

Understanding the Dynamics of Open Data: From Sweeping Statements to Complex Contextual Interactions

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1 Introduction

Governments all around the world are developing policies and practices to make their datasets available to society (Harrison et al. 2012a, p. 903; Ganapati and Reddick 2012). Key political acts were the public sector information directive in the EU (2003) and the open-government directive in the USA (2009). Opening up government data is often assumed to be a “good thing”: making public resources available to citizens is assumed to generate new economic activity and contributes to a “strong democracy” (Lathrop and Ruma 2010). The key argument for open data is that open access to public sector information is of greater economic, social, and political benefit than exclusive exploitation of this information. Successful examples are mentioned by open data proponents to highlight the benefits and create support for this change (Noveck 2009).

At the same time, our academic knowledge about the effects of open data is still surprisingly limited. Impact studies tend to focus exclusively on the economic gains of open data. Based on rather controversial methods, the European Commission

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(EC) extrapolates the impacts of open data and concludes that open data may result in an economic growth of 40 billion euros (Kroes 2011; Kronenburg et al. 2012, p. 11; Vickery 2011; Hoog et al. 2012). This number is controversial since the EC calculates how much it would cost the government to develop all the apps that have been and will be developed on the basis of open data. One could raise the question whether government should ever do this and what all these apps actually contribute to economic development. The EC study may help to generate support for open data but the foundations for their optimistic claim of impact seem rather simplistic.

This chapter challenges the effect study for the EC for three reasons. Firstly, this study only focuses on economic effects of open data and not on other desirables such as a clean environment, good education, equitable health care, etc. Luna-Reyes and Chun (2012) correctly note that open data are about realizing public value and not only generating wealth. Secondly, these models assume a linear development: open data are introduced and bring about the desired change. The studies do not take the dynamics of the interactions between the various stakeholders into account that may result in unpredictable and unforeseeable outcomes. Thirdly, the studies for the EC do not acknowledge the variation of open data incentives, practices and consequences between countries and business sectors (Veenswijk et al. 2012; Kronenburg et al. 2012; Hoog et al. 2012).

It is easier to criticize other approaches to studying the impact of open data and qualifying them as “simplistic” than to develop a valid approach to studying it. Our approach to studying the dynamics of open data is based on theories about complex interactions in the public sector (Koppenjan and Klijn 2004; Teisman and Klijn 2008; Meijer 2013a). This study aims to contribute to our understanding of open data by acknowledging the complexity of societal dynamics and by taking a variety of values and desirables into account. Our analysis highlights that the construction and impacts of open data should be understood as emerging from a series of reactions of a variety of societal actors to open data and to each other’s reactions to open data.

Acknowledging the complexity of multi-actor interactions may be rather disappointing not only to the proponents of open data but also to the opponents. We argue against sweeping statements about the impact of open data and in favor of studying contextual interactions. We conclude that whether open data delivers its “promise” depends on these specific interactions that can be managed and controlled to a limited extent. Open data and its uses should be studied as social constructions that emerge over time in a specific context. A smart local approach based on designing arrangements for joint learning is the best we can aim for (cf. Koppenjan and Klijn 2004; Meijer 2013a).

This chapter will theoretically and empirically explore open data as complex societal interactions. The theoretical exploration is based upon literature in public administration about complex decision making and the empirical exploration is based on two Dutch cases. We will first position open data vis-à-vis related concepts such as freedom of information, transparency, and public sector information. Then we develop our own conceptualization and we will define it as a multidimensional concept. After this, we will elaborate on the issue of societal dynamics of open data

and argue that these dynamics can only be understood as contextual and emerging. We will present two case studies to indicate how our perspective can help to understand the construction and impact of open data. We will end the chapter with some conclusions and implications for both the study of open data and the practice of open data policies.

2 Open -Government Information: Historical Trends and Changing Concepts

There is much confusion in the use of terms that refer to governments making information available to society. The idea that government information should be available to all citizens arose in eighteenth century (Meijer 2013b) but, still, open government is now presented as something new and trendy. How can we position the current wave of attention in broader trends over time?

The dominant term in the 1800s was “publicity” (Bentham 1791). Publicity was a broad concept that did not focus on access to government information but stressed the public nature of meetings of representatives. The key reasons for publicity were to constrain representatives to perform their duty and to secure the confidence of the people in their representatives. Later on in the nineteenth century, the notion of publicity was used to push for access to treaties, legislation, and minutes of parliamentary meetings.

