

# **“Open Government Data” - based Business Models**

## ***A Market Consultation on the Relationship with Government in the Case of Mobility and Route-Planning Applications***

Nils Walravens<sup>1</sup>, Mathias Van Compernelle<sup>2</sup>, Pieter Colpaert<sup>3</sup>, Pieter Ballon<sup>1</sup>, Peter Mechant<sup>2</sup>  
and Erik Mannens<sup>3</sup>

<sup>1</sup>*iMinds-SMIT, Vrije Universiteit Brussel, Pleinlaan 9, Brussels, Belgium*

<sup>2</sup>*iMinds-MICT, Ghent University, Korte Meer 11, Ghent, Belgium*

<sup>3</sup>*iMinds-Data Science Lab, Ghent University, Sint-Pietersnieuwstraat 41, Ghent, Belgium*

Keywords: Open Data, Business Models, Mobility, Route-planning, Government.

Abstract: This paper explores the business potential of open government data in the domain of mobility. Open data is often touted as the go-to policy for government to pursue, but the actual returns of following such a strategy remain somewhat illusive and anecdotic. Based on a research project subsidised by the Flemish Department of Mobility and Public Works, this paper presents the results of a market consultation with diverse stakeholders. The goal is to better understand the attitudes, bottlenecks, expectations and requirements related to open data of market stakeholders, so that the government can devise strategies that support sustainable open data initiatives and its policy goals at the same time. The paper offers a framework towards analysing this. It concludes that structural and iterative dialogue is desirable, both from the perspective of the market and government, but that this perhaps obvious key component is often overlooked.

## **1 INTRODUCTION**

An aspect that is deemed of particular importance to ‘smarter’ forms of governance is open data (Schaffers et al., 2012; Townsend, 2013). The idea is that governments are currently ‘sitting’ on a wealth of information related to divergent aspects of life in the city, but that this data is neither publicly available, nor easily interpretable. This has sparked a movement to encourage the opening of datasets in a structured and machine-readable way, under the ‘open data’ moniker, which has gained significant traction across local and national governments. The Open Knowledge Foundation is one of the strong proponents of open data and has come up with what has become the generally accepted definition of open data: “*Open means anyone can freely access, use, modify and share for any purpose (subject, at most, to requirements that preserve provenance and openness)*” (OKFN, 2015).

This means that open data can be used for any goal at no cost, with the only (potential) exceptions being that reusers mention the source of the data or

do not in any way prevent the data from being shared further on.

Open data has proven to be in high demand in some specific domains, with mobility often being one of the first application areas under consideration (see for example Jäppinen et al., 2013). The idea here is clear: (semi-)public transport organisations open up all kinds of data related to their operations and networks, with the goal of having external developers create new services and applications (‘apps’) based on this data. In principle, this can mean a cost reduction for the mobility organisations that open data, as they do not need to build and maintain their own services and apps, an activity that is generally accepted as being highly cost-intensive (Walravens, 2015). The benefit for citizens and users of the (public) transport systems is that a multitude of different mobility services become available, which appeals to different target audiences and niches.

In practice however, a number of challenges remain and ‘merely’ opening up data has not always proven equally successful (see e.g. Peled, 2011; Lee et al., 2014). Opening up data already entails

significant challenges to governments and public organisations before any data “leaves” the organisation (e.g. setting up internal processes to safeguard internal data hygiene and quality control, or implementing new or updating existing database systems). Relevant data can also be distributed over different government organisations or levels of governance, and some data applicable to the public may be under the control of private players that are less inclined to open it. After data are made available, the role of government is not necessarily played out. Ensuring that data is actually reused and relevant applications are built should also be considered a concern for these public organisations and open data policy makers. What the role of government can be in supporting the reuse of open mobility data is the main guiding question for the work presented in this paper.

