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# OPEN DATA DIFFUSION FOR SERVICE INNOVATION: AN INDUCTIVE CASE STUDY ON CULTURAL OPEN DATA SERVICES

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## Abstract

*Information Systems research on Open Data has been primarily focused on its contribution to e-government inquiries, government transparency, and open government. Recently, Open Data has been explored as a catalyser for service innovation as a consequence of big claims around the potential of such initiatives in terms of additional value that can be injected into the worldwide economy. Subsequently, the Open Data Services academic conversation was structured (Lindman et al. 2013a). The research project presented in this paper is an interpretive case study that was carried out to explore the factors that influence the diffusion of Open Data for new service development. This paper contributes to this debate by providing an interpretive inductive case study (Walsham 1995) of a tourism company that successfully turned several city authorities' raw open datasets into a set of valuable services. Results demonstrate that 16 factors and 68 related variables are the most relevant in the process of diffusion of open data for new service development. Furthermore, this paper demonstrates the suitability of Social Constructionism and interpretive case study research to inductively generate knowledge in this field.*

*Keywords: Open Data Services, Diffusion Factors, Interpretive Case Study, Social Constructionism.*

# 1 INTRODUCTION: OPEN DATA

The definition of Open Data was firstly developed by the Open Knowledge Foundation (<http://okfn.org/>) in 2005. They defined Open Data as “data that can be freely used, shared and built on by anyone, anywhere, for any purpose”. There are 3 principles behind this definition of Open Data: (1) availability and access (people can get the data); (2) re-use and redistribution (people can re-use and share the data); (3) universal participation (anyone can use the data).

Public administrations’ data was one of the foremost applications of the Open Data movement, pioneered in the respective projects (<http://data.gov>) for the USA, and (<http://data.gov.uk>) in the UK. Information on the cultural attractions, public equipments and services, businesses available within cities etc., is naturally part of this effort. Producing Open Data from proprietary databases, however, takes significant effort, mostly because of the variety of native formats in which the data was produced and stored by the various stakeholders. Some start ups (e.g. DataPublica in France, Dublinked in Ireland) were born to establish a large catalogue of the Open Data produced by the national and local administrations. They usually proceed by manually establishing a catalogue of public administration of data portals and then semi-automatically feeding them into their warehouses as a collection of datasets (see for example <http://www.dublinked.ie/datastore/datastore.php>). A dataset corresponds to a specific category of information aggregated at a specific level over a specific period of time (e.g. *premature children born in each department of France in 2005* (<http://datapublica.fr>)).

In their Digital Agenda ([www.ec.europa.eu](http://www.ec.europa.eu)), European commissioners listed 4 reasons for promoting Open Data initiatives: (1) public data has significant potential for reuse in new products and services. Overall economic gains from opening up this resource could amount to 40 billion Euros a year in the EU; (2) addressing societal changes. Having more data openly available will help us discover new and innovative solutions; (3) achieving efficiency gains through sharing data inside and between public administrations; (4) fostering participation of citizens in political and social life and increasing transparency of government.

## 1.1 Information Systems Research on Open Data

So far, Information Systems (IS) research on Open Data (and more generally on Public Sector Information), was mainly related to e-government inquiries, addressing aspects of democratic theory, voter participation, democratic deliberation, and open government in a broader context (Amichai et al. 2008). Later the focus included also Open Data seen as vital for the vitality of the civic society (Bertot et al. 2010). Finally, IS recent research explored Open Data, as a foundation and catalyser of innovation. The importance of Open Data as an enabler for innovation can be presented as 5 categories (Lakomaa et al. 2013):

1. Simulate Potential Viability to Ensure Funding: “*Open Data provides data that can serve as a test bed to simulate an application and build evidence for the factual viability of the proposed project*”.
2. Provide Information about Potential Market: “*Open Data creates an abundance of niche information through all sectors*”.
3. Reduce Development Lead Time to Application Market: Open Data is “*often of high quality and well-structured and thus requires less processing before it can be used in applications*”.
4. Drive Innovation beyond Applications: the usage of Open Data can be also indirectly reflected in the final outcome. This category could be a serious underestimation of the total impact of the release of Open Data.

