Open Data Disclosure and Use: Critical Factors From A Case Study

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Abstract: Little is known about the factors which influence the success or failure of open data initiatives. Based on the results of a workshop, we provide a list of success factors for open data publication and use (64 in total) and discuss their criticality in a particular setting using a case study (the ENGAGE project). In the context of this case the most critical success factors for open data publication and use related to legislation, regulation and licenses. However, the criticality of factors depends considerably on the context of the open data initiative. Our key conclusions are that 1) further work is needed to detail the success factors for open data publication and use in particular contexts; and that 2) a number of success factors, such as those related to sustainability of publication process and user feedback, appear to be more universally applicable than others.

Keywords: open data, success, success factors, taxonomy, e-government, case study

1. Introduction

A successful open data initiative is one in which quality data supply stimulates use and generates value. However, it has been argued that only a limited number of datasets is actually used (Bertot, McDermott, & Smith, 2012) and that open data infrastructures provide limited user support (Archer, Dekkers, Goedertier, & Loutas, 2013). In addition, sporadic attention is given to frameworks which explain how Open Government Data (OGD) generate value (Jetzek, Avital, & Bjorn-Andersen, 2013). Moreover, the potential and success of OGD appears to be supported mainly by anecdotal evidence (Jetzek, Avital, & Bjorn-Andersen, 2014). Many authors have pointed at the impediments of open data initiatives that may may block the derivation of value from the publication and use of open data (e.g., Barry & Bannister, 2014; Conradie & Choenni, 2014; Janssen, 2011). Open data success is not guaranteed.

A number of researchers have described factors which are important to make open data initiatives successful (e.g., Parycek, Höchtl, & Ginner, 2014; Zuiderwijk, Janssen, Choenni, & Meijer, 2014). Yet, what is perceived as successful depends on the context of the initiative. For instance, an initiative focused on the publication of open data by a particular organisation may require the support from an entire management team and the availability of a legal framework to prioritise data publication by the organization, while another open data initiative may not require such a framework since it is focused on the use of data that are already available.

Identifying context-dependent open data success factors may foster the publication of public data, and it may help policy makers, civil servants and other decision-makers who plan to start an open data initiative to consider whether they will participate in the initiative and under which conditions. This is expected to foster the publication of data, the successful use of published data and to stimulate its economic and societal applications. To contribute to research on context-dependent open data success factors, this paper aims to answer the following question: *Which factors are critical for the publication and use of open data in a particular practical case?* This paper first obtains a broad overview of open data success factors, and secondly specifies which factors from the broad overview are critical in a particular context.

2. Research background

2.1 Research on success factors in general

The concept of success in technology-driven project implementations is multidimensional and somewhat ambigious. Project stakeholders might have different expectations and evaluations of project performance. Hence, interpretations of success might differ. The Information Systems success model (DeLone & McLean, 2002, 2003) arguably provides the most comprehensive view and combines the key dimensions defining success. According to this model, a system can be evaluated in terms of information, system, and service quality; these characteristics affect the subsequent use or intention to use and user satisfaction; and as a result of using the system, certain benefits will be achieved. In our study we concur with this view and assume that three dimensions indicate success of an open data initiative: 1) quality of open data publication (e.g. accuracy, completeness, timeliness, consistency), 2) use of open data, and 3) emerging impacts and benefits. We use this conceptualization of open data success as a backdrop for our critical success factors (CSFs) study. Generally speaking it has been stated that critical success factors are the essential areas in which desired results lead to successful competitive performance (Borman & Janssen, 2013; Rockart, 1979). Applied to the field of open data, we define critical success factors for open data as factors which are critical for the succesful implementation of an open data initiative. We define an open data initiative as any activity that aims at improving the publication and/or use of open data, including initiatives on different levels (e.g. international, national, local) and by different stakeholders (e.g. civil servants, citizens, universities).