This research was part of a project carried out for the Department of Mobility and Public Works (<http://departement-mow.vlaanderen.be>) of the Flemish Government in Belgium. This large and complex department consists of eleven divisions that are responsible for diverse aspects of mobility, transport, traffic safety, road- and waterway infrastructure and so on. Faced with the increasing importance of open data on the regional, national and European level (i.e., through the PSI-directive, Janssen, 2011), the Department commissioned a study that would investigate and tackle the challenges related to implementing an open data vision. A crucial part of this project was to better understand needs and concerns that are present in the market related to open data, as well as to their relationship with the government. What follows are the findings of a limited market consultation with potential open mobility data reusers, with the goal of identifying their needs and concerns. First, an overview of challenges in open data business models and reuse is provided. Next the methodology used is presented, followed by the results of the analysis.

## 2 ON OPEN DATA BUSINESS MODELS

This section will provide some considerations on open data-related business models. Although reality is often far more complex, this discussion starts on the basis of a basic value chain depiction of the process of open data reuse. Why and how this process is far less linear in reality will be explained further on. This ‘value chain of open government

data reuse’ starts with the creation of the data by a public authority and ends with the consumption of a service or product that is at least in part built on top of that data. This basic chain is depicted in Figure 1 (Adapted from Ferro & Osella, 2013). The products of each step in the chain are indicated at the top of the chain, while the potential reusers of those products are listed below it.

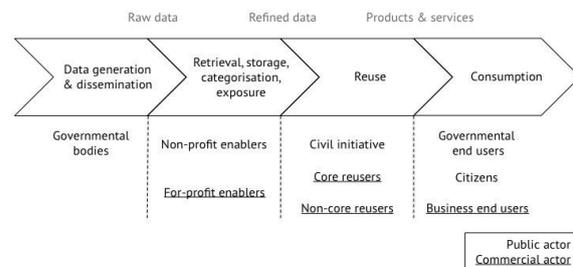


Figure 1: Open data value chain.

The first step in the chain is the creation of the data, which in this scenario happens exclusively within government. Clearly, data is also generated in the private sector and in civil society, but given the focus of this study, we will concentrate on open government data. The result of this first step is raw data. One can continue to process this data, for example by categorizing it, indexing it and making it searchable, opening it up in certain formats and so on. These processes can be executed by non-profit or commercial third-party players. The result of the step is enriched data that is more suitable for reuse. Although it is often forgotten, the moment in which data are created is an ideal time to generate as much (contextual) metadata as possible, making this enrichment easier, cheaper and higher in quality. At the moment of data creation, chances are higher that a lot of metadata and information about the data is available. We will return to this point later on. The next step in this chain is the reuse of the data, which for example can be done by civil society or citizens’ initiatives or by commercial parties that either do or do not make it the core of their business model. The results of this step are new products and services that can be consumed by governments, citizens, companies or other end users.

Although this figure and this value chain clearly represent the basic principles of open data reuse and their potential commercial opportunities, it remains a conceptual representation of reality. Often, reality consists of a much more complex set of interactions that make it much less obvious to arrive at successful open data reuse. For example, within government, step one and two will often be closely

interlinked given that even internal government organisations rarely work with true raw data (as became apparent from several of our interviews within the Department of Mobility and Public Works). More often than not, data will be documented in different ways, stored in different systems in divergent formats, made available through different channels and so on. While this does not per se has to be a problem, it can impact the way in which the next steps in the chain represented above can be taken. When one moves to a next step in the chain, the figure does not represent that government itself can also be a reuser of this enriched or more refined data (e.g., a different government service or department or in the case of intergovernmental data exchange). This could for example happen when reports need to be made or the government's own data needs to be contextualised.

In fact, the results of each step in this chain are new data that can, in turn, be useful to all the previous steps; a so-called feedback channel. Indexing and storing raw data can teach one something about the way data is captured and initially spread. As such, the reuse of data can teach one something about the quality of the metadata from step two, but also something about missing data that was not captured in step one, but may be useful for reuse after all. The consumption of services and products that are based on the opened data, in a similar way provide new insights into each of the previous steps. The difference is that with each step taken, it becomes more complex to find out where something may have gone wrong. That is why it is crucial to first ensure the internal processes are in place that can deal with this complexity, before considering opening up. Adding detailed provenance metadata at the moment of data creation of course also alleviates many of these concerns.

