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Best Practices in the Implementation of Open Data at a Municipal Government Level

CAPSTONE REPORT

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Abstract

As government open data models are increasingly adopted, many fail to bring efficiency, accountability, and transparency. The intent of this paper is to extract best practices from other research to help local municipalities implement their own open data models. Three best practices were found when implementing open data models, including a need to create policies and manage data, formatting data for multiple purposes, and to engage the public in understanding and fixing gaps in data.

Keywords: municipal open data, open data, civic data, local government data, open data models, open data policies

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Introduction to the Annotated Bibliography

Problem

In June 2013, President Obama and the G7 leaders recommended nations follow the Open Data Charter, a set of strategic principles that encourage governments to publish all data openly to improve the quality, quantity, and re-use of data that is released (G8 Open Data Charter, 2013). After his recommendation, President Obama's administration set a goal to create an open data policy that allows citizens to use data to make the government more transparent and efficient, improve government accountability, help advance the private sector through innovation, help the scientific community by sharing information to promote scientific insights, and create economic growth that benefits all (U.S. Open Data Action Plan, 2014). Recently, significant strides have been made at the federal level in relaunching Data.gov, a data repository to which any municipal or government agency can post its data, and in publishing the U.S. Open Data Action Plan (2014). The relaunch has made over 200,548 data sets, primarily of federal data, available to citizens and businesses (U.S. Open Data Action Plan, 2014).

At the state and local level, many agencies have begun to make strides in adopting open data models with over 500 cities publishing data in some form on their websites (Yavuz & Welch, 2014). The goal in publishing these data sets is that the data will provide more transparency, collaboration between departments and citizens, and participation between citizens and their local agencies (Evans & Campos, 2013). However, many of these efforts are immature at best since the jurisdictions are merely publishing data to "improve their image and increase their legitimacy" (Yavuz & Welch, 2014, p. 582). Thus, these efforts fail in creating the transparency, collaboration, and participation the agencies crave (Yavuz & Welch, 2014).

Over the last several years, many studies have been conducted and papers written pertaining to challenges and lessons learned in implementing an open data model. For the purposes of this study, an open data model is defined as the use of information and communication technologies in public sector organizations to increase the release of government data to increase government efficiency and accountability and to support and improve economic growth (Yavuz & Welch, 2014). Heise and Naumann (2012) wrote about the complexity of data sets and how independently maintained and sometimes erroneous data sets make integration challenging. Conradie and Choenni (2014) found that the ways in which data are stored and maintained and how departments process data all affect the usefulness of the data that are released. As a result, their efforts to publish open data often result in less than desired levels of transparency, accountability, and openness as the published data are not necessarily usable (Janssen, Charalabidis, & Zuiderwijk, 2012).

Recently, the City of Boulder decided to open data to the public in an effort to create civic efficiencies and provide transparency. Over the course of two years, much of the data that was published went unused by the public (City of Boulder Innovation and Analytics Program, 2017). Issues that led to the public's failure to access and use the data included:

- Lack of acclimation for public and city staff regarding the function and use of open data.

- Insufficient efforts to ease the public's understanding and use of the data.

- Failure to build an approach to foster engagement between the public and city staff regarding the available data.

The lack of an effective implementation of its open data model required the city to rethink its strategy and re-implement the program. While the City of Boulder was able to

allocate money on a second implementation of its open data model, for many jurisdictions spending tax dollars on re-implementing an open data solution may be infeasible due to lack of funding.

The State of Oregon is an example of a state government that has passed legislation to limit the amount of funding available for information technology (IT) projects. In 1997-1998, Oregon Measure 50 imposed a tax rate limit on all taxing districts in operation. After the enactment of Measure 50, no property tax increase could be enacted without the approval of the district citizens. A permanent rate limit is expressed as a tax rate per thousand dollars of assessed property value. Per Measure 50, "[a] local taxing district is permitted to have only one permanent rate limit" (Oregon Department of Revenue, 1997). Since the passage of Measure 50, the City of Bend has not raised property taxes. For a city of its size, the City of Bend has one of the lowest tax rates at $3.05 per square foot in the state of Oregon (City Property Tax Data, 2016). The inability to increase tax revenue means that the City of Bend has a finite and small amount of funding to implement an open data model, and even less funding available if a reimplementation is required. Understanding the pitfalls and successful strategies associated with implementing open data models can enable municipal districts or jurisdictions that are operating with limited funding to successfully implement open data models the first time, thus avoiding costly reimplementation.

Purpose

The purpose of this paper is to identify and synthesize selected scholarly literature that describes best practices in the creation of open data models for municipal and state government agencies. Government agencies can use this synthesis of past literature to develop strategies for adopting open data models.

Research Question

The foundation of this study is supported by the larger question of, what are best practices that can be used by government agencies to implement open data models? When exploring this issue, the following questions provide a guide to this paper:

- How does the technical infrastructure architecture impact the creation of open data models?

- Does the final format of the data matter when creating open data models?

Audience

Government agencies require dedicated time and resources to publish data for internal and public consumption. To reduce the time spent and to create meaningful and cost effective data models, agencies need to understand what lessons have already been learned by others who have succeeded or attempted to implement open data models. This paper is important in that it synthesizes findings from other research into one document that codifies those findings into specific strategies and pitfalls. The paper is meant for regional government agencies and municipal chief information officers who create or are planning to create open data models. Additionally, managers and directors within municipal departments who seek to leverage open data models to gain deeper analytical insights into their own or other departments' current business practices and to make data driven decisions can use the paper to understand the methods, standards, and best practices they could employ within their organizations. Lastly, citizen committees who help municipalities craft policies related to data sharing and usage can benefit from the findings of this paper.