5. Enhance existing Online Services and Offerings: Open Data can be used to create an additional user and customer value within already existing services.

Interpreting these statements it can be concluded that Big Data analytics make it possible to work through these massive amounts of Open Data to find unseen patterns and discover anomalies that can create opportunities for new products and services and new ways of operating more efficiently. The research presented in (Manyika et al. 2013) (McKinsey) aimed at quantifying the potential value of using open data in 7 domains of the global economy: education, transportation, consumer products, electricity, oil & gas, healthcare, and consumer finance. Their findings showed that between 3 and 5 trillion \$ can be created as additional annual value across these 7 domains.

All these concepts led academic authors to introduce and structure a new research stream named Open Data Services. This novel academic conversation is giving a structure to the investigation of Open Data as a foundation of service innovation (see for example “Open Data Services Minitrack” at the Hawaii International Conference on System Sciences, 2013 (Lindman et al 2013a), 2014, and 2015).

## **2 OPEN DATA SERVICES**

In itself the word “data” does not have a meaning, but can become information when interpreted by an actor. In Information Systems, data and information are conceptualized with a dichotomy of data and application, where data is used for storage and application is used for different operations based on data (Lindman et al. 2013b). In this way, a distinction can be made between supply and demand of Open Data. Specifically, the supply perspective aims at making the data available, and the demand side builds something useful on the data. Interpreting this statement, access to Open Data is just the first step within an infrastructure that allows end-users to consume Open Data Services. Hence, for the Open Data to become valuable there need to be a chain of steps that take the raw data, make it available to others as services, or further down the chain analyze, combine and present data in ways that make it useful for users to interpret as information. In (Lindman et al. 2013b), the authors adopted (Alter 2010)’s Work System Framework to describe what Open Data Services are and to propose an agenda in this way for IS researchers. In this framework two main parts can be identified following the distinction with supply and demand side of Open Data. Hence, there is an information system that provides the open data on one side, while on the other side services are built on top of this data for the final end users. Within the supply side, four main factors can be detected into this framework: (1) a technological building block, which includes data storage systems and standards for interfacing these systems. The other three dimensions are referred to the (2) type of raw data that is collected and transformed (information building block), (3) the processes and activities that are undertaken to reach the development of Linked Open Data (Berners-Lee 2006), and (4) the actors involved in this work system. Moving now to the demand side of this framework, the data is assumed to be available as Open Data. With data openly available to the public, designers (including developers and hackers) can apply different models and/or theories to the data, and create new artifacts (Kuk and Davies 2011). Hence, at this stage the Open Data is used to build a service. Finally, to make Open Data Services sustainable, there need to be customers.

The authors of this seminal paper concluded that there is a clear research gap, and in particular “it is entirely unclear how to build a sustainable open data market and establish actors within it” (Lindman et al. 2013b, pp. 1242). However, we learnt through a systematic literature review study how the conversation around this topic is rapidly evolving and being enriched by several contributions.

### **2.1 Literature Review**

In a recently accepted paper at the European Conference on Information Systems (Maccani et al. 2015) we presented a Systematic Literature Review (SLR) on Open Data Services. The process adhered to (Okoli et al. 2010)’s 8-step methodology. This study allowed us to systematically

identifying the research efforts that have been implemented to date in the topic of Open Data Services. In particular, the analysis was focused on studies that made an attempt to tackle the adoption and diffusion of Open Data for fostering Service Innovation. As a result of a systematic searching step and by implementing exclusion criteria, we obtained 46 papers that were ordered and searched and considered for this review. In order to provide a useful categorization of the literature we divided the papers into 3 groups based on which side of the Open Data Services framework these papers contributed to. In detail, the first group identified papers that tackled merely the supply side of the framework (i.e. that proposed IS-related solutions for public authorities to release Open Data efficiently and effectively); the second group encompassed contribution to the demand side; and the third joint together all contributions that covered both sides of the Open Data Services ecosystem.