In this context, it is important to consider that there is not only business potential in steps three or four of the chain, but also in steps one and two, including for government. Where the principles of open data mainly foresee that data are made available for free and for everyone, this is not per se the case for *services* that are based on raw data. Without wanting to end up in a semantic debate, one could argue that as soon as data is stored, indexed, catalogued and made searchable in a graphical user interface (e.g., a low threshold website that puts GIS-information on a map), this can be considered a service for which also government can ask a financial compensation. How to deal with these types of models from a government perspective will

be an important question for local and national governments going forward.

Finally, what the open data value chain does not capture is the motivation to start publishing open data and how new services and products are consumed. Often, reference is made to apps that will be built based on top of open data, purely because certain data sets are made available. In fact, it takes much more than only open data to put innovative services into the market.

First and foremost, data need to be made available in a format that is usable. Next, there needs to be a clear demand, which can be identified for example by market analysis. Finally, a minimum of incentive is required in order to stimulate developers to get to work with open data. This final aspect contains a lot of complexity: this incentive can include financial compensation, media attention, networking opportunities, expertise gain, peer recognition and so on. Additionally, each of these aspects can be responded to in very diverse ways. The market could be stimulated through financial support, but this would only be recommended when other incentives have failed or the government envisions a specific type of reuse that is not manifesting in the market. Competitions and hackathons may have their purpose, but only if expectations are managed and goals are clearly defined.

The goal of this research then, is to better understand the concerns the market has related to the reuse of open data and what the role of the government can and should be in this regard. To answer this question, an interview round was set up with potential open mobility data reusers. The following will explain the methodology used and the results from the interviews.

### 3 METHODOLOGY

This section briefly details the applied methodology (expert interviews), the sampling method and the analysis framework that was used.

#### 3.1 Expert Interviews

Expert interviews can be structured, semi-structured or open ended (Schmidt, 2004) with the first usually employed within survey research and the latter in more explorative stages of research. Semi-structured interviews allow for more flexibility in which topic lists do not need to be rigorously followed and can be modified depending on the expertise or the issues

raised during the conversation (Rathbun, 2008: p. 698). Semi-structured interviews allow us to approach the problem from *within* the context of the research subject and reveal both factual knowledge as well as the opinions of the interviewees, thus providing more insight into the various angles to the research questions. Of course, the data collection is dependent on the will of the interviewee and the circumstances in which the interview takes place (such as location, time limitations etc.) can have an influence (Rathbun, 2008). However, this method was most appropriate to gather more insight into the benefits and challenges related to open data reuse. The following section will briefly detail how the market players were selected.

### 3.2 Purposeful Sampling

In order to gather a diversity of inputs from the stakeholder interviews, a purposeful sampling (Patton, 1990) was conducted: “Purposeful sampling involves studying information-rich cases in depth and detail. The focus is on understanding and illuminating important cases rather than on generalizing from a sample to a population. [...] Rigor in case selection involves explicitly and thoughtfully picking cases that are congruent with the study purpose and that will yield data on major study questions.” (Patton, 1999: p. 1197). Our selection was based on crucial differences between the companies, which make them more interesting for comparison. These differences were related to the market player being national or international, large or small, active in the mobility domain or not, and being B2C or B2B. In agreement with the Department that subsidised this research, 7 companies were withheld (see Table 1).

Table 1: Companies and interviewees.

Company	Title
Prophets	Technical Director
Prophets	Creative Technologist
Ally	Business Developer
Be-Mobile	Chief Traffic
FlowPilots	Partner
Google Maps	Strategic Partner Manager Geo
InfoFarm	Data Scientist

Prophets is a Belgian mid-sized app developer and advertising agency that has expressed interest in mobility as a domain. Ally is a German startup that offers a multimodal route-planning app that uses open data from international cities and is active in Flanders. Be-Mobile is a Belgian company that

offers traffic solutions on an international scale. FlowPilots is a smaller developer that has participated to EU-funded research projects in the mobility domain, but has no commercial mobility apps. InfoFarm is a B2B company that specialises in data science and analysis. Finally Google Maps was also interviewed, perhaps the best-known and most-used multimodal route-planning application. All interviews lasted about one hour and were structured in the same manner.