2.2 Open data success factors

In general, the notion of success in existing open data literature can be related to a number of research themes, such as the evaluation of open data implementations, maturity of open data

initiatives, progress and development of open data infrastructures, and benchmarking of open data efforts. It has been more common to investigate failure and barriers in open data initiatives than to define and measure success. To the best of our knowledge no holistic CSF analysis has been conducted to date in relation to OGD. There are only a handful of studies that explicitly refer to the term 'success factor' in relation to open data initiatives. A search in Scopus for 'open data' in the keywords and 'success factor' in all fields returned eleven entries of which only three appeared relevant. One study (Sayogo & Pardo, 2013) used the term 'success factors' to investigate the motivation and the driving forces of adoption of an open data initiative; this is a specific interpretation of success factors expounded as 'drivers'. Table 1 summarizes the success factors mentioned in the selected studies. Other studies use terms such as 'enablers' (van Veenstra & van den Broek, 2013) or 'facilitators' (Cranefield, Robertson, & Oliver, 2014). In sum, there is a research gap as a holistic framework of CSFs in relation to open data publication and use is missing. The studies that explicitly refer to the concept of success factors are mainly focused on the data publication dimension.

Table 1: Overview of success factors mentioned in the literature

Area in focus	Identified success factors	Authors
Evaluation of open data strategy and portal	- Clear definition of responsibilities - Implementation using a process model - Integration of OD portal into CMS - Evaluation shortly after launch	Parycek et al. (2014)
Design of open data publishing process	- Think early about data publication - Develop guidelines about privacy and policy sensitivity of data - Provide decision support and liaise with other departments involved - Make data publication an integral, well-defined, and standardized routine task - Monitor how published data is reused	Zuiderwijk, Janssen, Choenni, et al. (2014)
Motivation to adopt a smart disclosure policy	- Success factors understood as economic rationale, regulatory and policy incentives, technology incentives and mimetic forces - Success attributed to the interaction between aforesaid factors and internal drivers of an organization, such as strategic fit and alignment and reputation risk	Sayogo and Pardo (2013)

3. Research methodology

In this study we opted for combining multiple research methods, since we first aimed to obtain a rich overview of factors which are important for open data publication and use, and then to narrow down this overview to factors which were critical for the publication and use of open data in a practical case. First, during a brainstorm session four academic researchers with expertise in the field of open data each individually developed an initial list of factors which influence open data publication and use based on their previous open data research (for example, Parycek et al., 2014; Zuiderwijk, Janssen, & Davis, 2014). The lists were developed from different perspectives (i.e. open publication and use) to make them together contain as many factors as possible.

Second, all four researchers presented the identified factors in a 3,5 hour workshop at the conference on Electronic Government and Electronic Participation (see Susha, Zuiderwijk, Janssen, Parycek, & Loukis, 2014). The workshop was attended by experts from the field of e-government

and e-participation and involved especially experts involved in open data research. The workshop started with 18 participants and ended with 23 participants. About two-third of the workshop participants were male and most participants were between 30 and 50 years old. The workshop participants received an initial list of factors important for open data publication and use on paper, and they were asked if there were factors that they wanted to add to the list. Thereafter, additional factors were discussed with the group of participants and more factors were added.

The brainstorm session and the interactive workshop resulted in a comprehensive list of factors important for open data publication and use. However, the overview was generic and did not account for the influence of contextual factors critical for open data publication and use. As a third research step, we conducted a case study, since this method allows for explorative research to investigate contextual factors. Case studies can help in "understanding the dynamics present within single settings" (Eisenhardt, 1989, p. 534). A case study can be defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 13). The case was selected based on theoretical sampling (Eisenhardt, 1989), i.e. it was chosen because it was expected to replicate previous cases, extend emergent theory, fill theoretical categories or provide examples. The case selection criteria were that the case represents both the publication and use of open government research data, allows for identifying factors which are critical to the publication and use of open data, and that case information should be available and accessible. The assessment of criticality was based on the judgement of the case's project manager, who completed a survey which contained all the factors identified in step 2, and who was asked to rate on a five-point Likert scale to which extent each factor was critical within the case.