Search Report

The bulk of the research for this annotated bibliography focused on scholarly articles and government policies that relate to the use of data to make government more efficient, accountable, and transparent. Various online sources were utilized for this study, specifically the University of Oregon online library research resources, focusing on psychology, local and regional document archives, public affairs information, computer science, business, and social science. Most of this research was conducted using the University of Oregon Libraries website, primarily because the University of Oregon Libraries website provides access to scholarly journals. Note that most municipal organizations do not have access to relevant and timely resources, making the subject matter of this paper important. Additionally, other related online search engines and sources utilized included Google Scholar and *Government Technology* magazine. Finally, specific municipal examples of open data model projects were referenced.

Information Evaluation Criteria

Keyword searches for studies, websites, and articles relating to smart government, transparency, open data, municipal efficiency, and government data provided search results that were examined for conclusions relevant to the success or failure of municipal or government open data programs. Five research evaluation guidelines of authority, quality, relevancy, timeliness, and lack of bias developed by the Center for Public Issues Education at the University of Florida (n.d.) were used when evaluating reference sources for use in this study. Authority was primarily evaluated by the author's participation in the academic community or by governmental organizational affiliation. Quality of the sources was judged by whether or not the source supports the findings with evidence and peer review of the source. Relevancy of a source was judged whether the information presented was related to government data. The timeliness of

a source was evaluated based on the publication date and whether relevant findings correlated to the current timeframe. Because the U.S. Open Data Action Plan is less than 10 years old, only sources less than 10 years old were selected for this study. Occasionally, older sources were used when needed to in order to relay specific information related to current terminology or issues due to the newness of government open data models. Finally, each source was evaluated for the presence of biases pertaining to the findings. Therefore, any articles that favored specific groups, entities, or results were discarded.

Search terms included in this literature search:

- Municipal open data,

- Open data,

- Municipal data,

- Government data,

- Civic data,

- Smart city,

- Municipal efficiency,

- Local government,

- Open data models,

- Open data policies,

- Government transparency, and

- Data provisions.

Documentation Approach

There is one overarching assumption in the creation of the best practices in the annotated bibliography and the conclusion of this paper, which is that the proliferation of data and public

open data models will continue in earnest for the foreseeable future. This study followed a qualitative approach. A literature review that synthesizes information of prior cases studies and scholarly research was used for this study. Three tools were used to gather data: University of Oregon Libraries databases, and to a lesser extent *Government Technology* magazine and Google Scholar. To assist in tracking the various data sources, the tool Easybib was used to track source notes.

The source case studies were analyzed via inductive analysis in order to synthesize common themes into strategies. Source information was codified in a spreadsheet document in order to organize and analyze the information into themes. Document metadata such as author, publication data, study findings, and level of government studied was used to facilitate analysis. To ensure the strategies are verifiable, the primary method of verification was a review of the authors and the literature to determine where the author worked or studied and for whom the author worked, and a review of the publisher to determine the credibility of the source. Additionally, to be included in this study, the work had to be a peer reviewed study.

Annotated Bibliography

Introduction to Annotated Bibliography

This annotated bibliography presents 15 references used to examine the importance of open data and strategies and best practices for implementation. The review is organized into three sections, including background on open data models, potential solution alternatives, and potential best practices in establishing open data models. Each source contains a full bibliographic citation, abstract, and summary. All the abstracts included are the full published length. The summary discusses the relevance of the article and how the article describes the problem and/or addresses the research questions.

Background on Open Data Models

Barns, S. (Ed.). (2016). Mine your data: Open data, digital strategies and entrepreneurial

governance by code [Special issue]. *Urban Geography, 37*(4), 554-571.

http://dx.doi.org/10.1080/02723638.2016.1139876

Abstract. Investment in the release of open data has become increasingly central to the implementation of smart city programs by governments around the world. Though originally arising out of a push towards "open government" and the pursuit of more transparent decision-making by public authorities at multiple scales, open data programs have more recently been adopted by municipal governments to support entrepreneurial goals of enhanced competitive positioning and attracting investment. As urban scholars now subject the smart city project to critical scrutiny for its role in advancing urban entrepreneurialism, this article considers the relevance of the open data agenda as it shapes wider understandings of the smart city. In particular, I address the collection of policy practices, aspirations, stakeholders, and entrepreneurs active in framing the opportunities and values of open data for urban governments.

Both the momentum of support for open data, along with a recent shift in the rhetorical aspirations of the open data movement away from the values of openness and transparency and towards a more confined focus on value generation, raise important critical questions for urban geographers concerned with the nature of urban governance in an age of big data.

  Summary. This study focuses on the idea of open data, from a city level all the way up to a national level, and the evolution of open data. Barns (2016) notes that when originally publishing open data, agencies looked at using open data in an effort help craft policies; however, this strategy morphed into using data to engage their citizens and business. With this evolution, the way open data models are evaluated has changed. Barnes (2016) notes that "[t]he analysis indicates that the rhetorical frameworks for evaluating open data programs are increasingly premised upon the integration of public service information (PSI) into big data value chains" (p. 567). Therefore, Barnes (2016) posits that the role of an agency is changing form a data provider or conveyer to data collaborator. Thus, it is important for agencies to include citizens and business when creating open data models and eliciting feedback from them about what data are important and what data are needed. This study is important to this annotated bibliography because it shows that initial thoughts on how data would be used are changing, thus agencies seeking to launch successful open data projects need to adjust the implementation method to include stakeholders outside of the organization.

