Open data outcomes: U.S. cities between product and process innovation

Ines Mergel[a], Alexander Kleibrink[b,*], Jens Sörvik[b]

[a] *University of Konstanz, Germany*
[b] *European Commission, Joint Research Centre, Spain*

ABSTRACT

U.S. cities, among the vanguards of open data globally, are investing in renewed efforts to support Open Government with the creation of open data portals that are used to provide machine-readable administratively collected data sets. Transparency of the public sector is still widely seen as the main outcome of these efforts. Such a simplistic view, however, misses the rich variety of innovations resulting from open data use. We conceptualize these innovation outcomes across two dimensions: internal/external and product/process. Interviews with 15 city managers in the U.S. who are responsible for the implementation of open data policies were conducted to compare policy intentions, perceived innovation outcomes as well as actual ones. The findings show that product-centric outcomes are predominant and relate mainly to external innovation, including applications, websites and new services. Process-centric outcomes constitute rather internal innovation, such as procedural changes and the revival of innovation culture in government. We close with a set of recommendations for open data efforts in government that include structural, procedural, as well as cultural changes for successful open data initiatives.

1. Introduction

Cities are investing in Open Government activities and focus specifically on open data portals that are used to provide machine-readable administratively collected data sets (Thorsby, Stowers, Wolslegel, & Tumbuan, 2017). Open data portals are online platforms that provide central and transparent access to government open data (Ruijer, Grimmelikhuijsen, & Meijer, 2017). These portals are accompanied by specific Open Government policies that define the issue, set responsibilities for compilation and publication of data sets, but also oftentimes include steps on how to engage the public to encourage reuse of open data. Common arguments in favor of open data portals are transparency and increased efficiency through reuse of data (Fung, 2013; Lourenço, 2015). However, these are only two indicators of innovation outcomes. As will be further outlined in this article, open data portals can have further effects on innovation, both internally on how government organize its processes (e.g. increased collaboration among departments), interact with actors to solve societal challenges (e.g. managing garbage) and stimulate innovation among external firms and organizations (e.g. enhanced restaurant recommendation services). This article sets out to answer two related research questions: if and how publicly initiated open data platforms trigger innovation inside and outside public administrations, and if so, what kind of innovations?

The existing literature on open data in government shows that there are a series of myths about the perceived impact on citizen engagement and participation, but at the same time highlights the many seemingly unsolvable barriers for government to release their data and for citizens or other stakeholders to reuse it in meaningful ways (see, for example, Conradie & Choenni, 2014; Janssen, Charalabidis, & Zuiderwijk, 2012). Implicitly, many open data initiatives assume that publishing data will result in new and innovative applications. As an example, the case described by Kassen (2013) shows how the City of Chicago aims to increase citizen engagement through its open data platform. However, there are few systematic studies of innovation outcomes that can be found in the literature so far (Janssen et al., 2012; Zuiderwijk, Janssen, & Davis, 2014).

To bring some clarity to the current approaches and especially a systematic view of the innovation outcomes of open data approaches, we employ a two-step empirical analysis. First, we review and synthesize open data policies and their expected innovation outcomes to extract their formal implementation requirements. Second, we present the results of interviews with public managers in U.S. cities in charge of implementation to understand the challenges and their perceived innovation outcomes as results of the actual execution.

We close with a set of recommendations for future open data efforts

---

* Corresponding author.
E-mail address: Alexander.KLEIBRINK@ec.europa.eu (A. Kleibrink).

in government that include structural, procedural, as well as cultural changes for successful open data initiatives.

2. Open data and innovation outcomes: linking the internal and external dimensions

Historically, the public sector has been central for generating and collecting large sets of data. Data range from land use, taxation, traffic, weather, tourist information, official statistics, business registers, public sector budgeting and performance, to all kinds of information about policies and their outputs (K. Janssen, 2011). Since its beginnings, open data activists and scholars have been focusing on increasing the supply of open data, i.e. making ever more state-held data sets available in an easily accessible way at no cost. This explains why we know a lot by now about the number of available data sets and downloads. Yet, only recently scholarship and practitioners have turned to questions of the actual impact open data has triggered (Worthy, 2015; Zuiderwijk & Janssen, 2014). Questions of impact or outcomes have often been equated with 'innovation', stressing the novelty of products and services associated with the re-use of open data (Worthy, 2015).

Conceptually, however, this debate has not been clear cut. Studies on business models for open data used typologies that mix public and private innovations without distinguishing between types of innovations (Zuiderwijk & Janssen, 2014). Other scholars were interested in the democratic implications of open data for citizens, suggesting to measure outcomes along dimensions like accountability, transparency, deliberation and participation, which partly overlap and are difficult to measure in practice (Bertot, Jaeger, & Grimes, 2010; Harrison & Sayogo, 2014; Margetts, 2006; Ruijer, Grimmelikhuijsen, & Meijer, 2017). Another branch of research examined how clearly specified citizen and user requirements and quality assurance can feed into the better design of Open Government platforms to tackle societal issues (Lourenço, 2015; Ruijer et al., 2017). Somewhat paradoxically, open data policies appear to have shifted focus away from their original accountability rationales toward questions of commercial effects stemming from the analysis of inter-linked data. Only scattered evidence exists on the impact of these efforts and to what extent the availability of ICT-based solutions more broadly has actually created change (Ubaldi, 2013). Yet studying these external outcomes is still obstructed by a lack of coherent conceptualization and measurement. We know much more about the antecedents and triggers of public sector innovation, less so about the innovations themselves (Walker, 2014). This article addresses this by structuring different innovation outcomes of open data portals according to standard innovation categories of process and product innovations that happens internally or externally to the government.

Innovation outcomes can be defined along the lines of the standard OECD and Eurostat definition of innovation, namely as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (OECD & Eurostat, 2005:46). However, what a product innovation is for one organization may be a process innovation for another. These innovations can be new to an organization, new to the market or new to the world. To simplify matters, we distinguish two main types of innovation outcomes as established by innovation scholars: products and processes (Schumpeter, 1961; Utterback & Abernathy, 1975). Process innovation includes for example new ways of manufacturing, new business models or new ways of interacting in value chains; product innovation, on the other hand, leads to new goods and services (Schumpeter, 1961; Tidd, Bessant, & Pavitt, 2016; Utterback, 1994).

In this article, we integrate concepts from innovation management literature and how public processes of open data can affect internal processes and product innovation, with concepts more originating in the innovation studies literature, which explores the effects public action can have on other actors in the system, i.e. external innovation

outcomes (Fagerberg, Mowery, & Nelson, 2005).

How do product and process innovations trigger broader change inside governments and in broader society? Most process innovations are about new internal ways of reusing data, measuring public sector performance or improving internal routines. In other words, they are rather about internal innovation outcomes. Yet, there can also be external process innovations, wen open data facilitates new forms of user-producer relationship between government and external suppliers. Most product innovations, on the other hand, are about external innovation outcomes. Open data published by governments can trigger new services and products. In this dimension there are also exceptions, as there are internal product innovations, e.g. new apps or portals used for internal purposes such as visualizing data. In the following, we discuss both dimensions in greater detail.