### 3.3 Interview Matrix and Topic List

When dealing with expert interviews, each interview does not need to be completely transcribed and a general topic list was composed, which was adapted depending on the interviewee and the operations of their organisation. In order to analyse the interviews in a structured way, an interview matrix was used. This matrix uses five key aspects of working with open data that were discussed during the interview, and places them against the three perspectives that were followed throughout the research: internal to the company, external to the company (e.g., in relation to government) and technical (see Table 2).

Table 2: Interview Matrix.

	Internal	External	Technical
Attitude			
Bottlenecks			
Expectations			
Requirements			
Business Sustainability			

This matrix was used to structure the interviews and the topic list and discusses various viewpoints on open data reuse challenges from different perspectives. The themes used in the table were decided upon with the steering committee of the project and based on key points from the analysis presented in Section 2 of this paper. ‘Attitude’ refers to the general position the interviewee has towards open data; ‘bottlenecks’ refers to the main challenges identified by the market; ‘expectations’ identifies what companies expect from government; ‘requirements’ are demands from the market; and ‘business sustainability’ explores how business models can be built on top of open data. This table was filled out during and after each interview (based on the transcripts), and allows for a structured comparison of the opinions expressed by the market players. The following sections will provide the analysis of the points discussed.

## 4 ANALYSIS

Each of the topics discussed with the experts will be described and analysed in an aggregated way below.

### 4.1 Attitude

When asked about their general attitude towards open data, the respondents agree that the core principle certainly holds value. The argument that is most often used is that the data *in casu* are generated with taxpayer money and should be made publicly available. Open data can be relevant for the internal workings of a company (e.g., projects could be finished in a more time-efficient way if all required data are available in open formats), as well as in the relation to external stakeholders (e.g., using open data as a basis to enrich data collected by the company and placing these combined data in the market).

The respondents do have some recurring remarks. The first relates to the availability of certain data (specifically, the ability to find them). The interviewed market players do not have clear-enough insight in where the open data they are looking for can be found. The Flemish Open Data Portal is also not very well known among the respondents. A second remark concerns the reliability of the data. Respondents indicated a lack of understanding of the context in which certain datasets were collected and with what purpose (the provenance of the data). This is not always clear to potential reusers that may have completely different types of reuse in mind than the application domains for which the data were collected in the first place. Provenance metadata can certainly be a solution here. A third aspect that impacts the attitude towards open data relates to communication (this will be discussed in more detail further on).

The respondents seem to differ on how to build business models on top of open data. For startups, open data can be a key resource towards building a minimal viable product (MVP), or even a more substantial one, without (high) financial costs for basic data. There is however some risk in completely basing a company's business model on open data. The interviewed startups indicated being aware of this risk, but pointed out that this risk is a calculated one and that there are only very few known cases in which a government organisation suddenly stopped providing essential datasets. The larger companies that were interviewed indicated that using a business model based exclusively on open data would be too high of a risk factor, at least without formal

guarantees from the data provider in terms of data availability and reliability.

Globally speaking, the attitude towards open data is positive and the interviewed stakeholders agree with the basic principles behind the concept. From a more practical perspective, some bottlenecks remain that will be discussed in the following section.

### 4.2 Bottlenecks

As mentioned above, some companies voiced concerns about finding the required data. The interviewed stakeholders indicate there are too many open data portals (partly as a result of Belgium's federated governance structures) and there is no overview or catalogue of available data. A number of respondents were not aware of the Open Data Forum of the Flemish Government that links to open data of various government organisations and local governments. A single portal containing (links to) as much data as possible appears to be important to the market stakeholders, combined with clear communication on the topic. Once the available data is found, interpretation of the data becomes the next bottleneck. Understanding the context in which a dataset was created is not always obvious, nor is it something that can be completely captured in the metadata according to respondents. Reusers want to understand why certain data were collected, why certain data were not measured or why particular outliers are seen in the data and so on.