The first group of papers included 20 contributions. In particular, different semantic web solutions (Cifuentes-Silva et al. 2011), (Fox 2013), (Cyganiac et al. 2010), (Wilde 2010), new architectures (Aoyama and Kojima 2013), institutional challenges (Felicetti et al. 2012), (Currie 2013), and different approaches (Lorey 2013), (Yu et al. 2011) were investigated to enable and maintain the release of Open Data by public authorities. In addition, few studies focused on individual projects such as Europeana (Isaac and Haslhofer 2011), (Haslhofer and Isaac 2011), DataBridges (Herschel and Manolescu 2012) and other case studies (Frosterus et al. 2012), (Oh 2013), (Stephenson et al. 2012), to describe approaches and activities involved in the publication of Open Data.

Eighteen of the articles considered for this SLR tackled both the demand and the supply side of the Open Data Services framework. The majority of these studies proposes technological related solutions for the efficient/effective release of Open Data, and provides subsequent examples of services designed/delivered as a demonstration of the validity of the proposed solution (Guo et al. 2010), (Matheus et al. 2012), (Ijima et al. 2011), and (Hannemann and Kett 2010). In addition, more studies focused on the design of various forms of frameworks to describe the activities and processes that are undertaken from the raw data till the adoption of Open Data for different purposes (Hartung et al. 2010), (Tcholtchev et al. 2012), (Rittenbruch et al. 2012), (Gautreau 2012), (Chan 2013), (Hausenblas 2009), and (Bizer et al. 2009). Moving ahead, two more studies were included in this category: (Lindmann et al. 2013b) and (Tammisto and Lindman 2011). These are considered the seminal works upon which the academic conversation around Open Data Services was drawn and were broadly explained in the previous section of this paper. In a similar way, (Latif et al. 2009) studied the value of the Open Data from its “Raw Data stage” till its usage.

Concerning the group that includes all studies focused on the demand side of the Open Data Services framework, 8 papers were searched and analyzed. Three of them introduce innovative services designed on top of Open Data. In particular, (Halb et al. 2010) presents a prototype for professional online editors, in (Groen et al. 2013) an innovative service for tourists in Amsterdam is proposed, and (Savelyev et al. 2011) focuses on the concept of Volunteered Geographic Services. In addition, (Hielkemma and Hongisto 2013) study how Living Lab methodologies can drive forward the urban competition for Open Data. An original contribution to this field is also given in (Ferro and Osella 2012, 2013) which propose a set of business models for private entrepreneurs that aim at harnessing and using public datasets for profit oriented businesses. Finally, the last article included in this group refers to above mentioned paper from Lakomaa and Kallberg (2013) in which Open Data is explored as a catalyser for Service Innovation.

## **2.2 Research Gap**

The SLR study showed that the demand side of the Open Data Services framework remains unexplored in IS literature. In addition, we searched across municipal Open Data websites of European capital cities and of the top 50 cities in Europe in terms of population. Our findings, confirmed the statement made in (Kuk and Davies 2011), i.e. in the open data context the most significant emphasis towards service innovation has been placed to catalyze “civic hacking” taking through weekend-hack days and competitions. In fact, high profile competitions have emphasized the potential benefits for

innovation, of releasing data to developers, and allowing actors outside of government to build services off the back of it. However, as shown in (Kuk and Davies 2011), out of 130 distinct projects that were proposed, only 10 remained active one month later. Then, the authors made a very strong statement as a conclusion of their study: “grand claims for the service revolutions that open data may bring about are overstated; though more modest claims can be grounded in evidence” (Kuk and Davies 2011, pp.15). As a result we see that the potential for Open Data for service innovation has been demonstrated in several ways, but in practice there are several challenges that need to be overcome. In our SLR study we found two papers that specifically focused on diffusion and adoption of Open Data. However, they are related to the supply-side of the Open Data Services framework (Janssen et al. 2012) and (Barry and Bannister 2014). Both these contributions used the lens of Institutional Theory (Scott 1995) to investigate the benefits and the barriers to the diffusion of Open Data, in terms of obstacles that governments face and need to overcome to release their data and make them “openly” available. Thus, we conclude that there is a clear research gap concerning the investigation on how Open Data diffuses for new service development, in order to achieve the benefits that have been strongly claimed in literature, and surprisingly not yet achieved in practice. As a consequence the following research question was formulated for this study:

What are the factors that influence the diffusion of Open Data for new service development?