The selected case was the European FP7 ENGAGE open data initiative, which aimed to develop an infrastructure incorporating diverse governmental data resources, empowering researchers and citizens, and stimulating scientific collaboration and research (see www.engagedata.eu). The developed infrastructure provided tools for dataset processing and acquisition. It went beyond existing simple open data repositories by additionally offering enhanced rich metadata to allow for the improved search and utilisation of datasets, and it provided a social and collaborative space for open data users. The initiative provided a one stop-shop to more than 52,000 datasets and has developed a community of over 700 registered users. We believe that this characterises a successful open data initiative.

4. Critical Success Factors for Open Data Publication and Use

4.1 Findings regarding open data disclosure

Table 2 provides an overview of the identified factors that are important for open data publication and shows to which extent each factor was critical in the case study. The table shows that legislation, regulation and licenses were most critical for the disclosure of open data in the ENGAGE initiative. Merely letting governmental organisations release their data voluntarily and on their own initiative seemed not sufficient to stimulate the use of and value generation from these data. To make the ENGAGE open data initiative successful it was found that it is critical to develop a legal framework for open data publication, to enforce the publication and curation of open data on administrations, to offer public administrations information about how they can

comply with data protection and privacy legislation, and to develop guidelines on issues with legal Intellectual Property Rights (IPR) allowing organizations to pick the correct licensing form. The criticality of these factors may stem from ENGAGE's focus on sharing datasets with various communities, as well as extending datasets and sharing those.

Table 2: Factors important for the publication of open data and factors identified as critical in the case study.

Categories	Factors important for the publication of open data	Identified as critical (+) or very critical (++) in the case study
1 Legislation, regulation and licenses	Having in place a (national) legal framework for open data publication	++
	Enforce publishing and curating of data on administrations (maybe even through penalties)	++
	Provide information about data protection and privacy legislation and how open data can be published in compliance with this legislation	++
	Develop a (national) guide on legal Intellectual Property Right (IPR) issues allowing organizations to pick the correct licensing form	++
2 Strategy and political support	Develop a strategy for open data publication at an (inter)national level	+
	Ensure that (top) management within governmental agencies supports publishing data	
	Generate support of policy-makers for data publication	
	Organize focus groups with heads of departments and open data policy implementers to give both proponents and opponents of open data an auditorium	
	Introduce incentives schemes for public servants (e.g. explain why a data provider would release data, explain what kind of value is created for the data provider)	
	Create consensus between open data publication and the organizational framework for publishing data	++
3 Management support and publication processes within governmental agencies	Define clear process steps for publishing data	++
	Determine which type of data is important to address societal issues and focus on the publication of these data	++
	Start with the publication of data which is interesting for users so that the users see the benefit of open data	+
	Determine which data and metadata will and will not be published	
	Determine which standards and vocabularies will be used for data publication	
	Determine which personnel has the key responsibilities for publishing open data	
	Determine where datasets will be published	+
	Release only data which is of high quality	++
4 Training of and support for civil servants	Create a virtual competence center which assists in answering questions and helping out with administrative data publication processes	+
	Provide training on open data publication within governmental agencies (e.g. training on how datasets can be anonymized)	
	Develop information campaigns in which questions about open data publication are discussed	
	Develop information campaigns in which success stories of internal and external open data use are discussed	