This brings us to another issue that came to the foreground in each interview: dialogue. The market is eager to engage more strongly in a dialogue with government to avoid some of the issues presented here. Today, an ad-hoc approach is mostly in place, in which departments, divisions, cabinets, agencies and so on only communicate with the market on a case-by-case basis. There is a clear appeal of organising these meetings on a more structural basis.

Besides missing out on a fundamental dialogue on open data, the interviewees would welcome more communication with the data provider in day-to-day practice. A more operational type of communication was suggested with a single point of contact at government level that provides support and answers questions on certain datasets. This of course requires effort. It also requires internal effort to cultivate and support an open data culture within the different administrations and divisions of government. The interviewed stakeholders believe that such an open data culture is not present in most government organisations at all today or only beginning to appear very slowly and gradually.

The market players indicate there is little that is not possible from a technical perspective and that there are no specific technical barriers related to starting to work with open data. What does become apparent however is that the data itself often still needs to be processed before it can be integrated into a product. The stakeholders stress the idea that once data are made available they can be used as such, is wrong and that government should not assume this is the case. This can turn out to be problematic for startups that want to integrate certain data directly into a product, but for several of the interviewed companies, their business model at least partially relies on cleaning up, enriching or improving open data and then reselling it to third parties or in some cases even to the organisation that initially provided the data. In summary, the idea is that reusing open data is, in most cases, also not ‘free’ for reusers, even when the data is available at no cost.

A final bottleneck that was mentioned is the fact that Flanders (and Belgium) lacks real-time open data, which are extremely important for mobility and route planning services.

### 4.3 Expectations

The biggest expectation from the market players is that government does not impose any restrictions on open data reuse (apart from those imposed by the PSI directive, the open definition or other existing legal frameworks of course). The market respondents conclude that several government bodies claim to pursue an open data policy, while in practice, a number of barriers remain. This mainly refers to the requirement posted by some public organisations to sign a one-on-one contract between the data provider and the company or organisation that wants to reuse the data (i.e., in the case of the Flemish and Brussels public transport companies). An additional issue that is brought up in this context is that data reusers do not have insight into the agreements made with other companies, since a bilateral contract is used rather than an open data license (e.g., CC0).

A second expectation that was mentioned links back to the idea of operational communications between government and market, mentioned in the preceding section. When open data is core to the functioning of a product or service, companies expect to have some guarantee that everything will simply keep working. The market looks favourably on service level agreement (SLA) models in which the administrative organisation for example foresees a 24/7 point of contact for technical problems or

questions on opened data. In such an SLA model, most market players would be willing to compensate the government, which does not necessarily go against the principles of the PSI-directive or the open definition. The government still makes raw data available to anyone for free and for whatever purpose, but can be compensated for any services it offers on top of that raw data.

A final point in this section builds on this idea and boils down to a fundamental interpretation of the open data concept. Interviewees told us that, when government indeed expects open data to lead to the creation of new applications in the mobility space, the role of existing mobile apps that are offered by public transport companies should be revised. A number of existing websites and apps owned and operated by the different public transport organisations in Belgium today offer multimodal route planning information (e.g., De Lijn, NMBS, MIVB, and TEC). A number of market players expressed that it is extremely difficult to compete with these services, especially given the strong marketing power of these public companies (e.g., through advertising in the public space and brand recognition). Despite the fact that these apps are often criticised and receive poor ratings in the online apps marketplaces, it is argued that the marketing and communication power of these public organisations is very difficult to compete with, for companies that want to enter the same market. If government claims to fully pursue an open data strategy, the market stakeholders feel that public organisations should stop commissioning, building and maintaining these types of apps.

