <p>No trained personnel to handle the OGD initiative</p> <p>Lack of and non-promotion of OGD culture</p> <p>Lack of interfaces between government and stakeholders regarding the manner in which value creation and innovation happened at the end of the stakeholders</p>	Institutional; Use and participation	<p>Emphasis of barriers and neglect of opportunities (Inter-); Unclear trade-off between public values (transparency vs. privacy values) (Inter-); Risk-averse culture (no entrepreneurship) (Intra-); No uniform policy for publicizing data (Intra-); Making public only non-value-adding data (Inter- and Intra-); No resources with which to publicize data (especially small agencies) (Intra-); Revenue system is based on creating income from data (Inter-); Fostering local organizations' interests at the expense of citizen interests (Inter- and Intra-); No process for dealing with user input (Intra-); Debatable quality of user input (Intra-); No access to the original data (only processed data) (Intra-); No explanation of the meaning of data (Intra-); No information about the quality of the open data (Intra-); Apps hiding the complexity, but also potential other use of open data (Intra-); Duplication of data, data available in various forms or before/after processing resulting in discussions about what the source is (Intra-); Difficulty in searching and browsing due to no index or other means to ensure easy search for finding the right data (Inter- and Intra-); Even if data can be found, users might not be aware of its potential uses; Data formats and data sets are too complex to handle and use easily (Intra-); No tooling support or help desk (Intra-); Focus is on making use of single data sets, whereas the real value might come from combining various data sets (Intra-); No incentives for the users; Public organizations do not react to user input (Intra-); Many entities are not so open-minded about the application of open data, and rather focus on the simple publishing of data rather than ensuring that it is of good quality in this aspect (Intra-); No efforts to update the websites or portals (Intra-); Lack of organizational commitment (Intra-)</p>	Supply	Janssen et al. (2012); Attard et al (2015); Mutambik et al. (2021)



Table 1: Identification of barriers and root causes

Demand-side rootcauses		
	Explanation in the context of developing countries	Amelioration of the impediments
<i>Privacy concerns</i>	It is liable that the user's data are prone to hacking, intrusion, security breaches and misuse by miscreants. Therefore, many OGD initiatives do not adopt the practice of publishing datasets. The government, likewise every publisher of an open dataset, is obliged to provide anonymised data to ensure personal data security within a particular dataset, as well as protection from miscreant activities (Wirtz et al., 2018). Users are averse to share their datasets and act as citizen journalists. These issues become overwhelming in the developing countries on account of their conservative and risk-averse cultures (Hofstede, 2011).	Ensuring that a culture open to experiences is important for a developing country and initiatives need to be taken by the government for understanding how OGD may be tapped hassle-free by the stakeholders with safety concerns being met appropriately.
<i>Inability to tap datasets</i>	Users cannot effectively consume datasets because they are not trained about the potential uses of datasets. Users are OGD-illiterates and cannot understand how to re-use these datasets for value creation and innovation.	Users should be provided with a manual guide for their reference to understand how they can create value from datasets for their purposes. Training should be provided to the users with the case studies and discussions by the successful OGD users who have succeeded in value creation and innovation.
<i>Costs related to the use of data</i>	Physical (mental exertion to select, sort and filter the datasets), social (influence of the peers and colleagues to tap the datasets), economic (costs linked with the access and use of datasets) and technical (inability to use and comprehend the statistical tools and techniques) costs are related to the effective use of the datasets. All of these cost constraints are more rampant in a developing country owing to their structural and functional limitations, case in point being the infrastructural issues, digital divide, information literacy issues or the socio-economic societal disaggregation.	Improvisation of the infrastructure and maintaining a budget balance at the government level are important to ensure that the requisite skill set be developed among the OGD users at bare minimum costs for the latter.