### **3 KEY RESEARCH DECISIONS**

This section is dedicated to the key research decisions that have been taken to guide this study. Three different paragraphs will be included. The first will describe choices in terms of philosophical underpinnings and will argue why inductive reasoning through qualitative data collection and analysis was employed. The second will present Case Study research as a suitable methodological guidance for this study. Finally, within the third, a reflection upon the role of theory in this project will be provided.

#### **3.1 Research Philosophy and Reasoning**

All research is based on some underlying assumptions about what constitutes “valid” research and which research methods are appropriate (Myers and Avison 1997). Across different fields of study, a wide range of research perspectives and paradigms operate concurrently (Burrell and Morgan 1979), (Astley and Van de Ven 1983). Given the usually complex and indeterminate nature of research studies, “the existence of a plurality of perspectives allows the exploration of diverse questions and hence adds breadth as well as depth to the knowledge generated” (Orlikowski and Baroudi 1991). In other words, “questions of methods are secondary to questions of paradigms” (Guba and Lincoln 1994). In general, the results of different combinations of ontological and epistemological choices are classified across three general research paradigms (Guba and Lincoln 1994) (Orlikowski and Baroudi 1991): Positivist, Critical, and Interpretive.

The purpose of this research project is to investigate the factors that influence the diffusion of Open Data for Service Innovation. Despite the well acknowledged Diffusion of Innovations Theory (Rogers 2005), our SLR showed that there is a substantial lack of theoretical insights specifically related to the recently introduced academic conversation of Open Data Services (Lindman et al. 2013b). As a consequence, to pursue a confirmatory way of research from well established theories (i.e. positivist approach) is not believed to be a beneficial strategy. Furthermore, it is not the scope of this study to criticize existing social systems and “reveal any contradictions and conflicts that may inhere within their structures” (Orlikowski and Baroudi 1991). Therefore, an interpretivist perspective is considered as the most suitable for this project. The resulting paradigm assumed for this project is Social Constructionism. The origins of Social Constructionism can be traced in interpretivist approach to thinking. Burr (1995) acknowledges that (Berger and Luckmann 1967) had a major influence to the development of this paradigm. In the IS field, given its nature, the conventional dichotomy between the social and the technical is problematic as technical and social choices are constantly negotiated and

socially constructed (Bloomfield and Vurdubakis 1994). Ontologically, the basic premise that is made here is that the Open Data released by cities authorities diffuses among service developers through an apparently natural process, but that in fact is complex, and contingent on several social actors and activities. From the epistemological point of view, social constructionism has been adopted in IS as a thought concerned with unraveling how these phenomena are constructed (Mitev 2000). The results of this research will then be a social construction of reality, in which the knowledge that will be developed assumes a correspondence of meaning of subjects constructing the diffusion process of Open Data (i.e. the reality to be studied). This study, consistent with its Social Constructionist philosophical underpinnings, involves an inductive reasoning. Generally, inductive studies can be conceptualized as a set of steps (Glaser and Strauss 1967). Huff (2008) summarizes them as follows: (1) extensively describe an interesting situation without use specialized vocabulary from existing academic literature; (2) create a first level of substantive categories by coding these descriptions; (3) modify and improve codes as additional data are collected, categorized and compared; (4) expect theoretic insights to emerge as categories stabilize and their relationships become apparent (5) conclude empirical observation when new categories are not required to account for further observations (Huff 2008).