Evans, A. M., & Campos, A. (2013, Winter). Open government initiatives: Challenges of

   citizen participation. *Journal of Policy Analysis and Management, 32*(1), 172-185.

   doi:10.1002/pam.21651

  Abstract. Much of the work in open government, both in its implementation and research, has emphasized data and the information and communications technologies supporting

their access, interoperability, and usability. This data-driven focus has not been proven to significantly increase citizen understanding of the complexities of issues and policies or their participation in relevant policy deliberations. If the primary goal of open government is to engage citizens, then current initiatives must be re-evaluated and new approaches explored shifting beyond data delivery. Releasing volumes of data on a Web site without background on why and how it is collected, how it is organized, and its intended use, leaves citizens with herculean tasks of determining its relevance and reliability. This paper suggests how to achieve the primary goal of open government, which is to ensure that the American public has access to objective, relevant, and reliable information to help them arrive at informed judgments about issues and the government's role in tackling these problems. This paper also summarizes recent activities undertaken at the national level to advance open government directives, principles, and plans.

Summary. "Open Government Initiatives: Challenges of Citizen Participation" is a peer reviewed journal article authored by Evans and Campos (2013). Evans is a clinical professor at the University of Texas at Austin, while Campos received her master's degree in public affairs from the University of Texas at Austin. In their study, Evans and Campos (2013) looked at factors that have prevented open data initiatives from creating higher levels of governmental accountability, transparency, and efficiency Though their research, they discovered that much effort is put forth in pushing data out to the public; however, little effort was given to the skill set and capabilities of their audience. Evans and Campos (2013) suggest that more studies should be funded, academically and federally, to help agencies produce more effective open data models. The study's audience is members of government agencies looking to create an open data model. Although this article mainly analyzed federal programs, the conclusions it draws are applicable

at any level of government. This source is important because it highlights that an increasing number of government agencies are publishing open data; however, these models can be ineffective in achieving improved government accountability, transparency, and efficiency. Therefore, a purposeful approach to publishing data by any government agency with these goals is needed.

G8 open data charter. (2013, June 18). Retrieved from

https://www.gov.uk/government/publications/open-data-charter

Abstract. In July 2013, G8 leaders signed the G8 Open Data Charter, which outlined a set of five core open data principles. Many nations and open government advocates welcomed the G8 Charter, but there was a general sense that the principles could be refined and improved to support broader global adoption of open data principles. Building on these efforts, and through an open, inclusive and representative process, a number open data champions from governments, multilateral organizations, civil society and private sector developed the International Open Data Charter.

The International Open Data Charter contains six principles:

- Open by Default;

- Timely and Comprehensive;

- Accessible and Useable;

- Comparable and Interoperable;

- For Improved Governance and Citizen Engagement; and

- For Inclusive Development and Innovation.

Summary. The Open Data Charter (2013) is a document that was created so that governments would standardize open data. This standardization then allows datasets to be

compared across regions, countries, and like agencies. The charter was developed to create a set of standards which make data more accessible, usable, and open. The Open Data Charter (2013) is written for a non-academic audience that has specific skills in database design and data collection. Although this source does not specifically address issues or strategies that local governments should use, it does explain the reasons why open data models are important. Additionally, the document represents the viewpoint of many governments, private industries, and others that data should be open and shared with citizens. This source is important because it emphasizes that open data models are important, and that collectively, and at many levels of governments, open data models are valuable.

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, adoption barriers and myths of open data and open government. *Information Systems Management, 29*(4), 258-268. http://dx.doi.org/10.1080/10580530.2012.716740

Abstract. In this article, based on data collected through interviews and a workshop, the benefits and adoption barriers for open data have been derived. The results suggest that a conceptually simplistic view is often adopted with regard to open data, which automatically correlates the publicizing of data with use and benefits. Also, five "myths" concerning open data are presented, which place the expectations within a realistic perspective. Further, the recommendation is provided that such projects should take a user's view.

Summary. In the journal article, "Benefits, Adoption Barriers and Myths of Open Data and Open Government," Janssen, Charalabidis, and Zuiderwijk (2012) frame the problem by stating, "Despite the significance of open data, little systematic and structured research has been conducted in this area" (p. 258). The authors note that "[n]one of the current research focuses on analyzing the benefits and barriers that go beyond individual projects, applications, or conceptual

ideas and global sketches" (p. 259). Janssen et al. (2012) also summarize the purpose of their

research, stating that their goal was to "analyze the benefits of and barriers to open-data systems

by synthesizing people's experiences with open data obtained from interviews and a group

session" (p. 259). Janssen et al. found several key findings in their case study. One of those

finding was "[t]he dream is that everyone can make use of the data that is available and that

anybody can use the data directly" (p. 265). This idea is important when looking at

implementing open data models in a municipal environment. Municipalities need to understand

that how information is collected, collated, and summarized affects how easily it is digested by

the public. If the data are not synthesized in a manner that is consumable, the efforts in creating

the open data are wasted.

In another finding, the authors indicated that the idea that "[o]pen government promotes

transparency and engagement to allow effective oversight" (p. 266) is a myth that many

governments and open data proponents believe. This conclusion is important to municipalities

because it assumes that the data are readily consumable and that the data are easily found when

needed by citizens.

A third finding was related to making data available with little to no effort. Janssen et al.

(2012) acknowledged that issues can arise because "[s]ource data can often not immediately be

used; quality assessment and the modification and processing of raw data might be needed first"

(p. 256). Thus, municipalities must realize that publishing data in an open data model can be

expensive and time consuming because specific data must be cleaned, organized, and redacted

depending on the quality and type. Overall, because this case study is based in the public sector

and because it reveals several key points in the planning of municipal open data models, it is a

good source of best practices.