Demand-side rootcauses		
<i>Lack of awareness about the OGD</i>	Users are unaware of the OGD initiatives and are unable to identify the potential of these datasets. In a tiered structure of the country across administration, it becomes difficult to disseminate the OGD initiative and its benefits to the stakeholders. Therefore, either the OGD initiatives are launched in their most basic manner without any sophistication or they are released without the users being aware of the potential of OGD and the manner in which re-use is possible, in the first case.	Governments ought to take up awareness initiatives across the administrative divisions to ensure that the OGD initiative's awareness seeps across the length and breadth of the administrative divisions. An interactive and widely accepted practice is the organisation of contests, workshops and even hackathons, where users with different level of knowledge and skills can have very practical experience.
<i>Insufficient statistical tools for re-use and value creation</i>	OGD portals do not provide adequate statistical tools for further processing the data. These issues creep up in the developing countries with little or negligible interest, funds or both to develop and sustain the OGD initiatives which has a bearing on the level of technological sophistication of the OGD portal.	Government needs to ensure that the OGD platforms are equipped with state-of-the-art tools and techniques so that maximum value may be earned from the reuse of OGD.
<i>Personality factors</i>	Behavioural dimensions associated with the users are a major determinant of their ability to tap the datasets. In order to realize value from the datasets, the user should be intuitive and deft in handling the data. Personal and social factors also have a bearing on the user's attitudinal disposition towards OGD. Peer pressure is a major factor in determining if the user is willing to demand and re-use the dataset. This is also a reason for the popularity of studies on users' behavioural intention to use data by adopting appropriate technology acceptance related frameworks, such as TAM and UTAUT. In a developing country, initiative and openness to new ideas and technologies becomes hampered or preempted on account of personal and social factors-case in point being the resistance to change as encapsulated in the cognitive resistance theory (Wirtz et al., 2016).	Awareness drives regarding the OGD initiatives need to be conducted at the individual and societal levels apart from the professional levels. Implicitly, campaigns and advertisements need to impress upon the users via multiple channels and formats.



Demand-side rootcauses		
Supply-side rootcauses		
	Explanation in the context of developing countries	Amelioration of the impediments
<i>State of economy</i>	Different economic growth rates among countries result in different implications for the developing countries. Developing countries do not have the necessary resources (economic, technical, and non-technical) to launch and implement the OGD initiatives, and thus, are unable to fund and sustain the OGD initiatives. This is even the case for the internet speed at which the dataset can be downloaded. If the internet speed is low, it will be difficult to access the data and the intention to upload the data by data publishers and the use of data by data consumers will decrease. OGD initiatives are really costly, and unless a certain amount of money is invested in such initiatives, the initiatives are bound to be stalled sooner or later. Implicitly, the government does not want to invest in the roll-out and implementation of the OGD initiative.	A multi-pronged and directional planning and execution is required from the government so that the OGD initiative are adopted as a “way of life” by the stakeholders. This calls for structural and functional changes in the countries across the administrative tiers horizontally and vertically.
<i>Infrastructure</i>	OGD initiatives stand on the shoulders of technology. However, it should be mentioned that different development rates across a country’s geography can result in complications while rolling out common IT infrastructure. For example, when it comes to a developing country India, it is a Herculean task to develop the IT infrastructure across the cities and villages. Conceding that village economy plays a major role in the country’s development, by failing to institute a well-developed IT infrastructure, the government fails to provide the benefits accrued from its OGD initiatives for those residing in the villages and hinterlands.	Information Technology (IT) infrastructure should be well developed and sufficiently advanced so that the state-of-the-art infrastructure can support the OGD initiatives of the governments. Again, the institutionalization of an advanced IT infrastructure requires adequate funding, and development of the well-established infrastructure around the country is very crucial and beneficial for governments.



Demand-side rootcauses		
<i>Unwillingness on the part of the government</i>	Some governments are insular and do not believe in releasing government data to the public. For example, in a developing country like Tanzania, the fifth government regime terminated the OGD initiative which was already heading to maturity phase. A case in point is the OGD initiative of the Qatar government, in which OGD is accessible only if one enters a proof of citizenship on the portal. Governments are therefore insecure if their data is being tapped by third-party or other miscreant for illegal and unlawful purpose. Similarly, if governments roll-out the OGD initiative, there is a clamour to reach the highest-ranking on the OGD radar without being able to meet the transparency objectives. Governments copy each other instead of trying to add value. Finally, without an appropriate legislative framework, it would be difficult to provide a sustainable OGD ecosystem.	Governments' attitudes are essential factors in determining whether the OGD initiatives will be successful or not. Implicitly, government leadership plays a key role in determining whether the country will adopt OGD initiatives. Politico-legal and administrative arrangements need to be in place for ensuring the sustainability of the OGD initiatives.
<i>Insufficiency or lack of data</i>	It has been observed that traditional economies do not believe in record-keeping and documentation. Therefore, they do not have the required data or they just refrain from publishing data. This concern is applicable to a number of countries. Sometimes, given the non-cooperative or lackadaisical attitude of the bureaucracy or ministries and departments, the data remain unshared or unpublished.	Provision of quantitatively and qualitatively advanced OGD should be the overarching aim of any government. After all, it is only with the cooperation between ministries and departments that the government data can be made available in free formats.
<i>Lack of trained manpower</i>	Without capable manpower with both sufficient digital literacy and general and preferably advanced knowledge and understanding of the OGD, OGD initiatives are liable to fail.	In order to properly implement the OGD initiative, it is important that the personnel entrusted with the publication of the data are sufficiently educated, trained and competent to deal with conflicting situations.