2.1. Internal dimension: public sector process innovation

Huijboom and Van den Broek (2011:9) rightly stated that, "whereas the drivers [of open data] lie predominantly outside government, the barriers are within government organizations." Open data policies are often seen as means to increase public sector efficiency by reusing same or similar data, reducing needs to recreate data and identifying new ways of organizing activities that can reduce work. As an example, the British Government Digital Service, now widely acclaimed for its comprehensive data.gov.uk portal, was originally established to enhance internal coordination processes. Indeed, public administration can achieve efficiency gains by better sharing data internally and across units and agencies. Process innovation is a key component of these efficiency gains, since it can change management structures and relations in terms of both technology and organization (Damanpour & Gopalakrishnan, 2001; Edquist, Hommen, & McKelvey, 2001; Walker, 2014). At the same time, it is not only the resources of an organization or its absorptive capacity (Cohen & Levinthal, 1990), i.e. the capabilities of an organization's staff, that influence its possibilities to change behavior and diffuse innovation; just as important is the internal organization, its culture, norms and procedures (Rogers, 2003; Tidd et al., 2016). Also, the interaction with external parties, such as customers, users and suppliers and their feedback have an impact on the development of innovations (Kline & Rosenberg, 1986; Nooteboom, 2000).

Open data policies can have important implications for internal processes, but just as well for external dimensions and the interplay between the sides. Opening up public data has been heralded as a new and improved way of addressing societal challenges (Ojo, Mergel, Janssen, & Zuiderwijk, 2015). Having more data available will help discover new and innovative solutions to the most pressing public needs. Through collaboration between public sector employees and external stakeholders, more resources and views are available to identify and solve problems (Janssen et al., 2012). The "wisdom of the crowds" brings more views on how to solve public issues, which improves the problem-solving capacity for complex issues and can lead to solutions previously not foreseen within administrations (Arzberger et al., 2006; Surowiecki, 2004). This is in line with a general trend also in the private sector of acknowledging that no organization alone has all resources and solutions in-house. Rather, collaboration across subsystems through open innovation is necessary to tap all relevant resources and better understand user needs (Chesbrough, 2003; Pfeffer & Salancik, 2003; Von Hippel, 2006). Areas of such collaboration include health, environmental issues, transport, land use and climate change.

With more data available, one of the greatest implementation issues could be removed and that is the reluctance of civil servants to embrace these policies and new solutions. In many administrations a closed culture prevails. Managers are afraid to disclose public data that can indicate possible failures or inefficiencies because of their potential for political escalation (Huijboom & Van den Broek, 2011). Orlikowski (2000) argues that technology development is heavily influenced by

human agency, with institutions both enabling and constraining the adoption of open data policies. On the other hand, institutional theory indicates that implementation of information technologies has had a tendency to rather reinforce current organizational structures rather than challenge and change them. Open data practices require new steering mechanisms to succeed, since traditional control mechanisms cannot be used in an open environment. Public administrations are by definition risk averse and care more about stability and public accountability at the expense of entrepreneurial thinking. New initiatives run the risk of being used for enforcing existing (power) structures, rather than enabling innovation (Janssen et al., 2012).

2.2. External dimension: economic growth and new products through innovations

By definition, open data is first and foremost about opening up data that is internally held by the public sector for external use, be it to citizens, journalists, start-up firms or other entities. Innovation scholars stress that innovation does not come about in isolation, but through the interaction between persons, within and between firms, and between firms and knowledge organizations such as universities and research institutes, including also public sector agents (Edquist et al., 2001; Freeman, 1987; Lundvall, 1992; Nelson, 1993). To understand innovation outcomes, one needs to explore how these interactions take place both within and across organizations. Institutional rules, norms and conventions evolve in tandem with organizational structures (Hollingsworth, 2000; North, 1993). Fiscal, political, judicial and other regulatory norms limit and shape the culture and structure of organizational behavior.

Innovation policy literature explores interventions that public agents undertake to enhance competitiveness and innovativeness of agents within the policy constituency. Such measures include research funding, subsidies, procurement, test labs, linking of actors, etc., in order to solve societal challenges (Ergas, 1986; Mazzucato, 2013), overcome market failures, generate new knowledge and ideas that later can become innovations, better connect actors, enhance functionalities in the innovation system or overcome path dependencies (Edler & Fagerberg, 2017). The external dimension of open data policy shares many of these objectives with innovation policy, in that it can stimulate the provision of new products and services, better link actors that can together create new solutions, provide data for new knowledge that eventually can become innovations, or bring in new solutions and perspectives to solve societal challenges.

If open data truly is an essential raw material, it can be the basis for many product and process innovations that will grow new companies and employment opportunities. Patient data, for example, has been used to develop new drugs in the pharmaceutical industry. Other important areas with public data include population statistics, weather data, transport, energy consumption, geographical information, data from publicly funded research projects and digitized books from libraries (European Commission, 2011). In addition, many cities are creating co-working spaces or create innovation laboratories to encourage, among other activities, the co-design or reuse of open data and other Open Government initiatives (Magadley & Birdi, 2009; Tõnurist, Kattel, & Lember, 2017).

The British and the Danish governments, for example, expect open data to lead to new services (Dunleavy & Margetts, 2015; Huijboom & Van den Broek, 2011). The key motivation of the Danish Ministry of Science, Technology and Innovation to support open data is the expectation that "ICT companies will be able to create new business in developing digital services and advanced content based on public data, and citizens can convert ideas and creativity into practical solutions to everyday problems" (Huijboom & Van den Broek, 2011:3).

However, research has shown that, without creating demand for open data, the barriers for reuse are too high, so that citizens and other stakeholders are less likely to use open data (Martin, 2014). A number
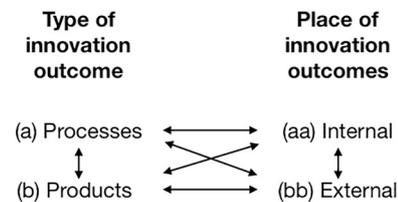

Fig. 1. Interactions between product and process innovations within and outside government.

of approaches have been applied to increase use and demand for open data portals, such as conferences, workshops, competitions, app contests, and other forms of active encouragement of data reuse in line with citizen needs (Gibbs, Kraemer, & Dedrick, 2003).

Few studies measure the actual impact of such policies on economic growth (for an exception, see, Gurin, 2014). Many governments refer to consultancy reports that estimate the potential value of these efforts. Danish authorities refer to a Gartner study that estimates open data policies could stimulate new services up to a value of 96.5 million USD and conducted their own geo and open data impact studies (PWC, 2017). Other influential studies include the PIRA (2000) (Commercial exploitation of Europe's public sector information) and Measuring European Public Sector Information Resources studies commissioned by the European Commission that price the economic value of public sector information at 896 billion USD in the U.S. and 81.3 billion USD in Europe (Dekkers, Polman, te Velde, & de Vries, 2006; European Commission, 2000; Vickery, 2011). In terms of open data sources, geo-positioning and weather data alone are said to amount to more than 120 billion USD in the U.S. (Gurin, 2014). Still, these studies indicate the high potential of open data in general.

From the discussion so far, a complex web of possible linkages between process and product innovations inside and outside government emerge. Fig. 1 depicts how in this matrix all elements can be related to one another. However, in practice obviously some relations are more likely to emerge than others. In the remainder of this article, we present novel data derived from an analysis of Open Government polices to identify the most prevalent types and locations of innovation outcomes in U.S. cities.