### 4.4 Requirements

When asked about the requirements the market players would expect from government, opinions were more varied. There was no consensus on the measures government should take to stimulate the reuse of open data or the development of innovative mobility apps. This could be related to the different types of companies that were interviewed (with professional developers building commissioned apps for customers whereas startups may be more inclined to develop their own products or services).

Whatever supporting measures government would take to stimulate open data reuse, they will then need to be adapted to the type of developer or reuser they are trying to reach. For students, hobbyists, and even startups a competition model in which some basic requirements are detailed and a limited award is made available, may suffice to kick-

start the development of some innovative apps (or concepts). More professional companies may be less inclined to participate in such a competition, as they would prefer cost-covering measures to create new applications and services. A proposed example could be that the government guarantees to use a service for the first five years after development, or assigns a bonus when the developer reaches certain KPIs or goals (e.g., a certain amount of users, access to enriched data based on the app's usage, ...).

There was consensus among the interviewed companies that there should be one basic criterion in whatever supportive initiative government would undertake: the business plan. In order to arrive at solutions that can improve mobility on the long term while providing an interesting value proposition to the end user, the basic requirement is a solid business plan with a coherent business model behind it. The final aspect that was discussed with the respondents goes more in depth on this matter.

#### 4.5 Business Sustainability

A theme that ran through all the interviews with the market players was the challenge of building a business model on top of open data that is sustainable on the long term. Regarding the payment models of the apps and services, the market players seem to agree that the consumer will no longer be willing to pay for the app itself. Other research also suggests that the value is higher up in the value chain (see, e.g., Walravens, 2015). The interviewed experts also stated that advertisement-based models are trickier on mobile devices and perhaps even more so in the domain of mobility. Freemium models are applied more in mobile apps and seem to pay off in certain categories, but market players are also actively exploring models in which an app with full functionality is made available for free to the public and the additional data that the use of the app generates, is recombined with other (open) data, to be sold on to interested parties. Through this approach, the buyers of this data get additional insight in the actual use of apps and services, and by extension the behaviour of the people using them. When such an app is based on open data, it may also be interesting for the data provider to receive an enriched version of that data set back (for free or on the basis of a paid agreement), as it can provide more insight into the data that is already being collected by the organisation. If the data provider is a public body in such a case, this enriched information may also support evidence-based policy making. As mentioned earlier, open data can also

create a direct financial return for government, by offering SLA's on top of the data. On the other hand, this would also require rather significant investment from government, mostly related to training and availability of people. Next to models that directly leverage the data, the market also sees a lot of opportunities in further supporting government through consulting and technical guidance. The respondents indicated that currently a lot of consultancy on open data is asked for, which is a different type of commercial opportunity tied to open data.

The most important distinctive feature (and perhaps business potential) of mobility apps themselves was stated to be the *intermodal* aspect of route planning applications, as well as integrating all kinds of contextual data into the travel advice provided to end users. The idea is that a user plans a route in the app and receives travel advice that truly combines different kinds of transport options (rather than the separate modes of transport presented in many apps today) and also dynamically and in real-time adapts its travel advice based on road conditions, weather and so on. In general, the interviewed market players still see a lot of potential for innovation in this domain and believe opportunities exist to create value that is currently not being captured.

## 5 CONCLUSIONS

The conclusions we can draw from this market consultation are not univocal. In that sense, it has proven interesting to follow a purposeful sampling approach and interview divergent types of potential reusers of open data that have different customers, business models, or activities in mobility. It does make it slightly more challenging to provide a universally applicable recommendation with regards to the role government can play in stimulating the uptake of open data. This is in fact the first conclusion: each governmental department or public body will have its own specificities or ways of operating, which in some cases will also be tied into the application domain it has competences over. This means that tailor-made plans of approach will likely need to be developed. Additionally, whatever supporting or market-stimulating initiatives governments may want to undertake, they will need to be adapted to these specific contextual factors.