A stronger focus on access to government information only arose in the 1960s with the freedom of information act in the USA in 1966. Freedom of information had existed in Sweden since the end of the eighteenth century and Finland had adopted similar legislation in 1951 but the USA attention influenced legal debates worldwide. Information access laws were adopted in Australia, Canada, and several European countries in the 1970s and 1980s, and most countries around the world in the 1990s and 2000s (Roberts 2006; Erkkilä 2012).

Until the 1980s, freedom of information was the dominant term and this term was mainly used to refer to passive access to documents. Citizens could get access to documents at their own request. With the rise of new public management, the word “transparency” increasingly replaced freedom of or access to information (Roberts 2006; Grimmelikhuisen 2012). Transparency was much more about publishing documents online and making these proactively available to citizens. Another element of transparency is the emphasis on performance indicators and making these available to citizens and stakeholders through websites (Meijer 2007).

From the late 1990s onwards there was a growing emphasis on new concepts: public sector information (PSI) (Janssen and Dumortier 2003) and open government (Perritt 1997). Early versions of these concepts are different from transparency in the sense that they put more emphasis on datasets than on documents but they are still similar in the sense that democracy and the rule of law are the main objectives (Perritt 1997, p. 397). The term PSI is from the start not only used to refer to democratic objectives but also to economic benefits gained through reuse by both

Table 1 Shifting concepts of government information

Concept	Starting period	Features	Additional objectives
Publicity	Early 1800s	Proactive access, laws, parliamentary minutes	Democracy
Freedom of information	Early 1960s	Passive access, documents	Human rights
Transparency	Late 1980s	Proactive access, documents, data	Accountability, individual choice
Open-government and public sector information	Late 1990s	Proactive access, datasets	Collaboration, economic growth

multinationals and SMEs (Janssen and Dumortier 2003). These forms of use were also expected to spur open innovation and this was seen as crucial to the economic developments of countries. The new discourse also expands the scope of openness from only documents and indicators of government decisions and actions to scientific, environmental, and statistical information that is gathered and used by government but also potentially useful to other actors. Similarly, building upon president Obama's memorandum on transparency and open government in the late 2000s, the term "open government" is not only used to refer to transparency and participation but also to collaboration between government and society (McDermott 2010; Luna-Reyes and Chun 2012).

The development stages should not be regarded as exclusive. Current debates about open data also highlight aspects of democracy and human rights and analyze both access to datasets and to documents. The stages should be regarded as an expansion of previous concepts and as a focus on new aspects of the concepts. The current debate about open data is an expansion and renews the focus in the sense that there is much emphasis for economic value while this was hardly debated before in debates about publicity and freedom of information. In addition, these aspects do not always match. Janssen (2011) points out that regulations for access to open data may inflict upon freedom of information rights. The current tensions are nicely phrased in the subtitle of Aichholzer and Burkert's (2004) book on public sector information in an information age: between markets, public management, and citizens' right. Table 1 provides an overview of the shifting concepts of government information.

The changes over time can be understood in relation to technological developments from printing to photocopying to electronic storage to Internet access (Meijer 2009). The latest development, the focus on open government and open data, is closely related to the current wave of open and interactive technologies. A key feature of Web 2.0 is the emphasis on public availability of data, open standards, open platforms, open innovation, and open interactions (Harrison et al. 2012a, p. 901). Open data is a specific aspect of this broader "techno-philosophy" of openness.

3 Open Data as a Multi-Dimensional Concept

While the historical analysis of open government has provided insights in the origins of the concept, it is still not clear what we exactly mean when we talk about open data. From a naive point of view, one could assume that open data is mostly a technical issue: it refers to access to government information in electronic form (Perritt 1997, p. 398). Open data means changing the nature of information systems in the sense that (part of) these systems are connected to the Internet so that not only users within the organization can access the data but also users outside of it. The rapid technological developments have changed the costs of granting universal access dramatically and these technological opportunities could now be used to redesign information systems and grant universal access to data.

Technical access, however, is only one aspect of open data. Legal access is a second component. Various legal frameworks define to what extent data can be used and processed by other users. Government organizations may restrict legal access by emphasizing their copyright or they may stipulate that data can be used but not processed to generate new applications (Perritt 1997). Copyright law, intellectual property rights, and database protection may form important obstacles to open data but other legislation, such as the Paperwork Reduction Act in the USA, may drive open data.