3. Data collection and analysis

In order to understand how open data policies and open data portals are linked with innovation in and outside of government, we selected cities as our focus, as they have been described as laboratories of democracy (Tarr, 2001). The data collection and analysis proceeded in two steps. First, 290 U.S. cities were selected as the unit of analysis and their websites were searched for open data policies and open data portals. This yielded a selection of 27 cities with both an open data policy and an open data portal, most of them with over 500,000 citizens. The selection shows that, cities with mid-size to large numbers of citizens are more likely to be financially viable and can invest in open data platforms (Thorsby et al., 2017). Other – smaller – cities might also provide what can be considered open data. However, they do this in a selective fashion, hidden as part of an individual department, on Excel spreadsheets, pdf files, or for selected activities (such as links to the last three years of building permit applications). Those cities howeuver have not consolidated their open data activities in a central portal.

Using Zuiderwijk's and Janssen's (2014) framework, we first analyzed open data policies based on their policy content and as a form of formally articulated intent of open data outcomes (see appendix A for the list of open data platforms and policies). Open data policies serve as instructions for the implementation of open data portals and as a framework in which city managers can use their bureaucratic discretion to implement additional services or build initiatives. In the first round of coding, we conducted a round of closed coding – focusing only on the

Table 1
Key rationales articulated in city and state open data policies.

Rationale of open data initiative	Number of times mentioned in city open data policies
Transparency, openness, accountability, trust	11
Access to data	8
Improve efficiency, decision making	6
Improve economic development	5
Improve participation & civic engagement	5
Improve collaboration	4
Increase (civic) innovation	4
Improve (online) service delivery	2
Create data-driven ecosystem	1
Fulfill citizen needs	1

categories "policy content" and "formally articulated intent" deducted from the literature (Corbin & Strauss, 2008; Strauss & Corbin, 1997). In the second – open – coding round, the policies were then inductively coded for any emerging codes. These open codes represent the ways that content and intent were operationalized in each of the cities' policies and are listed in Table 1 in the findings sections.

From those cities with an open data policy and an open data platform, a total of 15 city managers in charge of the implementation and management agreed to participate in qualitative semi-structured interviews (Kvale & Brinkmann, 2009). Questions for the interviews were derived from existing theories of open data and the results of the document analysis of the open data strategies and open data portals (Fereday & Muir-Cochrane, 2006). The interview outline – listed in Appendix B – focused on the history of development of policies and portals, drivers and barriers, measurable outcomes as well as perceived outcomes. The interviews were recorded with the permission of the interviewees, transcribed, and hand-coded line-by-line to identify emerging themes, the previously derived closed codes and any emergent topics that were raised in addition to the initial set of codes (Aronson, 1995; Strauss & Corbin, 1997). The resulting themes – perceived innovation outcomes – were compared to formal intent in an interpretative approach to describe and explain the outcomes of open data.

4. Findings

We organize the findings along the two data collection steps. First, we briefly discuss the formally declared rationales of having open data policies. In a second step, we present the findings from interviews and desk research on engagement instruments (Huijboom & Van den Broek, 2011) and innovation outcomes through process and products inside and outside governments. Internal innovations include improved internal data reuse, measuring government's internal performance, creating organizational design that support an internal open data culture, and creating a collaborative culture with users of open data. External innovations include product innovations and economic development innovations, which cater more to external audiences than internal government needs. Our document analysis of existing open data policies reveals key motivations for adopting open data initiatives and engagement instruments to foster the reuse of open data.

In the 15 reviewed city open data policies, the main rationales for open data include increased transparency, openness, accountability, and trust (11 times mentioned in city open data policies) through improved access to data (8). City policies have the objective to enhance efficiency of operations through improved (data-driven) decision making (6), economic development (5), improved collaboration (4), and participation (4).

4.1. Internal open data innovations

Despite that as one respondent stated, "*there is a general understanding that open data is just something that is used on the outside rather than something that's been realized inside,*" internal innovations are at least as important as external ones since they are a precondition for changing the organizational culture of government. Publishing open data creates a direct accountability link to those departments in government that are producing the data (which refers to the quality of data), but also those departments that are responsible for the transactions that accumulate the data published on an open data portal. As one public manager stated: "*… by putting your data out there, city employees know that the data that they are working with to run the government is out there for all eyes to see, they are more cognizant of it.*" Open data has therefore the potential to increase awareness, ethical considerations, and as a result improve good government practices. An example for increased awareness and accountability are campaign finance reports that are usually only reviewed by civil servants. With open data, public managers need to explain decisions about campaign finance data, so that the public understands why it is compiled in a certain way. One public manager points out a problem: "*People are probably more likely to leave something out, or put something on there that's surprising; a donation from an opponent, those kinds of things that would be shocking if the public found out.*" Publishing campaign finance data increases the potential for journalists to review the data and ask critical questions. As a result, civil servants become more conscious about the publicness of their choices and decisions and it might contribute to increased accountability.

In addition to increased accountability, there is also a shift in viewing open data as an asset. Similar to the statements in former President Obama's Open Government memo (Obama, 2009), data are seen as a national asset. In Philadelphia, the chief data officer (CDO) explains that data should be regarded as a public good, but not for one single purpose. Instead, he points out that data needs to create value as part of the cultural change in government: "*Creating more reusability, recognizing that a map or that data of the streets that you created could also serve for routing fire trucks in a completely different department.*" By creating a new resource for all of government to use, data can be reused across organizational silos in government and as a result makes government as a whole work more effectively and efficiently. When this cultural shift happens, it is also easier for civil servants to comply with existing freedom of information laws and begin to proactively release data before they are requested by the public.

4.1.1. Engagement instruments inside government

Open data reuse can be encouraged using different types of policy measures and instruments, among them communicative policy instruments, incentives, and multilateral instruments (Huijboom & Van den Broek, 2011). However, open data policies rarely include directions on how to engage stakeholders. The findings for the engagement instruments discussed in the next sections are therefore based on our interviews.

4.1.2. Education and information through marketing instruments

Many of the open data initiatives are still in their early exploration phases. Open data is overwhelmingly seen as an asset that is provided for use outside of government – as opposed to internal use. The educational and information instruments used therefore focus on making sure that external parties can reuse and situate open data in new contexts, easing thus availability and usability for citizens and professional stakeholders.

However, many of the innovation effects may be stronger internally than externally and serve both sides. There are a few examples of how open data policy serves both as a means to stimulate external innovation but also as a way for the city to improve communication and diffusion of information through new channels.

The City of San Francisco posts its restaurant inspections on the city website as open data and allows Yelp – a website that publishes crowdsourced reviews about local businesses – to combine these health scores with their restaurant scores and citizen reviews online.[1] Citizens can now see experiences others made in a restaurant combined with health and hygiene scores measured by the food inspection unit of the Department of Public Health. Authorities make public health data available where and when citizens need it. So far they would usually do this only on much less frequented government websites or through publicly displayed physical notices at restaurant. As one San Francisco public manager said in the interview: "*I call this an early benchmark, sort of one of the key stories that came out of the early part of our open data movement in San Francisco and it is an archetype for additional work.*"

This new form of informing and educating the public is also adopted by other cities such as New York City. Data is posted on the government's website in a format that makes it easy to reuse. This approach departs from the idea that citizens access this data on the government portal, since this rarely is their main access point. The portal or even government itself are not on citizens' radar screens unless they need to prepare an administrative act – on average this occurs 1.7 times per year. Engagement of citizens is therefore one of the complex if not wicked problems to solve.