What has become clear is that the concept of open data is generally perceived as positive by the interviewed stakeholders. There also is a demand for

more and higher-quality (richer and more correct) open data, on the condition that this is made available in an accessible way and not as the result of one-on-one contracts. Good communication about what is available and where, is key in this, together with the organisation responsible for providing the data.

To further stimulate interesting reuse, the market would like governments to consider ways in which the latter can provide some basic guarantees that mainly pertain to availability of data, to technical support and to a single point of contact with high availability. Next to the freely available open data, some market players would be willing to pay for a SLA. However, early feedback from government seems to indicate the cost would likely be too high in relation to the return.

Another conclusion is that the sector of mobility remains very interesting and still has high potential value that is currently not unlocked. Route planning services still have a future according to the respondents and there is still room for innovation in this domain. This progress is mostly identified in true intermodal route planning that can take the context of the user into account in innovative ways, as well as the predicted situation on his trajectory. One condition for all of this to come to fruition would be for government to reconsider the position of its own mobility applications and services, according to the market players. These existing public body apps are said to hinder the market potential of new and innovative apps.

Next to this, any stimulating measures government may want to take to increase open data uptake will need to be adapted to specific and diverse target audiences. It will be of high importance to consider both the audience, but also the end goal and the type of applications or services governments would like to see created, when considering any stimulating measures.

Perhaps one of the most important conclusions of this research ties into the idea of ‘dialogue’. Each of the market players indicated it would look forward to more structural dialogue between government and market players (as well as other stakeholders from civil society for example). Not only from an operational perspective, but much more to understand why certain decisions are being made, why certain data sets are open or closed, what the government’s roadmap is and so on. This process is of course also beneficial to government as it can better indicate and explain the types of reuse it would like to see and for what reasons, or more effectively gather input on which data are important

to open to the market, thus ensuring that its investments in opening up data have not been in vain. There are many different practical ways in which such a dialogue may take place, but these are secondary to the overall goal of increasing the efficient and more purposeful reuse of open data. Future research should explore the impact the form of dialogue has on the results it achieves.

## REFERENCES

- Ferro, E. and Osella, M., 2013, April. Eight business model archetypes for PSI Re-Use. In *Open Data on the Web Workshop, Google Campus, Shoreditch, London*.
- Janssen, K., 2011. The influence of the PSI directive on open government data: An overview of recent developments. *Government Information Quarterly*, 28(4), pp.446-456.
- Jäppinen, S., Toivonen, T. and Salonen, M., 2013. Modelling the potential effect of shared bicycles on public transport travel times in Greater Helsinki: An open data approach. *Applied Geography*, 43, pp.13-24.
- Lee, M.J., Almirall, E. and Wareham, J.D., 2014. Open Data & Civic Apps: 1st Generation Failures–2nd Generation Improvements. *ESADE Business School Research Paper*, (256).
- OKFN, 2015. Open Definition. Retrieved from <http://opendefinition.org>.
- Patton, M.Q., 1999. Enhancing the quality and credibility of qualitative analysis. *Health services research*, 34(5 Pt 2), p.1189.
- Peled, A., 2011. When transparency and collaboration collide: The USA open data program. *Journal of the American society for information science and technology*, 62(11), pp.2085-2094.
- Rathbun, B.C., 2008. Interviewing and qualitative field methods: pragmatism and practicalities. *Oxford Handbook of Political Methodology*, Oxford: OUP.
- Schaffers, H., Komninos, N., Pallot, M., Trousse, B., Nilsson, M. and Oliveira, A., 2011. Smart Cities and the Future Internet: Towards Cooperation Frameworks for Open Innovation. *Future internet assembly*, 6656(31), pp.431-446.
- Schmidt, C., 2004. The analysis of semi-structured interviews. *A companion to qualitative research*, pp.253-258.
- Townsend, A.M., 2013. *Smart cities: Big data, civic hackers, and the quest for a new utopia*. WW Norton & Company.
- Walravens, N., 2015. Mobile city applications for Brussels citizens: Smart City trends, challenges and a reality check. *Telematics and Informatics*, 32(2), pp.282-299.