Economic access and value is a third dimension of open data (Newbury et al. 2008; Vickery 2011). Data may be open for use but access may still be restricted if the user has to pay for access. Full economic access would mean that the data are made available at no cost and, in return, they can be used to develop applications that charge the users for their usage (Janssen and Dumortier 2003).

The last dimension of open data is the political dimension. This dimension refers to the fact that certain information may not be made available for political reasons. Political reasons may not only relate to unwelcome policy evaluations but also to access to information about certain citizen groups or specific parts of the country may be restricted for political reasons. The political dimension may be more difficult to measure than the other dimension since it refers to “coloring” the information (Grimmelikhuijsen 2012). How can we observe that data are “massaged?”

The four dimensions of open data and the relevant questions for these dimensions are summarized in Table 2.

On the basis of these four dimensions, we present the following definition of open data:

Open data means that government data are technically accessible for use by citizens and stakeholders without legal, economic, or political restrictions.

It is important to realize that open data is not a dichotomous concept: data can be open in certain dimensions and to certain degrees. Government organizations may choose to make certain data available at limited cost. This generates more openness than before but is still far away from complete openness.

Table 2 Dimensions of open data

Technical access	Can everybody access the government data or is access restricted? Are the data available in a machine-readable format so that they can easily be used in applications?
Legal access	Is everybody allowed to use the data for their own purposes or are there restrictions to use? Are citizens, stakeholders, and companies allowed to process and (re)publish the data?
Economic access	Are the data available at no cost or do people have to pay to access the data? Are citizens, stakeholders, and companies allowed to make a profit out of open data?
Political access	Is access not limited to politically desirable issues or does it entail all issues? Have the data not been “massaged” to avoid political sensitivities?

Now that we have indicated what open data is, we can now present our perspective on the role of open data in relations between government and societal actors. How can we understand why open data initiatives are being developed and what form they take? How can we describe and analyze patterns of usage of open data? What are the effects of this usage and are these effects desirable?

4 Societal Dynamics

The perspective on open data that seems to underlie much of the literature is the following (e.g., Perritt 1997):

- Government organizations create open data to attain various policy objectives such as economic growth, better individual choices, and more accountability
- Societal stakeholders use the data to construct new applications and to interact with government and other actors in the public sector
- These new applications generate collective desirables such as wealth and participation

We feel this argument is flawed because it ignores the political context of open data (who gains and who loses?) and it conceptualizes the application of open data as a commodity rather than an artifact that acquires its meaning in processes of sensemaking in political systems. Harrison et al. (2012a) acknowledge the need for a richer perspective on open data and, building upon Nardi and O’Day’s (1999) seminal work on information ecologies, they present the idea of an open-government

ecosystem. This perspective stresses interdependencies between the various actors, feedback loops, and variety of information resources. The instrumentality in much of the literature is challenged and replaced by a more holistic perspective on open data interactions.

We follow Harrison et al.'s (2012a) idea of analyzing complex interactions between various actors and propose to use theories of complexity to analyze the interactions within these ecosystems more specifically. Theories on complex decision making teach us that the emergence of open data should not be studied as a process in which one actor—a government organization—takes a decision about open data based on rational arguments. Political decisions emerge from interactions between actors with different interests, different sources of power, different perspectives on the public sector, and different interpretations of institutional rules (Koppenjan and Klijn 2004). Government decisions, especially those that have important implications, result from internal and external dynamics in which a variety of stakeholders try to put an issue on or off the agenda, influence the decision premises and influence the actual implementation of the decision. The construction of open data should be understood as the outcome of multi-actor and multilevel “games.” Meijer (2013a) highlights that these games are about power, information and rules and can be analyzed from a strategic, cognitive, and institutional perspective.

These “games” do not end with the construction of open data but continue in the sense that proponents will push for more open data or more openness along the other dimensions while opponents will make an effort to limit open data. Perceptions of impacts of open data play an important role in subsequent debates and proponents will try to highlight the positive effects while opponents will do the opposite. Framing open data is crucial to these interactions. Frames may create clear lines between proponents and opponents but through forms of “frame reflection” different stakeholders may be able to engage in forms of joint learning that can help them to construct forms of open data that are acceptable to both sides.

The starting event is the release of open data by government in response to pressure from internal or external actors. This event is complicated in terms of the number of actors involved but this single game could theoretically be mapped in terms of strategies and outcomes. The complexity increases considerably because actors start reacting to this event in various unpredictable ways. And complexity increases even more because actors react to each others' reactions. In sum, the starting event triggers a series of reactions and these trigger new reactions, and so forth. Second, third, and even fourth order effects render the outcome of open data highly unpredictable.