Veljković, N., Bogdanović-Dinić, S., & Stoimenov, L. (2014). Benchmarking open

government: An open data perspective. *Government Information Quarterly, 31*(2), 278-

290. https://doi.org/10.1016/j.giq.2013.10.011

Abstract. This paper presents a benchmark proposal for the Open Government and its application from the open data perspective using data available on the U.S. government's open data portal (data.gov). The benchmark is developed over the adopted Open Government conceptual model, which describes Open Government through data openness, transparency, participation and collaboration. Resulting in two measures, that is, one known as the e-government openness index (eGovOI) and the other maturity, the benchmark indicates the progress of government over time, the efficiency of recognizing and implementing new concepts and the willingness of the government to recognize and embrace innovative ideas. A benchmark model for the Open Government is proposed. Benchmark results with two measures - government openness index and maturity.

Summary. This research study examines the effectiveness of open data, specifically data.gov, for maturity, openness, and transparency by benchmarking and indexing data based on several factors. The intent is to compare the effectiveness of an implementation of an open data model and compare the model to other models. In establishing these coefficients, the study found that published data in several areas at a federal level remain weak and need improvement. Although these coefficients hold promise in measuring the effectiveness of an open data initiative, the formulas remain complex for an agency to calculate on its own. The study is important because it describes the various categories, sub-categories, and rating scales that agencies can use to help them measure their open data models. This study thus helps an agency

move forward in rating its current models or building new models to address maturity, openness, and transparency.

Potential Best Practices in Establishing Open Data Models

Heise, A., & Naumann, F. (2012, July). Integrating open government data with stratosphere for
 more transparency. *Web Semantics: Science, Services and Agents on the World Wide
 Web, 14*, 45-56. https://doi.org/10.1016/j.websem.2012.02.002

Abstract. Governments are increasingly publishing their data to enable organizations and citizens to browse and analyze the data. However, the heterogeneity of this Open Government Data hinders meaningful search, analysis, and integration and thus limits the desired transparency. In this article, we present the newly developed data integration operators of the Stratosphere parallel data analysis framework to overcome the heterogeneity. With declaratively specified queries, we demonstrate the integration of well-known government data sources and other large open data sets at technical, structural, and semantic levels. Furthermore, we publish the integrated data on the Web in a form that enables users to discover relationships between persons, government agencies, funds, and companies. The evaluation shows that linking person entities of different data sets results in a good precision of 98.3% and a recall of 95.2%. Moreover, the integration of large data sets scales well on up to eight machines.

Summary. In 2012 Heise and Naumann wrote "Integrating Open Government Data With Stratosphere for More Transparency." This peer reviewed journal article examines how easy it is to connect various government open data sources; the accuracy of these connections is then measured with software called Stratosphere. Heise is a former member of and Naumann is the head of the Hasso Plattner Institute of Potsdam, Germany. In their study, Heise and Naumann (2012) discussed the process and knowledge needed to create meaningful connections via a

fictional database administrator. What the authors found was that just publishing government data with the assumption that the data will be used to create meaningful decisions and more transparency was false. The authors note that in order to create meaningful insights a savvy database administrator would need to understand "the technical, structural, and semantic heterogeneity of the data" in order to create any automated analysis that would generate a meaningful summarization of the data (p. 1). The study targets an academic audience, but is specifically relevant because of the findings about the complexity of using the data. One weakness of the study is that it does not specifically address local data. However, the conclusions still apply to local municipal open data models.

Kassen, M. (2013, October). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly*, *30*(4), 508-513. https://doi.org/10.1016/j.giq.2013.05.012

Abstract. This article presents a case study of the open data project in the Chicago area. The main purpose of the research is to explore empowering potential of an open data phenomenon at the local level as a platform useful for promotion of civic engagement projects and provide a framework for future research and hypothesis testing. Today the main challenge in realization of any e-government projects is a traditional top down administrative mechanism of their realization itself practically without any input from members of the civil society. In this respect, the author of the article argues that the open data concept realized at the local level may provide a real platform for promotion of proactive civic engagement. By harnessing collective wisdom of the local communities, their knowledge and visions of the local challenges, governments could react and meet citizens' needs in a more productive and cost-efficient manner. Open data-driven projects that focused on visualization of environmental issues, mapping of

utility management, evaluating of political lobbying, social benefits, closing digital divide, etc. are only some examples of such perspectives. These projects are perhaps harbingers of a new political reality where interactions among citizens at the local level will play a more important role than communication between civil society and government due to the empowering potential of the open data concept.

Summary: In 2013 Maxat Kassen wrote, "A Promising Phenomenon of Open Data: A Case Study of the Chicago Open Data Project," which was published in *Government Information Quarterly,* a peer reviewed publication. Kassen is a former Fulbright Visiting Scholar at the University of Illinois at Chicago. Kassen's research focuses on e-government projects and the development of political communication through the use of digital technologies. In his study, Kassen found that it is important to not just publish data for machine consumption, but instead to format the data in a way that helps the community to understand the data. In doing so, the process creates better transparency, accountability, and efficiency within an agency. Additionally, Kassen found that it can be important to include private sector organizations in the design of the data model because private organizations can be instrumental in helping the municipality in creating the open data model. This source is important because Kassen provides potential best practices by positing that data needs to be formatted in a way that is understandable to the public, and that agencies should include private parties to help understand what is wanted by the public.