Demand-side rootcauses		
<i>Incompatible / inappropriate data formats</i>	<p>Although the concept of OGD is not new, in some cases the data published still do not meet even classical and obvious for open data requirements such as an appropriate machine-readable data format. If we look at the OGD portal of Oman, we will find that most of the open data are available in incompatible formats such as PDF, which cannot be considered “open data” format. It is difficult to re-use these data even for performing a statistical research on these datasets without very specific third-party software, which contradicts open data principles. Thus, provision of data in incompatible formats results in a lack of interest on the part of the users to access and reuse these datasets and, eventually, the OGD initiatives fail.</p>	<p>Datasets should be made available in user-friendly, by which we mean human- and machine-readable formats, such as CSV, and not in other non-machine-readable formats, such as PDF or JPEG. Although here we should also mention that CSV is not the most advanced data format as RDF is, but is one of the most appropriate human-readable formats.</p>
<i>Publishing up-to-date data and their maintenance</i>	<p>Once data have been published, they may become obsolete / outdated. This, however, reduces the value of the data significantly. As the most obvious and trivial example, with outdated data, little can be achieved in drawing statistical conclusions. As a result, the interest of the users’ declines in the long run and this leads to a failure of OGD initiatives. If we look at the OGD initiative of the Indian government, while the centralized portal (data.gov.in) has plenty of data available, most of them are outdated and may not be useful.</p>	<p>In view of this fact, it is important that governments take the opportunity to publish and maintain data in real-time, where possible and appropriate, or do their best to keep the data up-to-date, i.e. compliant with the real-world. Implicitly, the governments need to provide “smart” data (Nikiforova, 2021). Here, we would like to put an emphasis on keeping the data up-to-date, i.e. not only the publishing should follow the principle of the current data but also their maintenance is not of less importance, which, unfortunately, turns to be a problem for many OGD portals and at least some portion of their datasets.</p>



Demand-side rootcauses		
<i>Complaint / request/ feedback handling mechanisms are inadequate or conspicuously missing</i>	If there are any data- or infrastructure- related concerns, or if the data requires explanation or is faulty, of low quality or dubious, in some cases there is inadequate complaint and request handling mechanism to address users' request. Without a proper grievance handling mechanism, the user can fail to handle the query, and after a while, can stop using the data or even the whole portal.	Thus, there must be a dedicated official in charge of request (complaint, question, suggestion, recommendation) so that real-time solutions can be. Even more, different types of support should be provided to address all possible issues. Typically, there should be at least an opportunity to communicate with the responsible person of the portal, the data publisher of a particular dataset, and the holders of data initiative. In addition, taking into account current best practices of user support, chatbot, able to answer a list of frequently asked questions and navigate the user on the portal and capable of understanding how the dataset should be processed, should be in-built on the portal.
<i>Publishing of useless data</i>	There are cases where useless data is published on the portals, which may not be useful for value creation and innovation. Such government inefficient initiatives lead to the failure of OGD initiatives in the long run. Unfortunately, there are currently no well-established frameworks or methods for their determination. So some governments use their own ad-hoc approaches to identify them.	Datasets should be published timely and regularly, as well as should be valuable to users. Here, in turn, the term of "high-value datasets" comes and the need of their determination (Nikiforova, 2021). In other words, although there are topics that are important to the citizens of each country, which should be followed to and provided on the OGD portal, those - of interest in a particular country should also be determined and, obviously, provided to the end-user. In most cases, at least, an opportunity to make a request of dataset on the portal is provided. This should become the practice to be followed by every government, which should preserve the OGD initiative from failure, i.e. keeping the set of data up-to-date in terms of their topicality, potential value and source of open innovation.