Our alternative model to studying the societal dynamics of open data is the following:

- Government organizations and stakeholders have a variety of interests and perspectives on open data
- All these actors engage in interactions in which they try to influence the sociopolitical construction of open data

- These interactions take place in various “rounds” (Teisman 2000): practices and impacts are framed and reframed
- The practices of both governments and stakeholders emerge in path-dependent (and therefore unpredictable) ways from these interactions

In the following section we will present two case studies that show the value of our perspective on the dynamics of open data.

5 Illustrative Case Studies of Open Data Dynamics¹

Open Data in Public Transportation

Public transportation is an important domain for debates about open data. In some cities, such as London, the departure times of public transportation are available real time. The availability of this data enables the development of apps that can suggest alternative routes based on information about delays. This illustrates that open data about public transportation is an example of data that has direct value for individual choices of a large group of citizens.

The publication of data about public transportation has a (relatively) long history in the Netherlands. In 1992, the government funded the creation of the public transport information service 9292ov by a group of public transportation companies. For a long time, this has been the only provider of this information and users had to pay for this information when it was provided over the telephone. The information is now freely available on a website but there are still important limitations. It provides real-time information only of trains and not of other means of transportation. For this reason, in 2006 a new initiative called GOVI was developed to provide real-time information about other means of transportation.

In 2009, the minister of transportation reacted to the demand for real-time information and introduced a plan to present full, real-time information to all travelers through a National Database Public Transportation. One of the added values for the minister is that the database can be used to check whether public transportation companies are as punctual as they have promised in their contracts with government. He reserved 30 million euros to develop this database. Parliament wanted the minister to ask 9292ov to develop it but the minister responded that it has to be an open bid procedure. Therefore, the minister decided to develop two databases: one about trains and one for other means of transportation. The idea is also that these

¹ The objective of the case studies was to illustrate the relevance of the argument about societal dynamics. Data for these illustrative case studies were collected in the period May 2012–May 2013 through a content analysis of websites. Much information about these initiatives is available online (as can be expected of open data). Initiatives that were relevant for these domains were selected through a search on the Internet and contacts with key informers. We used the model of the societal dynamics of open data to analyze the data. Follow-up in-depth research through interviewing is needed for a thorough reconstruction and understanding of these dynamics.

databases will be connected to a National Database Road Traffic to provide citizens full information about transportation. These developing plans enhance complexity and full, real-time open data have not been realized yet by the minister.

At the same time, three youngsters of age 14 and 15 years old have managed to realize real-time information about the buses of Connexxion (one of the largest public transport companies in the Netherlands). They contacted Connexxion and asked for the information and Connexxion then contracted the company of the youngsters to develop the app. This app is now freely available in the app store. Later, Connexxion started to cooperate with 9292ov: information about trains is now also available through the app and 9292ov contains information about the Connexxion buses.

The case illustrates the various components of our model:

- Government organizations and stakeholders have a variety of interests and perspectives on open data. Various actors, government, public transportation companies, providers of information, public transportation lobby groups, and even individual (young) citizens interact in the construction of open data. They have a variety of commercial and public interests. Government has a variety of interests such as providing information to citizens but also stimulating them to travel with public transport and, even more interestingly, public accountability. They can use the data to check whether public transportation companies are as punctual as they have promised in their contracts with government.
- All these actors engage in interactions in which they try to influence the sociopolitical construction of open data. These actors interact in the sociopolitical construction of open data. 9292ov tries to protect its monopolistic position in the provision of this data but the minister of transportation is influenced by the GOVI initiative to provide real-time open data. In his policy choices, he is influenced by parliament and legal restrictions but then a new initiative by a group of youngsters leads to new debates about the possibility to provide this data.
- These interactions takes place in various “rounds”: practices and impacts are framed and reframed. A first round took place in 1992 when government supported the creation of 9292ov public transportation information services. It was quiet for a long time but things were stirred up by GOVI in 2006. An important new round took place before and after 2009 when the minister developed and redeveloped his policy for providing public transportation data. A last round of interactions has been started by three youngsters who acquired the data from a bus company.
- The practices of both governments and stakeholders emerge in path-dependent (and therefore unpredictable) ways from these interactions. The monopolistic role of 9292ov can only be understood as a decision taken in the context of the early 1900s and local reactions such as GOVI and the initiative of the three youngsters were highly contingent. From a rational choice perspective, one cannot understand why government just does not demand that 9292ov releases the data but the complex societal interactions highlight why this construction is unpredictable.