Sangiambut, S., & Sieber, R. (2016). The V in VGI: Citizens or civic data sources. *Urban Planning, 1*(2), 141-154. https://doi.org/10.1016/j.giq.2015.05.003

Abstract. Volunteered geographic information (VGI), delivered via mobile and web apps, offers new potentials for civic engagement. If framed in the context of open, transparent

and accountable governance then presumably VGI should advance dialogue and consultation between citizen and government. If governments perceive citizens as consumers of services, then arguably such democratic intent elide when municipalities use VGI. Our empirical research shows how assumptions embedded in VGI drive the interaction between citizens and government. We created a typology that operationalizes VGI as a potential act of citizenship and an instance of consumption. We then selected civic apps from Canadian cities that appeared to invoke these VGI types. We conducted interviews with developers of the apps; they were from government, private sector, and civil society. Results from qualitative semi-structured interviews indicate a blurring of consumer and citizen-centric orientations among respondents, which depended on motivations for data use, engagement and communication objectives, and sector of the respondent. Citizen engagement, an analogue for citizenship, was interpreted multiple ways. Overall, we found that government and developers may increase choice by creating consumer-friendly apps but this does not ensure VGI offers an act of civic participation. The burden is placed on the contributor to make it so. Apps and VGI could potentially further a data-driven and neoliberal government. Planners should be mindful of the dominance of a consumer-centric view even as they assume VGI invariably improves democratic participation.

Summary. This study examines the implications of integrating publically-generated data into local government open data models. As citizens get familiar with using and generating data, there is a growing need from the public to be able to provide data to the local government via mobile applications or other means. The study showed that although there is potential for these applications to capture data, government organizations remain in charge of the data and how they are integrated into the open data model. Decisions, policies, and collaboration between agency and citizen remain less collaborative than hoped due to the unstructured or unmanicured nature

of the publicly-generated data. This study is relevant to this annotated bibliography because it shows that crowd sourcing of data and inclusion of that data in an open data model requires well planned management. Without structure to the process, capturing the data will have little value to the agency and citizens. Therefore, as an agency creates the applications that collect the volunteered data, the agency must consider how the end user will collect, store, and use the data.

Susha, I, Zuiderwijk, A., Janssen, M., & Grönlund, A. (2015). Benchmarks for evaluating the progress of open data adoption. *Social Science Computer Review, 33*(5), 613-630. doi:10.1177/0894439314560852

Abstract. Public organizations release their data for use by the public to open the government. Various benchmarks for evaluating the progress of open data adoption have emerged recently. In order to help bring about a better understanding of the common and differentiating elements in open data benchmarks and to identify the methodologies and metrics affecting their variation, this article compares open data benchmarks and describes lessons learned from their analysis. An interpretive meta-analysis approach was used and five benchmarks were compared with regard to metadata (key concepts, themes, and metaphors), meta-methods (methodologies underlying the benchmarks) and metatheories (theoretical assumptions at the foundation of the benchmarks). It was found that each benchmark has its strengths and weaknesses and is applicable in specific situations. Since the open data benchmarks have a different scope and focus and use different methodologies, they produce different results in terms of country ranks. There is an obvious gap in both the literature and benchmarks regarding the evolution of end-user practices and individual adoption of open data. Furthermore, lessons are drawn for the development of more comprehensive open data benchmarks and open government evaluation in general.

Summary. This study examines the importance of open data benchmarks and the methodologies applied for those benchmarks. This source is important as it will help an agency understand that the benchmarks help measure the success of a program. Based on the results of this study, the authors show several lessons in using these benchmarks; first, benchmarks should cover the open data policies, readiness of data for use by the public, implementation approach, as well as the rate of success of the adoption of the open data model. Second, an agency should also use benchmarks that measure the organizational change, community building, user support, and publication of open data sets. Additionally, these benchmarks should be used by agencies to improve their open data models.

Zuiderwijk, A., & Janssen, M. (2014, January). Open data policies, their implementation and

impact: A framework for comparison. *Government Information Quarterly, 31*(1), 17-29.

https://doi.org/10.1016/j.giq.2013.04.003

Abstract. In developing open data policies, governments aim to stimulate and guide the publication of government data and to gain advantages from its use. Currently there is a multiplicity of open data policies at various levels of government, whereas very little systematic and structured research has been done on the issues that are covered by open data policies, their intent and actual impact. Furthermore, no suitable framework for comparing open data policies is available, as open data is a recent phenomenon and is thus in an early stage of development. In order to help bring about a better understanding of the common and differentiating elements in the policies and to identify the factors affecting the variation in policies, this paper develops a framework for comparing open data policies. The framework includes the factors of environment and context, policy content, performance indicators and public values. Using this framework, seven Dutch governmental policies at different government levels are compared.

The comparison shows both similarities and differences among open data policies, providing opportunities to learn from each other's policies. The findings suggest that current policies are rather inward looking, open data policies can be improved by collaborating with other organizations, focusing on the impact of the policy, stimulating the use of open data and looking at the need to create a culture in which publicizing data is incorporated in daily working processes. The findings could contribute to the development of new open data policies and the improvement of existing open data policies. A framework is developed which contains key elements for comparing open data policies. Policies are context-dependent, and a variety of policy implementations exist. Public organizations can learn much from each other's policies. A gap between political ambitions and organizational realities is identified. Open data policies require a trade-off between openness and risk.