5 Evaluation of the open data initiative	Develop metrics and success indicators for data publication by government departments	
	Evaluate the realization of metrics and success indicators as an integral part of the open data initiative	+
6 Sustainability of the open data initiative	Identify the need for data	++
	Create a strategy for maintaining published datasets	+
	Ensure data provision continuity, including timely and automatic updates of data	++
	Be transparent towards open data users about the conditions under which data publication takes place	++
7 Collaboration	Arrange meetings with open data users to find out what their needs are and how the data from the governmental agency are used	
	Organize internal meetings to discuss the data publication processes and to evaluate them	
	Organize inter-organizational collaboration about and management of open data initiatives	
	Ensure agile and open cooperation with various other organizations (administration, universities, CSO, Open Knowledge Foundation)	
	Organize inter-organizational collaboration (e.g. network meetings) to learn from the open data initiatives of other governmental agencies	
8 Open data platforms, tools and services	Integrate the open data platform into existing Content Management Systems (CMS) to kick-start the progress	
	Have one central portal which combines data from many different governmental organizations (federal level)	++
	Implement advanced data search functionalities	+
	Use complementary toolsets for performing additional curation tasks (cleaning, linking, visualizing, analyzing)	
	Use a "web 2.0" approach for open data, allowing citizens to post, rate, work with datasets and web services	+
	Integrate frameworks for assessing data quality and usability of data and platform, providing continuous feedback to developers and administrations	++
	Provide a forum to discuss what can be learned from open data use	
	Develop a clear User Interface (logical symbols, clear setup of the web page, simple design)	++
9 Accessibility, interoperability and standards	Use standards for data, metadata, licenses, URIs and exchange protocols	++
	Use cloud infrastructures able to gather, manage and publish open data, interoperable with other sources within the country or region	
	Integrate metadata schemas and federated controlled vocabularies for properly categorizing information	++
	Provide various types of metadata, in line with metadata standards (e.g. CERIF, CKAN, DC, EGMS, DCAT)	++
	Provide Application Programming Interfaces (API's) for open data provision in the form of service feeds (from open data to open services)	++
	Enable multilinguality of metadata and data, allowing for the reuse and integration of data from different countries/languages	++

Many critical factors were also mentioned in the sixth factor category concerning the sustainability of the open data initiative, which can be explained by the fact that ENGAGE was a temporal project that could receive funding for three years maximum. Critical factors were also found in the ninth category concerning accessibility, interoperability and standards, which is rooted in

ENGAGE's focus on providing homogenous access to heterogeneous datasets. Essential factors with regard to sustainability concerned identifying the need for data, ensuring the continuity of data supply (including timely and automatic updates of data), and being transparent towards open data users about the conditions under which data publication takes place. Factors regarding accessibility, interoperability and standards that were critical for open data publication success referred to multilingual metadata and data, the use of standards (for data, metadata, licenses, URIs and exchange protocols), the integration of metadata schemas and federated controlled vocabularies, the provision of various types of metadata in line with metadata standards, and the supply of APIs for open data provision in the form of service feeds.

Another factor that was not part of the broad overview of open data success factors derived from the brainstorm session and workshop, but that was found to be critical in the case concerned data stewardship and the development of a management plan for this. Stewardship refers to the "careful and responsible management of something entrusted to one's care" (Dawes, 2010, p. 380). Dawes (2010, p. 380) writes that stewardship in the context of information refers to „assuring accuracy, validity, security, management, and preservation of information holdings". Our third factor category already partly covers management support, yet a number of these factors were assessed as 'not critical' by the case study respondent. The case study showed that some other management factors related to assuring accuracy, validity, security, and preservation were critical for the success of ENGAGE. Management factors that were assessed as very critical were releasing only high quality data, defining clear process steps for publishing data, publishing data that are important to address societal issues. The criticality of these factors stems from the fact that ENGAGE was a new initiative which started without any users. It needed to attract a large user base from the beginning of the project, which required the provision of accurate, valid, high-quality and secure datasets that OGD users could trust.

The case study also revealed factors that were very uncritical for open data publication in the ENGAGE initiative. The very uncritical factors were mainly found in category seven regarding collaboration. In this category three factors were assessed as very uncritical for the ENGAGE initiative, namely the organisation of inter-organizational collaboration about and management of open data initiatives, the assurance of agile and open cooperation with various other organizations, and the organisation of collaboration with other organisations. Since ENGAGE is an international initiative, it may be surprising that collaboration was uncritical for the success of this initiative. A possible explanation is that the collaboration success factors were mainly focused on the data publishing processes, while ENGAGE was more focused on how data that had already been released could be used by researchers and citizens. Therefore, the ENGAGE initiative was less concerned with trying to get interesting data published, but more with how open data users could make sense of interesting data that were already available.