Finally, another choice in research that is acknowledged as being fundamental across several disciplines is that between qualitative and quantitative approaches. We decided to adopt the former approach for two main reasons. First, the emerging concept of Open Data for Service Innovation, due to its novelty, must be investigated through an exploratory-oriented study, as opposed to a more confirmatory one from well established theories (which would lead to a more quantitative approach). Secondly, as the reality of Diffusion of Open Data for new service development will be analyzed from the meaning given by the people that are actively involved in constructing such reality, qualitative research methods are appropriate as they are “designed to help researchers understand people and the social and cultural contexts within which they live” (Myers and Avison 1997). In other words, this study must generate rich data, meant as data that enable thick descriptions, thick interpretation, and thick meaning (Ponterotto 2006). Miles and Huberman (1994) have strongly advocated the strengths of qualitative data to place the phenomena of interest in their specific context, to generate rich descriptions, and, finally, to investigate the topic “from the inside” (pp. 255).

### **3.2 Research Methodology: Case Study**

As a result of a comparative analysis between different methodologies employed in interpretive/constructionist qualitative inductive research (with a specific focus on IS), Case Study research was found to be the most suitable for the purposes of this research. Case study research is the most common qualitative method used in IS (Orlikowski and Baroudi 1991). Although there are numerous definitions, Yin (1994) defines the scope of a case study as follows: “a case study is an empirical inquiry that (1) investigates a contemporary phenomenon within its real-life context, especially when (2) the boundaries between phenomenon and context are not clearly evident” (Yin 1994, p. 13). Hence, Case Study Research is a qualitative approach in which the investigator explores a bounded system (a case in a specific setting/context) over time, through detailed, in-depth data collection involving multiple sources of information, and reports a case description and case-based themes. As a summary the choice of Case Study research methodology was motivated by several factors. These are seen as both strengths of the methodology itself arose from the literature and coherent aspects in relation to the purposes of this research and its philosophical, reasoning, and approach choices. In particular, Case Study:

- Is a methodology consistent with Social Constructionism, Inductive Reasoning, and Qualitative Approaches (Stake 2006), (Walsham 1995), (Eisenhardt 1989), (Eisenhardt and Graebner 2007), and (Lauckner et al. 2012).
- Ensures richness and depth in order to understand the phenomenon of interest (Anaf et al. 2007), (Flyvbjerg 2006), and (Stake 2006).

- Enables the exploration of complex situations allowing for the gathering of multiple perspectives, from a range of sources, including contextual information (Stake 2006), (Flyvbjerg 2006), and (Lauckner et al. 2012).
- Is particularly useful when the unit of analysis is a process, which is compatible with the research question of this study (Stake 2006), (Walsham 1995), and (Lauckner et al. 2012).

In the context of the constructionist paradigm in which this research is situated, Yin (2003) and Stake (2006) emphasize the importance of establishing a specific framework that structures data collection in a case study. Inductive qualitative case study researchers usually combine multiple data collection methods (Eisenhardt 1989) and keep the design of the process flexible. The main reason of combining different methods is described in (Eisenhardt 1989) as “providing stronger substantiation of constructs” (pp. 538). While observation was a natural source for collecting data during the time we spent within the case, document analysis (i.e. organizational website, newspaper articles, company reports and regulations, and policies) and interviews were chosen as the other main sources for the data collection process. In interpretive IS case studies, as an outside observer, Walsham (1995) argues that interviews are the primary data source, “since it is through this method that the researcher can best access the interpretations that participants have regarding the actions and events which have or are taking place, and the views and aspirations of themselves and other participants” (Walsham 1995, pp. 78).