Summary. "Open Data Policies, Their Implementation and Impact: A Framework for Comparison" is a peer reviewed journal article written by Zuiderwijk and Janssen in 2014. Janssen is an associate professor of Information and Communication Technology and Governance at Delft University, while Zuiderwijk conducts research on open data connectivity at Delft University. The purpose of their study was to look at the policy factors that limit open data model initiative. In their study, Zuiderwijk and Janssen (2014) develop a framework that helps determine the differences in open data policies. From the research, the authors conclude that many of the policies that affect open data models, at multiple levels of government, are primarily designed with the jurisdiction's point of view in mind. What makes this article unique is that it specifically looks at policy decisions, whereas very few other articles touch on this subject. The article is meant for government employees, more specifically policy analysts, who will help design and implement open data models. This source is relevant to this annotated bibliography

because it highlights the need for agencies to look at open data policies from a citizen's

perspective, not just from the agency's perspective.

Potential Solution Alternatives

Conradie, P., & Choenni, S. (2014, June). On the barriers for local government releasing open

data. *Government Information Quarterly, 31*(1), S10-S17.

https://doi.org/10.1016/j.giq.2014.01.003

Abstract. Due to expected benefits such as citizen participation and innovation, the

release of Public Sector Information as open data is getting increased attention on various levels

of government. However, currently data release by governments is still novel, and there is little

experience and knowledge thus far about its benefits, costs and barriers. This is compounded by

a lack of understanding about how internal processes influence data release. Our aim in this

paper is to get a better understanding of these processes and how they influence data release, i.e.,

to find determinants for the release of public sector information. For this purpose, we conducted

workshops, interviews, questionnaires, desk research and practice based cases in the education

program of our university, involving six local public sector organizations. We find that the way

data is stored, the way data is obtained and the way data is used by a department are crucial

indicators for open data release. We conclude with the lessons learned based on our research

findings. These findings are: we should take a nuanced approach towards data release, avoid

releasing data for its own sake, and take small incremental steps to explore data release.

Summary. "On the Barriers for Local Government Releasing Open Data" is a peer

reviewed journal article written by Conradie and Choenni (2014), who are both researchers at the

interdisciplinary research group of the Rotterdam University of Applied Science. The article

summarizes the challenges and fears that local governments encounter when creating open data

models. To create the study, Conradie and Choenni (2014) collected data from six different

municipalities through an approach called participatory action research (PAR), collecting data

from interviews, workshops and questionnaires. Through their research, Conradie and Choenni

(2014) found several underlying issues, including municipalities often feared that false

conclusions would be drawn, data licensing may be needed and thus limit the exposure of the

data, internally no owner of the data was known, and no priority on which data should be

published first was known. The study's audience is the academic community, but the findings

are specifically relevant to local open data model initiatives. Overall, the article notes various

barriers to implementing open data; however, as other articles show, there are many other

barriers that Conradie and Choenni (2014) did not identify. This source is important to the

annotated bibliography because it shows that a municipality must make strong efforts in actively

managing an open data model. The authors note that controls over who updates the data, who

manages the data, and the format of the final data all contribute to the effectiveness of an open

data model.

Lee, M., Almirall, E., & Wareham, J. (2016, January). Open data and civic apps: First-

generation failures, second-generation improvements. *Communications of the ACM,*

59(1), 82-89. doi:10.1145/2756542

Abstract. On his first day in office in 2009, US Pres Barack Obama signed the

"Memorandum on Transparency and Open Government," asking government agencies to make

their data open and available to the public. The aim was to provide transparency in government

and improve provision of services through new technologies developed on the backbone of civic

open data. Transparency was achieved through a public data catalog that was the most

comprehensive at the time, providing such information as real-time crime feeds, school test

scores, and air-quality metrics. However, as of May 2010, only one year later, few citizens had make the effort to comb through the more than 272,000 data sets they had been provided. In this article, the authors examine early strategies behind the open data movement. They interviewed application developers and civic organizers in eight cities in the US and Europe, including Amsterdam, Barcelona, Berlin, Boston, Helsinki, New York, Philadelphia, and Rome.

Summary. This qualitative study identifies specific issues with allowing third party application designers to publish apps based on municipal open data models. The study concluded that early applications provided little cost savings to cities and were of only minor use to citizens; these finding were primarily due to poor governance by the municipality. In response to these issues, the authors found that successful initiatives incorporate better management of the data repositories and crowd sourced content. By standardizing data formats and application program interfaces (APIs), multiple municipalities could reuse standard application code.

The authors noted that one problem that continues to plague municipalities and application designers is that these second-generation applications remain buried in in the various application markets and are hard for citizens to find, thus the production of these applications results in less than desirable returns on taxpayers' money. This study is relevant to the overall purpose of this annotated bibliography as it highlights the need for municipalities to actively manage and curate the data and tools used in dissemination of the data as a best practice.

Robinson, P., & Johnson, P. (2016, June). Civic hackathons: new terrain for local government-citizen interaction? *Urban Planning, 1*(2), 65-74. http://dx.doi.org/10.17645/up.v1i2.627

Abstract. As more and more governments share open data, tech developers respond by creating apps using these data to generate content or provide services that citizens may find useful. More recently, there is an increase in popularity of the civic hackathon. These time-

limited events gather tech enthusiasts, government workers and interested citizens, in a collaborative environment to apply government open data in developing software applications that address issues of shared civic importance. Building on the Johnson and Robinson (2014) framework for understanding the civic hackathon phenomenon, Canadian municipal staff with civic hackathon experience were interviewed about their motivations for and benefits derived from participation in these events. Two broad themes emerged from these interviews. First, through the development of prototypical apps using municipal open data and other data sets, civic hackathons help put open data into public use. Second, civic hackathons provide government staff with valuable feedback about municipal open data sets informing and evolving future open data releases. This paper concludes with reflections for urban planners about how civic hackathons might be used in their practice and with recommendations for municipal staff considering using civic hackathons to add value to municipal open data.