4.2 Findings regarding open data use

The survey also asked for factors which were critical for open data use in the ENGAGE initiative (see Table 3). None of the factors mentioned in the survey was assessed as uncritical or very uncritical. The factors in Table 3 that were not assessed as critical or very critical were assessed neutrally as 'neither uncritical, nor critical'. Factors that were very critical for open data use success were found in the tenth category regarding legislation, regulation and licenses, which can be explained by ENGAGE's focus on freely sharing datasets, and in the eleventh category

concerning success stories, which can be explained by the importance for the project to attract a large user base. With regard to legislation, regulation and licenses, the provision of information on the meanings and implications of licenses, and on privacy legislation and how open data can be used in compliance with this legislation were critical. As far as the success story category was concerned, the provision of readily available examples of open data use (e.g. apps) to non-experts, as well as the development of stories about successful open data use were critical. Success stories were used to attract more people to the infrastructure. In addition, all the factors in the category of feedback and sustainability were assessed as critical for the use of open data in the ENGAGE initiative, including the provision of mechanisms for governmental agencies to know how their data have been reused, to know what can be learned from the reuse of their data, and to know how the publication of their data can be improved based on feedback that they received from open data users.

Table 3: Factors important for the use of open data and factors identified as critical in the case study.

Categories	Factors important for the use of open data	Identified as critical (+) or very critical (++) in the case study
10 Legislation, regulation and licenses	Provide information on the meanings and implications of licenses	++
	Provide information about privacy legislation and how open data can be used in compliance with this legislation	++
11 Success stories	Provide readily available examples of open data use (e.g. apps) to non-experts	++
	Develop stories of successful open data use	++
	Involve community key players to propagate success stories	+
12 Incentives for open data use	Provide incentive schemes to engage citizens in open data usage	
	Stimulate the development of specialized, open-data driven startup incubators	
	Stimulate the development of business models to allow enterprises to develop add-on services on top of open data platforms, at a cost	+
	Support issue-oriented community building through participatory events	
	Align events, competitions and hackathons with, for example, university curricula, awards, festivals and "direct marketing"	
13 Training of and support for open data users	Ensure agile, dynamic, and professional support services and training for potential open data users	+
	Organize events and ensure community building where the potential benefits of open data are communicated to users (e.g. by building scenarios for usage)	
14 Feedback and sustainability	Provide mechanisms for governmental agencies to know how their data have been reused	+
	Provide mechanisms for governmental agencies to know what can be learned from the reuse of their data	+
	Provide mechanisms for governmental agencies to know how the publication of their data can be improved based on feedback that they received from open data users	+
15 Research and education	Develop university and continuous education curricula on open data	
	Develop and maintain research areas roadmaps on open data, in order to consolidate research efforts and address open issues	

A factor that was not part of the broad overview of open data success factors derived from our brainstorm session and workshop, but that was seen as critical was that open data users should know precisely and in a scientific manner the methodology of how the data were produced. For instance, if the dataset was derived from a survey, it should be clear to the user which method was used, how the sample of respondents was selected, and under which conditions the data were created and can be reused. Since datasets could be reused and changed on the ENGAGE infrastructure, users needed to know how datasets had been produced, and how changed datasets differed from original datasets.

5. Case study discussion

The case study showed that the criticality of success factors depends considerably on the context of the open data initiative. A first critical contextual factor is the level on which the initiative is organized. For example, since the ENGAGE open data initiative was organized on an international level and involves datasets from different countries in various languages, the factor of multilinguality was critical. The multilinguality factor is likely to be less important for other open data efforts which are organized on a local or national level. Furthermore, the phase of the open data process that the initiative focuses on, i.e. the publication or the use of open data, also determines which factors are critical for success, and it is important to make a distinction between factors critical for open data publication on the one hand, and factors important for open data use on the other hand. The case study showed that some factors were only critical for the success of data publication, while others were only critical for data use. If these categories are not separated, this may lead to unrealistic expectations of open data decision-makers.

Other contextual aspects that may influence the criticality of success factors for open data use are whether the data are reused for commercial or non-commercial purposes, since the need to make open data use profitable is likely to lead to different success factors than not-for-profit data use. A factor such as the development of a successful revenue model was not critical in the context of the ENGAGE case since it did not aim to make money with open data use, while this factor may be critical for commercial open data use initiatives. Moreover, the studied case concerned a three-year open data initiative. The temporal dimension is also important for determining CSFs, since open data CSFs may also vary over time, and they may depend on a long-run or short-term focus of the open data initiative. While the factors of collaboration for data publication were found to be uncritical for success in the ENGAGE initiative, these factors may be critical for the sustainable provision of open data in the long-run.