In line with this approach are open data services that proactively deliver customized information to various stakeholders. Notifications and alerts that are sending out updated information to contractors are a good example. This allows businesses to comply with updated building regulations, improve safety, (re)apply for permits on time, and be aware of expiration dates of existing permits. As one public manager said: "*Most of the time the reason somebody's not paid attention was because they were not aware of the rules and regulations, not because they are bad actors. The information provision has been hugely impactful in terms of helping businesses out and relieving the regulatory burden.*"

Focus lies on those regulations and types of government data for which no bureaucratic discretion is needed, no wiggle-room for businesses to negotiate exceptions exists and every business owner must apply for the same permit. This is an example of a proactive service that government can provide by analyzing past transactions, combining them with updated regulations, and creating public value by communicating this information to government stakeholders.

The City of Los Angeles has created a competition to engage citizens in the use of open data from its GeoHub open data portal. The Los Angeles Bureau of Sanitation (LASAN) created a block-by-block cleanliness rating system based on video and pictures documenting illegal dumping, cleanliness, and waste sites. That data is mapped publicly on GeoHub (http://cleanstreetsla.com/cleanstat/) displaying the coded streets in colored lines according to their rating. Citizens can rate their streets rated "not clean," "somewhat clean," and "clean". The city partnered with non-profits in the neighborhoods to provide additional pick-up services, added 5,000 additional trash cans, and cracks down on illegal dumping to reduce the number of streets that were deemed "not clean". After a year, 80% of the streets that were initially rated "not clean" are now rated clean. In addition, citizens can compete in a contest to earn money for their own neighborhood improvements.

4.1.3. Internal promotion of open data success stories

Open data is for many civil servants and citizens an intangible concept to which they mostly connect through the display of data sets in Excel spreadsheets on open data platforms. It is therefore difficult to communicate the advantages and opportunities, or to gain buy-in from departments to provide their own data sets. Innovative public managers therefore emphasize the use of internal marketing and promotion instruments to gain attention and increase awareness.

A powerful instrument is the recognition of open data initiatives that have made a difference, such as internal change initiatives or civic innovations. As an example, the City of Los Angeles gives out the Mayor's civic innovation awards. Others use internal newsletters to highlight performance gains due to internal reuse of open data, with information about the initiatives provided in tangible, transparent, and understandable formats.

4.1.4. Process innovations through improved internal data reuse

Innovations related to internal open data reuse can be derived for example from the Open Government directive (Obama, 2009) that encourages the public sector to set up an easy access point to data that is already available somewhere in government but has not been made systematically available to the public and/or the government sector itself.

Open data can serve as an impactful internal information provider to a variety of departments that otherwise would not communicate or collaborate with each other by design. One public manager states: "*When open data is released to the public … it is also released to other government actors.*" This internal aspect of information sharing allows departments to pick up a data set posted on the open data portal without having to engage with other department heads. The internal operations aspect of data sharing is therefore focused on other government users as customers of open data initiatives. Government can increase their internal operation paradigm by providing data to each other as a reliable source of information. GeoHub from Los Angeles is a good example.

At the same time, many administrative acts are still paper-based in government, with little incentive to change as long as citizens are not complaining. In turn, this also means that data cannot be easily extracted or sorted to fix potential flaws of the system. In internal conversations about open data, departments put pressure on each other to make viable data available for internal reuse: "*The fire department needs to get all your permit data and what comes to light in those conversations is that the way we run permits, we put it on an Excel sheet and then we send it to the site. These processes come to light and that [the department] can't deliver. It then creates an incentive to modernize their system.*" Open data initiatives can therefore bring benefits to government operations that had little to do with necessary visibility or transparency of specific data sets demanded by the public.

4.1.5. Open data to measure government's own performance

Most open data initiatives are measuring their success of open data programs by displaying the number of data sets that were released. These numbers are prominently featured on the first page of the open data portals, such as on data.gov. However, these numbers do not reflect the quality of these data sets, their reusability, or the actual demand for them. Similarly, many governments are using PerformanceStat reports to show their initiatives' and programs' performances. These reports come in highly curated forms and are published in pdf format on the website.

The only open data portal that also includes information about the government's own performance is the Louisville, KY, open data portal, that has a section called "Open Performance". The page includes four data sets: i) absenteeism data highlighting the number of employees absent from work, ii) total hours worked, iii) number of high sick leave consumers, and iv) the number of employees who left government. While this is an interesting first step toward creating transparency about government's internal operation, the low number of indicators shows that, continuous performance measurement is still in its infancy.

The advanced open data initiatives mentioned in this article have reversed the notion of simply pushing out as many data sets as possible and started to measure the estimated demand fulfilled for each data release. These include for example targets to track the estimated impact of a data set release in addition to the number of datasets that are cataloged. These target numbers and categorization attempts are

---

[1] For a blog post explaining the collaboration between the mayor's office and Yelp, see: https://www.yelpblog.com/2013/01/introducing-lives

supporting strategic decisions and improve the process of data release. Departments can set up a process that combines indicators of public demand to prioritize and then track the use of prioritized datasets to understand what the impact of their open data initiative is. As a by-product, governments understand who the users are.

A major shift initiated through open data focuses on the internal innovation culture. However, so far there is little evidence that governments go beyond qualitative assessments, such as (self-)reflection on the availability, usefulness, and reuse of open data sets that could be easily gleaned from open data. A rigorous framework for assessment is lacking to evaluate government operations and show with what kind of input what kind of public value is created.

One public manager who reflects on the lack of evaluation of government's own data for internal purposes states: "*It's kind of evidenced in our current quarterly report, which right now is PDFs, but in the future they will actually be data and will be on the website. We want to know if open data actually helps folks enhance their internal work: how many apps are actually being fed by open data, what is the economic activity. All those sorts of questions that a lot of people ask, we want to make sure the apps are capturing.*" The initial questions that arise by reviewing apps and mashups can then lead to data-driven conversations around emerging examples.

The conversations mentioned in the quote above lead for example to thematic releases of data sets that include a product innovation, such as thematic websites or portals like the San Francisco Housing Data Hub.

On this thematic data hub, many different data sets collected by various departments for a variety of purposes are combined into a contextual website that shows how city policies affects housing affordability in San Francisco. Interested parties can identify all programs and related data using this portfolio approach. Different forms of visualization make it easy for both public servants and external users to generate insights. While this might not be an apparent innovation observable on the surface, it reflects an internal process innovation; challenges civil servants experience when they implement policies surface when they can reflect on the implementation goals in comparison to outcomes.

4.1.6. Organizational routine innovations

In the highly risk-averse environment of government, individual civil servant initiatives are restricted by the bureaucratic environment. Open Government strategies, however, have created possibilities to rethink the ways government innovates to improve service delivery.