Both the progress and standstill of the development of open data in public transportation cannot be understood from the naive model: This case highlights that we need to analyze complex multi-actor interactions over time to understand how open data came to be constructed and reconstructed over time.

Open Data in Policing

Citizens are highly interested in information about crime in their neighborhood. This information is less directly connected to citizen choice than information about public transportation although it can be used in the choice for buying or renting a house. The value of this information lies more in informed debate about public safety. Citizens can use the information to push for better safety in their neighborhoods by contacting the police, politicians, or media.

The police in The Hague have a website that presents a crime map: hoeveiligismijnwijk.nl (“How Safe is my Neighborhood?”). The data come from the national police registration system for crime and the website was developed in 2006 and renovated in 2011. For privacy reasons, this information is not presented at a lower level of aggregation. It is possible, however, to search for information on the basis of year and month to obtain an idea of the development over time. It is also possible to search for specific types of crime. Interestingly, the police do not offer the data as open data and therefore other stakeholders cannot develop their own applications. The reason for this choice seems to lie in the sensitive nature of the information and the risk that people may react too strongly to information about public safety.

More specific information is provided by the Utrecht police department through stopdecriminaliteit.nl (“Stop Crime!”). The origin of the data is the same national police registration system. Privacy seems to be less of an issue here since the exact crime locations are presented on the map. This crime map is both meant to obtain information from citizens about these crimes and to inform them about prevention methods. The idea behind the website was that citizens will be more willing to take preventative action when they see the actual level of crime in their neighborhoods. The Utrecht police department also does not make the data available as open data.

A third police initiative in the Netherlands was the crime map stopwoninginbraak.nl (“Stop Burglary!”). This website contained information about burglaries and requests to provide information. Interestingly, this website is no longer available. The reasons for ending the initiative are not known.

In addition to these crime maps, the police also release graphic information about crime—photos and videos—to get useful information about criminals. [De-politiezoekt.nl](http://depolitiezoekt.nl) is an app that presents information about crimes and asks citizens to come with information. The information comes from specialized systems for police investigations. This information is also controlled by the police and not made available as a data file for other stakeholders to develop their own applications.

At the same time, several commercial initiatives have been developed to present different kinds of safety information to the public. The website [112meldingen](http://112meldingen.nl) (“911

calls”) collects all alarm calls and provides this information on a website. Another commercial initiative is misdaadkaart.nl (“Crime Map”) which provides information about crime. The information is based on police press releases and presented at the level of streets. Press releases are analyzed automatically by search bots and the information is put into a database that forms the basis for the website. The website serves as an advertisement for the company behind it that specializes in helping companies to access “hidden” information.

The case illustrates the various components of our model:

- Government organizations and stakeholders have a variety of interests and perspectives on open data. Police, citizens, and commercial parties all have an interest in data about crime and public safety. The police are rather careful in publishing the information about public safety since they feel that this may lead to unwanted developments such as the further decline of a neighborhood with a relatively high-crime rate. Commercial organizations are interested in the data because they can use these to build websites that attract large groups of citizens and hence can be used to present advertisements. Citizens are generally interested in the information and feel they have a right to know but citizens who have been alleged with criminal acts or who have been victimized may feel that their privacy is being invaded upon.
- All these actors engage in interactions in which they try to influence the socio-political construction of open data. The police clearly try to control the “game” but they are increasingly pushed by commercial initiatives to present more open data. Interestingly, commercial initiatives such as [112meldingen](http://112meldingen.nl) and misdaadkaart.nl manage to aggregate data from individual alarm calls and press releases and create new forms of open data. The information is not disseminated as open data but through individual releases but smart software can convert these into datasets. This shows that the capacity of the police to control open data is limited.
- These interactions takes place in various “rounds”: practices and impacts are framed and reframed. An interesting issue here is the issue of privacy and practices of privacy protection are shifting over time. The police present videos and photos through depolitiezoekt.nl and this practice has been criticized by privacy lawyers. Commercial initiatives such as misdaadkaart.nl generate a level of precision that exceeds the level that the police in The Hague choose by presenting the information at the street level and put aggregated at the level of the neighborhood. At the same time, we see that an initiative such as stopwoninginbraak.nl is withdrawn. There is no linear expansion, there is a trend towards more transparency of crime data but at the same time, there are also movements back to more opacity.
- The practices of both governments and stakeholders emerge in path-dependent (and therefore unpredictable) ways from these interactions. The police react to commercial initiatives and commercial initiatives react to police initiatives. Private initiatives such as [112meldingen](http://112meldingen.nl) and misdaadkaart.nl put a pressure on the police to bring more data out in the open.