The findings of our study offer several interesting insights and implications. The first point of reflection is regarding the critical success factors for publication as opposed to those for use of open data. In our case study we observed that several CSFs for publication, compared to none CSFs for use, were found to be uncritical. This yields several explanations. First of all, the selected case was a project conceived to support open data use which made it a priority. Moreover, the CSFs for open data use in our list are relatively generic, strategic, and high-level, while many of the CSFs for publication are very low-level, tactical, and detailed (e.g. category nine). Therefore, we recommend further research into the CSFs for open data use to make them more context-specific and practice-oriented. For instance, category 14 regarding feedback and sustainability can be detailed with an overview of specific mechanisms. It may be possible that, while the success factor

of feedback and sustainability is very critical in a particular case, the specific mechanisms to implement it can vary on a case by case basis.

The second point of reflection concerns the extent to which the identified factors (or some of them) can be universally applied to different organizational settings. In the literature (Poon & Wagner, 2001) there is a notion of 'meta-CSFs' – a smaller number of CSFs of utmost criticality which if managed correctly result in all other factors going right as well. In the selected case the factors of legislation, regulation, and licenses were found to be critical for both the publication and use of open data. An explanation we propose is that this category of CSFs is especially important to start off with open data publication and use – to set the legal framework, establish the rules, and make all stakeholders aware of them. This is, however, a temporary success factor that is most critical at early stages of open data implementation. On the other hand, the factors from category six on sustainability are ongoing critical success factors that are relevant at all subsequent stages after the project launch. Ensuring continuity, efficient maintenance, transparency, and demand-driven operation are the key elements of success of an open data initiative. It is our proposition to consider the CSFs in category six on sustainability as meta-CSFs for data publication. Similarly, the success factors concerning feedback mechanisms and success stories can be considered meta-CSFs for open data use. In section 2.2 we offered a definition of success of an open data initiative which emphasized such attributes as high quality publication, use and user satisfaction, and benefits ensuing from that. CSFs focusing on the continuity of the publication process, on the interaction between publisher and user, and on illustrating benefits with success stories are hence intrinsic elements of success in this interpretation of the term.

6. Conclusions

This paper aimed to answer the question: *Which factors are critical for the publication and use of open data in a particular practical case?* A brainstorm session and an interactive workshop were used to first identify a comprehensive list of factors which are important for open data publication and use. Subsequently, the findings from a case study showed which of these generic factors were critical for open data publication and use in a particular context. The open data initiative that we studied took place in the context of infrastructure development for open data publication and use, where a community of open data users provided raw and processed datasets, and collaborated on open data transformations, analysis, visualisations, discussions and dataset quality rating. Categories of factors that were most critical for open data publication in this initiative referred to 1) legislation, regulation and licenses, 6) sustainability of the open data initiative, and 9) accessibility, interoperability and standards. Success factor categories critical for open data use concerned 10) legislation, regulation and licenses, and 11) success stories. The CSFs in the case were complemented with a number of success factors that were not obtained from the brainstorm session and the interactive workshop, such as data stewardship, the development of a management plan, and the provision of detailed information about the methodology of how the data was produced.

The broad overview of generic factors obtained from the brainstorm session and the interactive workshop may be used by other researchers as a framework for investigating the criticallity of success factors in a certain context. The case study allowed for identifying context-dependent open data success factors, which may foster the publication of public data, foster the use of published

data, and stimulate its economic and societal applications. The combination of methods used in this study was found to be useful to identify CSFs for open data publication and use. We recommend further research to complement our single case study with other cases from a variety of contexts. This could help to determine the criticallity of success factors in specific contexts, and to obtain more insight in whether a particular open data initiative may be successful or not. It may also offer guidance to decision-makers regarding whether they will participate in an open data initiative and under which conditions. Additionally, further research could investigate whether quantitative approaches towards measuring the success of open data initiative can be useful.

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