A voluntary disclosure of open data leads to increases in effectiveness and efficiency of government operations. As one public manager notes his department was able to completely rework the process how his department's call centers were operating. At times of traditionally high demand, like the season of income tax declarations, more employees had to be hired. However, with the training of open data managers, civil servants not only looked at peaks in workload, but combined this data with other related information, such as sick time, breakdown of calls, time of day and languages used: "*We worked with their systems group and their front counter and started sharing some of that information. They changed their theory of call centers to change the command site, the type of calls, and went online to change some of their forms. They changed their response time from two weeks to 24 hours. A dramatic, dramatic service improvement.*"

Open data initiatives then incrementally change organizational innovation culture: Some cities, like the City of Philadelphia, recruited a chief information officer (CIO) who has been collaborating with the CDO to encourage innovation from where it originates instead of only developing new solutions within one specific innovation department. They have also trained staff together with Philadelphia University to become '*deputized as innovators*' and support them to try novel approaches.

4.1.7. Opening government with open innovation approaches

Another internal change occurs when government opens itself up to include knowledge from its stakeholders to improve government operations, even beyond those interactions required by law or other regulations.

Stakeholders include for example neighborhood groups to understand how communities are interacting with data and how these interactions might create change. As an example, campaign finance data sets are published on the government website, which is reused by citizen groups (e.g., Open San Francisco) to visualize the data in an easily digestible format. The visualizer shows where the money goes and who receives campaign finances. Initially, demand for better data increased. Several cities in California worked on similar problems simultaneously and citizens built a community around these complex problems across city boundaries. For government, the initial idea was to provide open data passively and let interested stakeholders reuse the data, which then can evolve into a change in the relationship between government and its stakeholders. As one public manager mentioned, this passive approach is not sufficient: "*We need to help citizens move from information to empowerment.*" Open data has emboldened neighborhood groups to now ask for data in reusable formats and advocate for improved policies.

A new form of collaborative innovation culture with civil society occurs when citizens are reusing open data. Many cities and states are teaming up with local brigades of Code for America. Governments are using the interactions with civic hackers to understand what the most important data is and learn from them in a user-centered approach to change how government needs to think about open data. As one public manager explains: "*I go to hack night every Wednesday. We are there essentially to provide insight and support around our open data and also to better understand where the emerging priorities around data are. We are not done. We have got a lot more data to publish.*"

Government oftentimes takes a passive approach to open data – release the data and waits for what happens. In NYC, students were using open data in a class project and analyzed the number of parking tickets issued around the city. They focused on outliers – parking spots that earned over $20,000 in tickets. It turned out that citizens did not pay, because the parking signs were misleadingly placed. This was an unintended result of open data use and led to changed operations. The city painted new parking signs on the streets so that fire hydrants were no blocked by parked cars.

In addition to these 'professional' reusers of open data, many cities are also collaborating with media and journalists who are interested in data analysis instead of building their own apps. The goal is to build trust and openness through proactive and transparent data sharing. As one chief data scientists explains: "*We have strived to change the traditional or adversarial role with the press by becoming their partner with the usage of data. The press does not necessarily understand some of the data that is presented and we help provide context.*" As an example, the San Diego Association of Governments' nine police departments are submitting their data about crime reports to a shared database. Journalists, for example from the Union-Tribune, are then mashing the data with a Google map and show arson cases, crimes against children, elder abuse, murder or rape.[2]

4.2. External open data innovations

Most of the open data innovations are focused on engaging external reuse of open data. The product innovations observed in these cases are built for example by civic hacker groups to fill some light-weight citizen needs, but also some enhanced services, like yelp. There are also

---

[2] See, for example, The San Diego Union-Tribune (http://www.sandiegouniontribune.com/news/public-safety/sd-me-sd-crime-summary-20170517-story.html)

external process innovations like businesses using open data to generate new business leads. The innovations mentioned here would not have been possible without the release of open data.

Many respondents highlight the need to engage with external actors in new and elaborated ways for benefits of open data policies to materialize. Simply posting data sets online does not lead to innovation.

4.2.1. Engagement strategies: competitions, app contests, hackathons, camps

The engagement instruments to gain external attention for open data include hackathons, co-working spaces, digital town halls, and source code sharing on GitHub, so that others can reuse software code. Hackathons are first of all means to generate new products. At the same time, the mere fact of having a hackathon can increase participation, collaboration and transparency.

Internal process and performance management outcomes are related to these new structural forms of interactions, but they have also generated a shift in the internal culture in government with regard to collaborative innovation. Following national initiatives, such as the National Civic Day of Hacking, local and regional initiatives replicate similar hacking days either weekly or monthly. Most of the time these events are either tied to a specific data set or to an urgent issue government needs to address. As one public manager states: "*We have summer-long competitions where we challenge people in three key areas: water, transportation, and immigration. It provides a big stage for people who do good stuff with open data and get recognition for it.*" The issues or key topics to focus on are in some cases derived from focus group events and conversations with stakeholders inside and outside of government to figure out the key priority areas that line up with the leadership's priorities but also with more static department areas.

As an example, Kansas City has created the Mayor's Cabinet Challenge directed at young professionals who want to serve on various taskforces to study and create solutions on topics such as innovation, open data, technology, and community engagement. This active outreach mechanism is aimed at increasing talent inside of government, but also serves as a marketing instrument.

4.2.2. Product and service innovations outside government

Product-centric innovations usually occur with the user in mind. One aspect is that government allows its users to shape, share and consume information in innovative ways. Among these product-centric outcomes are open data products that have been known for quite some time, e.g. apps, mashed-up maps, new forms of notifications, such as 311 (non-emergency city service phone number), or websites. An important example includes applications that promote transparency, like City of Chicago's Board of Ethics that is used by the website ChicagoLobbyists.org to display which lobbyists have paid to which clients.[3] This is similar to the previously mentioned example of Yelp, where a commercial platform can enhance its services and their value to customers by adding in this case health and hygiene scores measured by the food inspection unit.

These product-centric innovations are outcomes of engagement instruments that focus on external innovations in form of new partnerships, the engagement of stakeholder groups beyond letting them build apps. As one public manager notes: "… *it's not necessarily about the app per se. It's more about the way that folks are interacting with government and are taking a renewed interest.*"

4.2.3. Process innovations outside government

Open data policy does not only have an impact on products and service innovations externally, but also on process innovations outside government. In Philadelphia, users of two different open data sets created economic opportunities for themselves. They combined data on

property maintenance violations with data on historic buildings, filtered for broken windows to generate leads for business opportunities and contacted the owner of historic buildings who are required to fix them.

As another example, the City of San Francisco has used open data as a marketing instrument and learned how to push data out in formats that are easily reusable by business or citizens. Their corporate partner Socrata has helped set a standard and others in the ecosystem around the open data platform have slowly adopted the same standard. Through this push/pull strategy of opening data the city has created demand and supports external innovation beyond their own data platform.

4.2.4. Start-ups and innovation support systems

The evidence that companies create jobs because of open data is of mostly anecdotal nature. There is evidence, however, that open data in conjunction with other innovation support efforts has created an ecosystem of co-working spaces and by extension related start-ups that are using these spaces to generate new products and services. Some existing firms might leverage open data to generate more activity which in turn leads to new jobs. One specific company was created in Washington, DC, called *1776.vc.*, and focuses on civic technology start-ups to identify how to use technology and data.