       Summary. Robinson and Johnson (2016) contend that the adoption of open data civic hackathons provides opportunities for municipal staff and the public to engage in discussions about what information the general public wants to see from open data models. As a municipality's data model matures, these events could extend to other types of events where the data are explored and discussed. One issue that the study brings up pertains to how this particular movement by local governments could be construed as a backdoor form of application procurement that excludes vendors who normally charge for these services. This study is very relevant as it highlights the public's interest in and needs for the publishing of open data models. The authors note the best practice of engaging municipal staff in the development and understanding of the data and their use if the data are to be usable or meaningful.

Sieber, R. E., & Johnson, P. A. (2015, July). Civic open data at a crossroads: Dominant models

and current challenges. *Government Information Quarterly*. *32*(3), 308-315.

https://doi.org/10.1016/j.giq.2015.05.003

Abstract. As open data becomes more widely provided by government, it is important to

ask questions about the future possibilities and forms that government open data may take. We

present four models of open data as they relate to changing relations between citizens and

government. These models include; a status quo data over the wall form of government data

publishing, a form of code exchange, with government acting as an open data activist, open data

as a civic issue tracker, and participatory open data. These models represent multiple end points

that can be currently viewed from the unfolding landscape of government open data. We

position open data at a crossroads, with significant concerns of the conflicting motivations

driving open data, the shifting role of government as a service provider, and the fragile nature of

open data within the government space. We emphasize that the future of open data will be

driven by the negotiation of the ethical-economic tension that exists between provisioning

governments, citizens, and private sector data users. We define four main models for how

government delivers open data; data over the wall, code exchange, civic issue tracker, and

participatory open data.

Summary. "Civic Open Data at a Crossroads: Dominant Models and Current Challenges

was written by Dr. Peter A. Johnson and Dr. Renee E. Sieber (2015). Sieber is an associate

professor in the Department of Geography and School of the Environment at McGill University

and specializes in the use of geospatial technologies for public participation. Dr. Johnson is an

assistant professor in the Department of Geography and Environmental Management at the

University of Waterloo. Dr. Johnson's expertise is in the use and evaluation of geospatial

technologies, open data, mobile devices, and other technologies. The article was published by *Government Information Quarterly*, which is a peer reviewed journal. In their paper, Johnson and Sieber (2015) describe the quickly evolving relationship between open data and the public. This relationship helps the private sector look for opportunities to privatize or increase efficiency through public and private partnership by sharing data. The authors note that this could cause issues with the prioritization of data for economic benefit instead of social benefit. However, many of the current municipal open data models are merely set up in a way that only allows citizens to view data as an end-point and not in a way that would allow for interaction or use of the data to dig deeper to ask questions. This study is useful for this annotated bibliography because it shows that municipalities should consider partnering or subcontracting with external entities to publish and manage data.

Yavuz, N., & Welch, E. W. (2014, October). Factors affecting openness of local government

websites: Examining the differences across planning, finance and police departments. *Government Information Quarterly, 31*(4), 574-583.

https://doi.org/10.1016/j.giq.2014.07.004

Abstract. The use of information and communication technologies (ICTs) in public organizations increasingly holds the potential to improve transparency, accountability, and public participation, by providing a more effective and efficient disclosure of information to the citizens and organizations and by providing channels for interaction with the government. While transparency and interactivity features of government websites constitute two critical elements for public participation and democracy facilitated by web-based technologies, little research has been done to explain why some public organizations choose to deploy website technology more openly with these features. This paper aims to examine the managerial, organizational, and

environmental factors that are related to variation in transparency and interactivity features of local government websites, which we believe are key dimensions to governmental website openness. The paper first develops a literature informed conceptual model of governmental website openness and then tests this model using data from a national survey of 850 government managers in 500 cities. The model results are compared across three different departments: community development, finance, and police department. Overall findings indicate that higher website openness is positively related to increased frequency of public participation in agency decision making and civil society influence, increased technical capacity, lower organizational control, and higher perceived usefulness of website technology. In addition, due to differences in the operating contexts of the departments, the effects of organizational control, technical capacity, environmental influences, and perceived usefulness of website technology on governmental website openness tend to differ by the type of department. City departments approach the utilization of website technology differently due to various internal and external factors. For management, there is clearly no one-size-fits all approach to affecting openness. Overall, website openness is positively related to increased civil society influence Website openness is positively related to perceived usefulness and technical capacity. Website openness is negatively related to organizational control.

   Summary. "Factors Affecting Openness of Local Government Websites: Examining the Differences Across Planning, Finance and Police Departments" is a peer reviewed journal article by Yavuz and Welch (2014) which looks at variables affecting how data are published on municipal websites. Yavuz received a Ph.D. in Public Administration from the University of Illinois at Chicago (UIC) and is currently an assistant professor at the Middle East Technical University in Turkey. Welch also received a Ph.D. in Public Administration from Syracuse

University and is a professor at Arizona State University. The Yavuz and Welch (2014) study looks at the factors that explain why there is no standard of publishing data for public consumption. What Yavuz and Welch (2014) uncovered is that organizational differences, organizational control, and technical capabilities all affect what data are pushed to a website and how the data are presented on the site; these factors then limit the usefulness of these sites.