### **3.3 Role of Theory**

The central notion is to use a case study as the basis from which to develop theory inductively. “The theory is emergent in the sense that it is situated in and developed by recognizing patterns of relationships among constructs within cases and their underlying logical arguments” (Eisenhardt and Graebner 2007, pp. 25). In this way, it is important to reflect upon the use of theory. Our research question can be classified as phenomenon-driven, i.e. that focuses more on the importance of the phenomenon and emphasizes the lack of explanations given by existing theory. Within the Open Data Services ecosystem, this project investigates the diffusion process. As a consequence, the main high level theoretical concepts to bind the research within these boundaries need to be considered. The term “high level concepts” is here written in order to emphasize the need of avoiding the risk identified by Galser and Strauss (1967) when they state that covering “all the literature before commencing research increases the probability of brutally destroying one’s potentialities as a theorist” (pp.253). IS literature on Diffusion of Innovations is plentiful (Nakicenovic and Grubler 1991) and several IS studies have focused on identifying factors that influence the diffusion of particular innovations (Quaddus and Xu 2005), (Norton and Bass 1987). Most of these studies used the models proposed by Ajzen and Fishbein (1980) and Davis (1989). In general terms, these authors suggested that some external factors affect the perceptions about an innovation, which in turn impact the diffusion of such innovation. This model is generic in nature and is likely to be applicable in most IS innovation diffusion processes (Quaddus and Xu 2005). As a consequence, the term diffusion in the definition of the focus for this study is structured as follows: “External Factors” → “Perceptions” → “Diffusion”. This simple scheme will allow us to bind the data collection and analysis from the case that will be studied within the diffusion process without constraining too much the research and subsequently limit both the flexibility of the study and the quality of the findings.

## **4 THE CASE STUDY**

The case study selected for this research offers a range of Open Data Services in a major European city (the name of the company is omitted to ensure anonymity). First, at a volunteer level, an idea emerged with the goal of improving (and creating) potential tourism opportunities in an area located close by the city. This area, despite the presence of numerous cultural attractions, was at the time underexplored by the numerous visitors passing by (the city’s International Airport is located in the

area and over 18 million visitors pass through it annually) and underexploited from the local authority and community.

This case was selected for several reasons, including: (1) this case is represented by a business that offers one or more services designed from one or more city-based Open Dataset(s) that satisfy a want or need within a market; (2) as a consequence of the previous point, the case is relevant to study the *Quintain* (Stake 2006) that is the factors that influence the diffusion of Open Data for Service Innovation; (3) since the very first contact with the case, a significant interest was observed from the CEO of the company to take part of this study. In addition, the subject responsible for the company and its activities ensured us the possibility of conducting interviews, and to collect relevant documents and material; (4) the company and its people are based in a location that allowed us to conduct data collection processes in person. In addition, more flexibility in scheduling the various meetings was gained as well; (5) the CEO of the company is also actively involved in the Open Data ecosystem outside his company. Thus, useful insights from the broader context are expected to emerge and to enrich the case study outcomes. The data collection process involved multiple semi-structured interviews with the CEO of the company, observations, and both internal (company reports and presentations) and external (e.g. city council reports, publicly available news) documents. Finally a last meeting with the CEO was undertaken to ensure that correct interpretation of the data collected was achieved.

#### **4.1 The Open Data Services Offered**

The Open Data Service offered by the case was described as a “Citywide Consumer Facing Tourist Platform” (Local Council Report 2012). Since the first pilot was developed, the service was gradually refined until it became integrative part of the local Open Data ecosystem.

The service was initially conceived as a way to create a “Historical Challenge” (Company Report) from the city council’s Historical Dataset. In this challenge, users “are encouraged to discover historical and cultural sites in the area through an innovative Find and Reward Facebook App and Mobile Website” – the CEO stated. In other words, people undertake a game/challenge in which they need to find and match their locations with the ones of the cultural sites. The game ends when the user is able to check into three cultural sites. If he or she has done so, a reward of a voucher for a free tea or coffee is provided. Since then, a wide range of Open Data provided by the local authority was integrated into the application. According to the documentation collected, these datasets include: (1) top cultural attractions: information about Culture and Entertainment, Museums and Galleries, Tours, Zoos and other attractions. All these types of information are provided from the original Open Data portal through 10 different datasets. These include both localisations and descriptions of the main cultural experiences in the area; (2) transport: within this category data about Buses, Trains, Trams and Bicycles are used; (3) food and nightlife: localisation and general information (e.g. meals, offers, and opening times) are taken about bars and restaurants in the area; (4) outdoor locations: here localisation and information about Scenic Locations and other Natural Heritage Sites are taken from the city council’s Open Datasets; and (5) accommodations: finally, Open Data about Hotels, B&Bs, and Apartments are integrated in order to support visitors in finding a suitable accommodation for their stays. The ensemble of these datasets is believed to include all the information that people need when they visit the area. The broad range of information included is believed to fully improve visitors’ stay in the city.