There are also a number of firms that have been created based on government collaboration with the civic hacking non-profit group Code for America[4] in organizing hackathons. As one public manager notes: "*We did a couple of measures and metrics on that. Anecdotally, we can say we had a number of new firms created in the two or three years, a lot of them coming out of the Code for America hub.*"

These economic activities cannot be directly derived from the use of open data, but as one public manager notes: "*Basically pulling out some sort of notion of how we help cities manage requests for public information…. They are trying to sell to cities to help them managing and starting a virtual cycle.*"

Another driver comes from the requests or the anticipation of start-ups for government to publish new open data sets: "*Recently, we had a new start-up that wants to help build filters, navigate complaints against buildings that they manage. The city collects data on complaints. The company wants to help building owners make sure that they can track all these things and leverage the data the city has.*" These start-ups are anticipating data availability from government to generate a service or a product.

Some cities are choosing to collaborate with the private sector to create innovation labs, like the City of Boston that created an Innovation District. Others team up with universities to build on existing academic successes, such as the Harvard and Stanford Innovation Labs to create a win-win situation: academics get access to data from citizens, can run neutral focus groups, or foster start-ups and transfer knowledge from academia to business. Co-working spaces and innovation labs are bridging internal and external innovation with open data. Finally, a third option is to bridge internal and external innovations by creating innovation labs, like *San Francisco's SuperPublic lab* that brought together public, private, nonprofit, and academic sectors together to solve urban problems.[5]

Some cities have set up internal innovation funds, like Philadelphia's Innovation Fund. These are designed to support ideas that are coming out of the innovation labs.

---

[3] See, for example, Chicago Lobbyists (http://www.chicagolobbyists.org/)

[4] A network of volunteers that is mostly city-based and collaborates closely with government to improve data sets, but also to create prototypes of apps, mashups, or websites that can then be adopted or further developed by outside contractors.

[5] http://www.govtech.com/civic/San-Francisco-Opens-Superpublic-Innovation-Lab.html

Table 2
Summary of process/product & internal/external innovation outcomes.

	Process outcomes	Product outcomes
Internal	Internal procedural changes; Improved internal data reuse; Awareness for the quality and publicness of open data; Innovation culture in government	De-siloization through multi-purpose portals; Applications to analyze performance
External	Start-ups; Gaining new customers; Easier access to government resources	Applications; Websites; New services

4.2.5. Innovation outcomes: products or processes?

Product innovations include products or online services, such as apps or new websites combining different data sets that can either be innovative changes or iterations of already existing services. Process innovation outcomes, such as new forms of service delivery including internal procedural changes – are more difficult to trace because they are oftentimes not directly observable in the form of an actual product (see, for example, Damanpour & Gopalakrishnan, 2001). Not surprisingly given the nature of engagement instruments and the focus on external innovations for the public, the outcomes are overwhelmingly related to product innovations: 12 of the 15 cities use apps and one city sees utility infrastructure as a product innovation. The other observed outcomes focus on process innovation, but are only mentioned by individual cities for each of the following types of processes: process and performance management innovations, training and outreach, hackathons, innovation spaces and new partnership and innovation funds. Trained participants and users being made aware of new open data functionalities have critical multiplier potential to widen the use of open data and hence increase innovation outcomes.

Our conceptual discussion and findings are summarized in Table 2. Most of the possible innovation outcomes in our sample are process-oriented and take place inside government. There is scope for both new products and processes taking place outside governments.

4.3. Policy implications of our findings

While the findings presented are not generalizable due to the small sample size, the results point to three implications and ideas for future research and practice to improve open data engagements, policies and platforms that encourage innovation.

First, we need a better understanding of necessary structural changes. The main innovation instrument is apps, which is intended to achieve external innovation outcomes. However, there seem to be more repercussions on the internal side, in the preparation of delivering open data instruments. Therefore, governments need to consider how to 'institutionalize innovation' and move the responsibility for innovation away from political appointees such as mayors or governors to permanent staff and a permanent office of innovation. New positions such as a Chief Data or Chief Innovation Officer could serve this role, but also influencers who can demonstrate the value of open data initiatives and encourage innovations across departments. If the goal is to encourage synergies across data sets and enhance the impact data can have on effectiveness and efficiency in the public sector, governments may need to realize a stronger shift toward internal innovation by 'socializing' open data initiatives across departmental silos.

Secondly, procedural changes are critical to establish new routines and adjust existing ones. Open data needs to be managed so that it creates internal and external innovations with a clear link to public value creation to justify the expenses but also to increase the likelihood of success. In addition, advanced open data initiatives can contribute to other continuous performance improvements by combining outcomes with input. Results can include increases in efficiency, improvement of the quality of government services, and a replication of similar efforts across government departments. Public managers must understand the needs and opportunities of their stakeholders by developing a richer

conversation around open data. Building and sustaining open data initiatives can benefit from more agile and user-centric innovation approaches.

Finally, longer-term cultural change may indeed be necessary for open data initiatives and their outcomes to be sustained. Open data applied in a comparative manner can be used to analyze performance of public administration: internal procedures are usually a black box and the processes of how data is collected, cleaned, how decisions are made, especially after participatory processes, is unclear to the public. In addition, government's default should be to continuously communicate the clear link to value creation to ensure public support to these important initiatives.

5. Conclusions: moving toward innovation outcomes of open data

Open data policies and movements have mushroomed around the world. U.S. cities have invested massive efforts to publish open data and encourage private and civic actors to use Open Government data for innovative processes, products and services. Still we know very little about how best to conceptualize and measure such outcomes. In this article, we present novel insights from an analysis of interviews with public managers in U.S. cities responsible for the implementation of open data platforms. We show the multi-faceted nature of the identified outcomes that are triggered by open data. We find that the rationale of running open data initiatives is predominantly two-fold: on the one hand, ensuring transparency, openness, accountability and trust remain a prime reason to develop open data strategies. This is in line with the origins of the idea and the civic movement (M. A. Janssen et al., 2012; Zuiderwijk & Janssen, 2014). On the other hand, the qualitative interviews were necessary to understand that city managers see innovations through open data by improving internal efficiency and decision making as equally important drivers. Already now public managers employ a wide array of engagement instruments to reach out to relevant communities. They do this through marketing, competitions and by awarding success stories.

We used established typologies from innovation studies and were able to distinguish between process and product innovations outcomes that happen internal or external to the organization (Fagerberg et al., 2005; Utterback, 1994). The vast majority of U.S. cities included in our study engage in product innovations, only very few seek to intentionally develop internal process innovations. Most product-centric innovations, however, are outcomes of engagement instruments that focus on external innovations in form of new partnerships engaging stakeholder groups beyond letting them build apps. Product-based open data initiatives are thus often associated with external innovation and the creation of economic development opportunities.

Internal innovations, on the other hand, oftentimes materialize through new or improved processes and less so through new applications. By creating a new resource for all of government to use, openly available data becomes an asset and creates value across organizational silos in government and as a result makes government as a whole work more effectively and efficiently. At the same time, performance data is an important management tool for public managers. Once it is published, civil servants know that public scrutiny is higher and hence they are more likely to behave more accountably. Public managers who want to improve internal processes first reuse open data for better understanding their inner workings. Based on this they build higher quality performance data, which can also be published. In sum, these interrelated processes build the credibility of the concerned public-sector organization.