Again, the model can be used to analyze multi-actor interactions in a complex policy domain. The key conflict here is different from that in public transportation. The police are reluctant to open up the information for reasons of privacy and negative publicity while citizens feel they have a right to know and always have a high interest in crime-related information. Commercial parties exploit the public demand for crime-related information to build commercially relevant websites. The struggle here is about the best way to curb crime within the basic principles of law. Does that mean that everybody is to have access to crime data or can the police limit access for reasons of privacy or perverse effects?

6 Conclusions and Implications

Building upon theories about ecosystems (Nardi and O'Day 1999; Harrison et al. 2012a) and theories of complex decision making (Teisman and Klijn 2008), this chapter has presented a model to study and understand the complex interactions around the sociopolitical construction of open data. By applying this model to two empirical cases, we have shown the value of the model for analyzing these dynamics. The model highlights the feedback loops, the holistic nature of these interactions, the variety of information resources, the construction over time, the path dependency, the multi-actor interactions, the different interests and perspectives, and the emerging nature of open data.

What does our model mean for the empirical study of open data? This model highlights that we should be modest in our ambition to develop general knowledge about open data. It might be possible to identify patterns in a large set of cases but a search for general patterns may close our eyes to the relations that develop in specific situations. These specific patterns should not be considered as outliers but as interesting experiments that help us to learn about these dynamics. We propose a multi-method strategy where we try to enrich our understanding of open data by conducting both large-scale research and specific case studies. These types of knowledge product complement each other and they can both provide valuable insights for policy makers and society at large.

That brings us to the question of the social relevance of this research: How can this model be valuable for policy makers and society? We follow Harrison et al. (2012b) in their assertion that open government is not a good thing in itself but needs to be assessed in terms of public value realization. Our analysis highlights many similar points as Harrison et al. (2012a) but while they believe the ecosystems perspective also has prescriptive value, we believe in the power of an evolutionary approach. We think that policy makers should develop a diverse and heterogeneous perspective on open data. Van Gunsteren (2006) makes a distinction between two types of learning: instruction and variation and selection. The first type of learning assumes that there is one person that knows what we need to learn and learning takes place through experimenting while the second type of learning is based on an evolutionary perspective on change that stipulates the generation of variation and subsequent se-

lection of the best alternative. Van Gunsteren presents the evolutionary perspective as most fitting for ambiguous situations and we would argue that open data certainly qualifies as such. Our knowledge about these dynamics is limited and there is also much debate about the values at stake. Therefore, we think the principles of variation and selection can be most useful for policy makers that need to develop plans for open data.

Although the evolutionary perspective assumes a certain modesty of policy makers, it does not imply that decision makers cannot influence processes of change. When applied to issues of open data, they need to do four things:

- Ensure variation in open data initiatives and usage. Policy makers should stimulate diversity by making different types of open data available and actively stimulating diverse groups to use these data. They may stimulate government organizations to actively engage in arrangements with multiple private organizations to develop new forms of reuse (Veenswijk et al. 2012).
- Create selection mechanisms for open data initiatives. Policy makers can stimulate an environment that helps to select the most viable alternatives. They can do this by creating competitions for promising initiatives. Selection should not be based on numbers of visitors and generation of resources but on their contribution to the realization of public values.
- Ensure retention and dissemination of strong open data initiatives. These viable open data initiatives should be preserved in stable organizational and institutional forms by providing long-term funding and public support. Veenswijk et al. (2012) stipulate that there can be no open data sustainability without a sound learning environment.
- Steer open data initiatives indirectly. Policy makers can try to influence processes indirectly through knowledge exchanges, incentive structures, and stimulating conditions but they should not try to determine the outcomes of the complex societal interactions through formal mechanisms.

These evolutionary principles constitute building blocks for a strong public learning environment for open data. This evolutionary perspective acknowledges the complexity of open data dynamics and moves away from homogeneous approaches focusing only on linear relations between open data and public value. The emphasis on variation and selection helps to find nuanced and rich forms of open data usage that actually help to produce a variety of public values.

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