Demand-side rootcauses		
<i>Incomplete datasets</i>	<p>It has been observed that the datasets available on the portal are not complete and this leads to incorrect inferences. In some cases, the legends are missing or the datasets are bereft of suitable references. In other cases, a lack of metadata or data and their attribute description are observed. In other cases, the issue lies on the incompleteness of data within the dataset, i.e. some values are missing. For instance, publishing agrarian data for selected years and an absence of other years would lead to drawing incomplete or inaccurate conclusions. In other cases, if the lack of data has not been noticed, data user will not be even aware of the incompleteness of conclusions. The latter is also important in the case of another barrier – data quality. Thus, the OGD initiatives are bound to fail under the given circumstances.</p>	<p>Proper and complete datasets should be made available for the users. Quality control and feedback mechanisms should be in place with the stakeholder involvement at all levels.</p>
<i>Language of the databases</i>	<p>Owing to reasons such as government insularity or lack of proper IT infrastructure, datasets are provided in vernacular and there is no possibility to check datasets in popular languages, such as English. This is the case for Latvian OGD, for instance, where only partial translation of the portal but not the data(set) is ensured. This may create problems in understanding datasets and their references.</p>	<p>It is important that datasets are available in English apart from local language for wider usage. This would go a long way in furthering the reuse of OGD by a range of stakeholders for multiple purposes given the ease of understanding and compatibility with the local language.</p>
<i>Unavailability of online tools to understand datasets</i>	<p>OGD portals are ill-developed which results in the missing out of the significant aspects linked with OGD publishing. For instance, tools and techniques in the form of tutorials, manuals, guides, FAQs, contact form, online support, etc. are missing on the OGD portals- case in point being the OGD portal of Bangladesh or Nepal.</p>	<p>At least basic statistical applications should be made available on the portal thereby allowing the user to understand the data and make at least very basic processing tasks on the portal, i.e. without their downloading and export in the local software. This includes the ability to search, filter and draw charts and figures from the data available on the portal.</p>



Demand-side rootcauses		
<i>Non-provision of external stakeholder contribution to the database</i>	Often, the governments publish the datasets without engaging or inviting the other stakeholders in contributing to the datasets for reasons like insularity, culture of secrecy, lack of credibility or to obviate the long-drawn process of checking the veracity of the datasets that are provided by external sources. Thus, nonprofit sector or citizens, etc. are not allowed to recommend or add a dataset (Kassen, 2017).	Even citizens and other stakeholders may publish the datasets as and when they are freely available, with the final consent of the government and the party concerned. Citizen journalists are active these days and can report datasets on the common portal for wider reach and usage. This, once again, is the case for very topical subject such as COVID-19 related figures, which can be collected by external and even non-governmental organizations (such as research institutions) (Maione, Sorrentino & Kruja, 2022).
<i>Inaccurate or misleading data</i>	There have been cases where the data is inaccurate, false or misleading. Inaccurate, false or misleading data would lead to incorrect interpretations and would be comparable to a false knowledge base and false conclusions (Egala & Afful-Dadzie, 2022). However, this is a very complicated question, which turns to a new research direction, because although the quality of the data is not a very new object of interest, the open data quality is not the same well-studied, where third-party data with a lower level of detail are under question. What is more complicated in the context of this study is the fact that there is no clarity on who should take responsibility for the quality of the published data, i.e. the holder of the portal, which turns into a very resource-consuming and challenging task, or the publisher of a particular dataset, and even more challenging – how to verify that data quality control has taken place?	Incoherent and inaccurate datasets should be removed from the portal and not published, in the first place. Therefore, datasets should be accurate, true and meaningful.
<i>Costs associated with the dataset usage</i>	In addition to physical and mental exertion to tapping datasets, user fees are often charged. Thus, the users become averse to tapping the datasets and the OGD initiatives fail to take-off properly.	As far as possible, OGD portal should not charge any fee because of its potential for the eventual economic development of the country via value creation and innovation by the users. At best, a user account may be asked to be created for identifying the misuse of the datasets.



Demand-side rootcauses		
<i>Lack of supportive legal frameworks</i>	The lack of a proper supporting legal framework is critical to the OGD initiative's success. This is especially evident in Tanzania, where the cybercrime and information access laws appear to be at odds with the open data policy.	Open Data practices necessitate legal considerations in order to provide assurance in terms of privacy and ownership. To avoid conflicts, the OGD legal framework should be harmonized with other legal frameworks.

Table 2: Demand-side and supply-side categorization of root-causes