Our findings show the added value of employing a parsimonious typology of the different kinds of innovations open data initiatives can trigger. Government as a platform has emerged as a consulting or industry term that led to the notion of government only needing to publish data openly and citizens will immediately start to reuse it. However, it usually takes professionals with data science or

programming skills to use the API, program apps, or create mashups. In order to create public value, government needs to take on a proactive role and change to a "*government as service*" notion to actively promote data sets, engage civil society, and promote innovation through data from inside government. The most advanced open data initiatives are combining their efforts with government innovation labs that serve as fora to interact with multiple stakeholders, especially with academia. Here, the newest academic knowledge is tested and implemented in close to real time.

Our approach highlights the added value of tapping into the perceptions of public managers, since they provide important insights into the way those who are responsible to generate innovation through open data perceive the public value that they are creating. We have conducted our study in an environment that was driven toward open data and open data platforms through a policy initiative in the U.S. – former President Barack Obama's Open Government memo (2009). While many of these efforts were later translated into the Open Government Partnership (a coalition of countries making commitments to increase their Open Government activities), our findings are by no means representative of all open data efforts around the world. Instead they represent the current status quo among cities in the United States. Additional research is necessary to test our innovation framework for open data outcomes at a larger scale. Research in this direction will not only help us to better understand the many innovations Open Government data can trigger. It will also make a case for thinking about intended outcomes before new open data initiatives are launched, thus providing more focus on those products and processes that generate real public value.

Disclaimer

Acknowledgements

Appendix A

U.S. cities' open data policies and portals.

U.S. Cities included in data collection	Open data portal	Open data policy
Chattanooga	https://data.chattlibrary.org	https://github.com/cityofchattanooga/Chattanooga-Open-Data-Executive-Order/blob/master/Open%20Data%20Policy.md
Hartford	https://data.hartford.gov	Not available online
Lexington Lafayette	https://data.lexingtonky.gov	Not available online
Long Beach	http://datalb.longbeach.gov	Not available online
Los Angeles	https://data.lacity.org	https://gist.github.com/rebeccawilliams/8031812
Louisville	https://data.louisvilleky.gov	https://data.louisvilleky.gov/sites/default/files/Louisville%20Metro%20Open%20Data%20Policy%20_%20Rev1.0.pdf
Minneapolis	http://opendata.minneapolismn.gov	http://www.ci.minneapolis.mn.us/policies/opendata
NYC	https://opendata.cityofnewyork.us	https://www1.nyc.gov/assets/doitt/downloads/pdf/nyc_open_data_tsm.pdf
Oakland	https://data.oaklandnet.com	https://de.scribd.com/document/171673962/Resolution-Establishing-An-Open-Data-Policy-For-The-City-Of-Oakland-For-Making-Public-Data-Available-In-Machine-Readable-Formats-Using-Open-Data-Stand
Philadelphia	https://www.opendataphilly.org	https://gist.github.com/PhillyCDO/3623582
Pittsburgh	https://data.wprdc.org/organization/city-of-pittsburgh	http://apps.pittsburghpa.gov/cis/ProposedPittsburghOpenDataOrdinance.pdf
San Diego	https://data.sandiego.gov	http://dockets.sandiego.gov/sirepub/cache/2/epti51qr2hrtc3ppa2b5fnmq/75784607042017122300791.PDF
San Francisco	https://datasf.org/opendata/	https://data.sfgov.org/terms-of-use
Twin Cities	https://brigades.opendatanetwork.com/brigade?brigade=Open%20Twin%20Cities	http://www.opentwincities.org/2014/07/31/minneapolis-passes-open-data-policy/

Appendix B. Interview protocol

1. Opening remarks, informed consent, use of data
2. What is your personal background and what is your current position and responsibility?
3. What is the current status of your open data policy and open data portal?
4. How does the city government leverage open data toward innovation?

5. What are some specific examples of open data innovation in government?
6. Specifically, what are some operational examples of innovation that were developed out of open data?
7. What are some other non-traditional ways that open data has been used?
8. What is your observation: How are you open data sets used outside of government?
9. Are there specific ways in which you encourage reuse of your open data sets?
10. How specifically does your city stand out in the reuse of open data and open data innovation?
11. Generally, what are specific innovation trends you see with open data?
12. Closing remarks

References

Aronson, J. (1995). A pragmatic view of thematic analysis. *The Qualitative Report, 2*(1), 1–3.

Arzberger, P., Schroeder, P., Beaulieu, A., Bowker, G., Casey, K., Laaksonen, L., & Wouters, P. (2006). Promoting access to public research data for scientific, economic. and social development. *Data Science Journal, 3*, 135–152.

Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). sing ICTs to Create a Culture of Transparency: E-government and Social Media as Openness and Anti-corruption Tools for Societies. *Government Information Quarterly, 27*(3), 264–271.

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology.* Cambridge, MA: Harvard Business Press.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128–152.

Conradie, P., & Choenni, S. (2014). On the barriers for local government releasing open data. *Government Information Quarterly, 31*, S10–S17.

Corbin, J. M., & Strauss, A. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory.*

Damanpour, F., & Gopalakrishnan, S. (2001). The dynamics of the adoption of product and process innovations in organizations. *Journal of Management Studies, 38*(1), 45–65.

Dekkers, M., Polman, F., te Velde, R., & de Vries, M. (2006). *Measuring European public sector information resources. Final Report of Study on Exploitation of public sector information–benchmarking of EU framework conditions.*

Dunleavy, P., & Margetts, H. (2015). *Design principles for essentially digital governance. 111ᵗʰ Annual Meeting of the American Political Science Association*3–6 (San Francisco, September).

Edler, J., & Fagerberg, J. (2017). Innovation policy: what, why, and how. *Oxford Review of Economic Policy, 33*(1), 2–23.

Edquist, C., Hommen, L., & McKelvey, M. D. (2001). *Innovation and employment: Process versus product innovation.* Cheltenham: Edward Elgar Publishing.

Ergas, H. (1986). *Does technology policy matter?* Brussels: CEPS Papers.

European Commission (2000). *Commercial exploitation of Europe's public sector information.* Brussels: Office for Official Publications of the European Communities.

European Commission (2011). *Communication on open data: An engine for innovation.* Brussels: Growth and Transparent Governance.

Fagerberg, J., Mowery, D. C., & Nelson, R. R. (2005). *The Oxford Handbook of Innovation.* Oxford, UK: Oxford University Press.

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. *International Journal of Qualitative Methods, 5*(1), 80–92.

Freeman, C. (1987). *Technology Policy and Economic Performance: Lessons from Japan.* London, UK: Pinter.

Fung, A. (2013). Infotopia: Unleashing the democratic power of transparency. *Politics & Society, 41*(2), 183–212.

Gibbs, J., Kraemer, K. L., & Dedrick, J. (2003). Environment and policy factors shaping global *E*-commerce diffusion: A cross-country comparison. *The Information Society, 19*(1), 5–18.

Gurin, J. (2014). *Open data now: the secret to hot startups, smart investing, savvy marketing, and fast innovation.* McGraw Hill Professional.

Harrison, T. M., & Sayogo, D. S. (2014). Transparency, participation, and accountability practices in Open Government: A comparative study. *Government Information Quarterly, 31*(4), 513–525.

Hollingsworth, J. R. (2000). Doing institutional analysis: Implications for the study of innovations. *Review of International Political Economy, 7*(4), 595–644.