Although meant for an academic audience, Yavuz and Welch's (2014) study is very relevant to this annotated bibliography because they look at local municipal open data sites while examining the perspectives of stakeholders such as community development departments and police departments. The differences in perspective that the authors found show that each stakeholder reacts differently to published data; therefore, strong management in data publishing is needed to meet external demand and internal dynamics. The strength of this article lies in the fact that the study looks more at organizational factors of the various municipal departments and less at data issues.

Conclusion

Throughout this annotated bibliography, various scholarly resources confirmed what the G8 Open Data Charter (2013) concluded: data at all levels of government are important assets that help engage and educate citizens. Additionally, these resources identify several specific best practices related to publishing data in order to promote transparency, accountability, and government efficiency (U.S. Open Data Action Plan, 2014). Heise and Naumann (2012) noted that it is a false assumption that a municipality can just publish government data that will be used to create transparency and meaningful decisions internally by staff or externally by citizens. Based on the qualitative and quantitative research studies presented in this annotated bibliography, it is possible to identify several best practices or strategies in the creation of municipal open data models. These best practices include management and cultivation of the data, formatting data so it can be consumed, and the inclusion of public input and help.

Management of Data by the Municipality

Lee, Almirall, and Wareham (2016) found that successful open data initiatives incorporate successful management of the data repositories. One of the first areas on which a municipality should focus its strategy is the approach taken to manage the data and the structure needed to maintain the data (Janssen et al., 2012). A key finding from Conradie and Choenni (2014) and Heise and Naumann (2012) is that in order to properly implement an open data model the municipality must have a comprehensive data policy that considers multiple viewpoints, a well-defined governance structure, and a team that can maintain and understand the data. Multiple experts recommend that municipalities consider the viewpoints of both the municipality and the citizen when structuring open data models and managing the data (Yavuz & Welch, 2014; Zuiderwijk & Janssen, 2014). Zuiderwijk and Janssen (2014) note that the policies needed

to govern data are primarily designed with the municipalities' point of view in mind and not from the citizens' or end users' points of view.

Once the database design is determined, the raw data oftentimes must be cleansed to be useful; Janssen et al. (2012) note that "[s]ource data can often not immediately be used; quality assessment and the modification and processing of raw data might be needed first" (p. 256). Conradie and Choenni (2014) note that many municipalities do not fully understand who the owners of the data are and do not have priorities for which data should be published first. Heise and Naumann (2012) wrote that for a municipality to create meaningful insights they must have a database administrator who understands "the technical, structural, and semantic heterogeneity of the data" (p. 1).

Lastly, Veljković, Bogdanović-Dinić, and Stoimenov (2014), note that an open data model must be graded to understand how effective the data model is at providing useful data. Susha, Zuiderwijk, Janssen, and Grönlund (2015) also confirmed that open data model effectiveness is important when managing open data platforms; therefore, each data model should be measured using specific tools and metrics.

Importance of Data Formatting

Kassen (2013) asserts that a municipality must understand that just publishing data for machine consumption is not enough; it must choose data formats that help the community understand the data. Evans and Campos (2013) came to the similar conclusion that if a municipality releases data without providing background on why and how the data are created, the organizational structure of the data, and the data's intended use, citizens will have a hard time determining if the data are relevant and reliable. These findings show that the team that manages

the data must format it so that the data can be turned into knowledge (Conradie & Choenni, 2014).

Civic Participation

Once data are published in a meaningful manner, it is important for that municipality to elicit feedback from the public, as Barns (2016) posits that the role of an agency is changing from a data provider or conveyer to a data collaborator. When determining causes of the failure of their original open data model project of 2017, the City of Boulder officials identified not engaging the public before publishing data as one of the critical issues (2017). This theme was repeated multiple times in the scholarly literature; Sieber and Johnson (2015) stated that public participation is ever evolving and a municipality must therefore try to maintain a connection with the public during open data model projects.

Additionally, Sangiambut and Sieber (2016) concluded that the public can help in establishing how data are used or by augmenting the open data model with private data (2016). Lee et al. (2016) even recommend the use of crowd sourced content in open data initiatives. Robinson and Johnson (2016) note that municipalities can make the data within the data models more meaningful by encouraging and engaging the public to help develop tools to explore or visualize data. Robinson and Johnson (2016) added that these types of engagements help the public understand the data through staff involvement while the staff gets useful feedback on what data are wanted.

Lee et al. (2016) note that any applications developed by third parties that leverage the open data models may have issues if not maintained, and that these issues are challenging to discover due to the vastness of application stores. These findings show that municipalities embarking upon open data projects that include third-party applications must elicit feedback

from the public, help the public understand the data, and remind the public where or how to access the third-party applications (Lee, Almirall, & Wareham, 2016).

Recommendations for Further Research

While the body of research presented in this annotated bibliography provides several best practices that municipalities can use when creating an open data model, there is more research that can be done to examine other factors and create more knowledge in this area. A recommendation for further research to identify additional specific strategies is to investigate the standardization of data across regional municipalities. This standardization of data could allow for regional data governance and sharing of data among several parties. The goal when standardizing data sets is to enable businesses and the public to compare policies associated with the data to see which are the most effective.

Summary

This annotated bibliography creates a core list of timely and relevant research that details best practices when creating open data models. By following these strategies, a municipality stands a better chance of creating a data model that increases transparency, accountability, and efficiency. As the City of Boulder (2017) experienced, implementing an open data model can be challenging, and enabling a successful implementation is especially important as jurisdictions face funding constraints. Best practices a municipality can adopt that foster success in open data model initiatives include incorporating strong data management and policies, presenting data in formats that are useful and meaningful for the public, and finally including public feedback to identify gaps in how the data are gathered and presented.

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