Huijboom, N., & Van den Broek, T. (2011). Open Data: An international comparison of strategies. *European Journal of ePractice, 12*(1), 4–16.

Janssen, K. (2011). The influence of the PSI directive on open government data: An overview of recent developments. *Government Information Quarterly, 28*(4).

Janssen, M. A., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, adoption barriers and myths of open data and open government. *Information Systems Management, 29*(4), 258–268.

Kassen, M. (2013). A promising phenomenon of open data: A case study of the Chicago open data project. *Government Information Quarterly, 30*(4), 508–513.

Kline, S. J., & Rosenberg, N. (1986). An overview ofinnovation. In R. L.a. N. Rosenberg (Ed.). *The positive sum strategy: Harnessing technology for economic growth* (pp. 275–304). Washington, DC: National Academy Press.

Kvale, S., & Brinkmann, S. (2009). *Interviews: Learning the craft of qualitative research.*

California, US: SAGE230–243.

Lourenço, R. P. (2015). An analysis of open government portals: A perspective of transparency for accountability. *Government Information Quarterly, 32*(3), 323–332.

Lundvall, B.-Å. (1992). *National systems of innovation: Toward a theory of innovation and interactive learning.* London, UK: Pinter.

Magadley, W., & Birdi, K. (2009). Innovation labs: An examination into the use of physical spaces to enhance organizational creativity. *Creativity and Innovation Management, 18*(4), 315–325.

Margetts, H. (2006). Transparency and digital government. In C. Hood, & D. Heald (Eds.). *Transparency: The key to better governance* (pp. 197–207). Oxford, UK: Oxford University Press.

Martin, C. (2014). Barriers to the open government data agenda: Taking a multi-level perspective. *Policy & Internet, 6*(3), 2017–2240.

Mazzucato, M. (2013). *The entrepreneurial state: Debunking private vs public sector myths.* London, UK: Anthem Press.

Nelson, R. R. (1993). *National innovation systems: A comparative analysis.* New York: Oxford University Press.

Nooteboom, B. (2000). *Learning and innovation in organizations and economies.* Oxford, UK: Oxford University Press.

North, D. C. (1993). *Economic performance through time (prize lecture to the memory of Alfred Nobel).*

Obama, B. (2009). Transparency and Open Government, memorandum for the heads of executive departments and agencies. http://www/.whitehouse.Gov/the_press_office/TransparencyandOpenGovernment.

OECD, & Eurostat (2005). *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data.* Paris: OECD.

Ojo, A., Mergel, I., Janssen, M., & Zuiderwijk, A. (2015). Open data to solve societal issues: workshop. *Paper presented at the Proceedings of the 16th Annual International Conference on Digital Government Research.*

Orlikowski, W. J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science, 11*(4), 404–428.

Pfeffer, J., & Salancik, G. R. (2003). *The External Control of Organizations. A Resource Dependence Perspective.* Stanford: Stanford University Press.

PIRA (2000). *Commercial exploitation of Europe's public sector information.* Brussels.

PWC (2017). The impact of open geospatial data - follow up study. Retrieved from https://sdfe.dk/media/2917052/20170317-the-impact-of-the-open-geographical-data-management-summary-version-13-pwc-qrvkvdr.pdf.

Rogers, E. M. (2003). *Elements of diffusion Diffusion of innovations.* 1–38 New York.

Ruijer, E., Grimmelikhuijsen, S., Hogan, M., Enzerink, S., Ojo, A., & Meijer, A. (2017). Connecting societal issues, users and data: Scenario-based design of Open Data platforms. *Government Information Quarterly, 34*(3), 470–480.

Ruijer, E., Grimmelikhuijsen, S., & Meijer, A. (2017). Open data for democracy: Developing a theoretical framework for Open Data use. *Government Information Quarterly, 34*(1), 45–52.

Schumpeter, J. A. (1961). *The theory of economic development: An enquiry into profits, capital, credit, interest, and the business cycle.* New York, NY: New York University Press.

Strauss, A. L., & Corbin, J. M. (1997). *Grounded theory in practice.* Thousand Oaks: Sage Publications, Inc.

Surowiecki, J. (2004). *The wisdom of crowds: Why the many are smarter than the few and how collective wisdom shapes business, economies, societies, and nations.* New York, NY: Doubleday.

Tarr, G. A. (2001). Laboratories of democracy? Brandeis, federalism, and scientific management. *Publius: The Journal of Federalism, 31*(1), 37–46.

Thorsby, J., Stowers, G. N. L., Wolslegel, K., & Tumbuan, E. (2017). Understanding the content and features of open data portals in American cities. *Government Information Quarterly, 34*(1), 53–61.

Tidd, J., Bessant, J., & Pavitt, K. (2016). *Managing innovation: Integrating technological market and organizational change.* 3rd edition ed.Chichester: Wiley.

Tõnurist, P., Kattel, R., & Lember, V. (2017). Innovation labs in the public sector: What they are and what they do? *Public Management Review, 19*(10), 1455–1479.

Ubaldi, B. (2013). *Open government data: Toward empirical analysis of open government data initiatives.* OECD Working Papers on Public Governance. OECD.

Utterback, J. M. (1994). *Mastering the dynamics of innovation.* Boston, MA: Harvard University Business School Press.

Utterback, J. M., & Abernathy, W. J. (1975). A dynamic model of process and product innovation. *Omega-International Journal of Management Science, 3*, 639–656.

Vickery, G. (2011). Review of recent studies on PSI *Re*-use and related market developments. Retrieved from http://ec.europa.eu/information_society/policy/psi/docs/pdfs/report/final_version_study_psi.docx.

Von Hippel, E. (2006). *Democratizing innovation.* Cambridge, MA: MIT Press.

Walker, R. M. (2014). Internal and external antecedents of process innovation: A review and extension. *Public Management Review, 16*(1), 21–44.

Worthy, B. (2015). The impact of open data in the UK: Complex, unpredictable, and political. *Public Administration, 93*(3), 788–805.

Zuiderwijk, A., & Janssen, M. A. (2014). 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.

Zuiderwijk, A., Janssen, M. A., & Davis, C. (2014). Innovation with open data: Essential elements of open data ecosystems. *Information Polity, 19*(2), 17–33.

Dr. Ines Mergel is Full Professor of Public Administration at the Department of Politics and Public Administration, University of Konstanz, Germany. Previously she taught at Syracuse University's Maxwell School of Citizenship and Public Affairs, USA. She holds a Doctor of Business Administration from the University of St. Gallen, Switzerland, and an MA in Business Economics from the University of Kassel, Germany. She currently serves as Associate Editor of Government Information Quarterly.

Dr. Alexander Kleibrink is a Senior Analyst and Team Leader at the European Commission's Joint Research Centre, where he works on innovation and regional development policies, public policy and collaborative governance. He holds a Doctor of Political Science from Free University of Berlin, Germany, and an MA in Public Policy and Management from the London School of Economics and Political Science.

Jens Sörvik, PhD, is the Project Leader of an administrative agreement with the Directorate-General for Communications Networks, Content and Technology at the European Commission's Joint Research Centre in Seville, Spain. He holds a PhD in Research Policy from Lund University, Sweden, and an MSc in Economics from Lund University, Sweden.