The integration of such information and the delivery of the service enable three main outcomes defined by the CEO as: (1) Mobile, (2) Social, and (3) Analytics. In general terms, according to the CEO of the company, the first includes all the outcomes in terms of information and experience provision to the users’ mobile phones including Gaming Experience, Real Time Buses, Trains, and Trams, Maps, Transport, and locations and information within the Food, Nightlife, Outdoors, Professional, Shops, and Accommodation categories. The Social component is a result of the interactivity aspect of this Open Data Service. In detail, the application collects Users Reviews and

Updates, information about preferences within the visiting experience. It also provides a platform for sharing experiences with other actual or potential visitors. Finally, at the Analytics level, the CEO explained: “If we have the application we can track, we can discover patterns, we can do the enjoyment level, and where does that go? That is a government attraction and we can then analyse this information at an Open Data level”. Hence, innovative analytics capabilities implemented on the data stored and collected (from both the usage experiences and the result of the above explained Social outcome) enable the discovery of User Tracking, User Preferences, Top Patterns, Top Attractions, Top Routes, Visitor Enjoyment, and Buying Patterns. All this precious information is then released to the council and/or as Open Data. This is consistent with the objective of the company of being part and fostering the local Open Data ecosystem. Thanks to the highly scalable solution, the company is currently expanding the service outside the country across those cities where the data needed is made available by the local authority as Open Data.

#### *4.1.1 Design and Technical Characteristics*

The application is designed using HTML5. This internet standard is characterised by interoperability across browsers. This means that the application “runs over any browser meaning that there is no need to design individual applications for specific devices”. The application is quickly updated and added through loading the related Open Dataset from the city council. The mobile app and the website are integrated with Facebook Timeline application, and they serve as a single entry point for getting all the information needed to visitors. The Content Management System is designed as a single entity in order to allow businesses and tour operators throughout the city to update events, business listings, and deals. This information directly populates the application’s database. Finally, a central platform is in place to enable incoming contributions from the city council, businesses, and the community. By designing this platform, dynamic information is obtained.

## **4.2 Qualitative Data Analysis**

The common thread is that all qualitative modes of analysis are concerned primarily with textual analysis (whether verbal or written) (Myers & Avison 1997). In fact, all the qualitative data collected in relation to the case were in a textual form. In particular, interviews were transcribed, documents and the website were collected as texts, and finally data from observation and informal meetings and discussions on site were collected and stored through field notes.

As the outcome of this study we aimed at identifying a range of factors and associated variables as well as the links between these factors that influence the diffusion process of Open Data for new service development. This implies that from a wide range of data collected from the case, the analysis process has the goal of encapsulate it within meaningful categories and links. Generally to this process the term “coding” is assigned in literature (also the terms “data condensation” or “data distillation” were used to describe this process (Tesch 1990)). Thus, it involves subdividing the data as well as assigning categories (Dey 1993). All in all, coding allows the researcher to communicate and connect with the data to facilitate the comprehension of the emerging phenomena (Basit 2003). We chose manual open coding (as opposed to coding facilitated by software) primarily because of the social constructionist nature of this study. After transcribing the Semi Structured Interviews (SSI), summarizing field notes and collecting other documents, the steps that were implemented were (Miles and Huberman 1994), (Darke et al. 1998), (Berg 2001), (Patton 2002): (1) manually review the transcripts, line by line and sentence by sentence, and all the data collected to uncover key patterns/themes and produce key words/phrases (indicated as “key statements” in this document); (2) produce labels/categories of these key words/phrases. Identify high level factors and corresponding variables and formulate tentative assertions about those for which strong evidence is found; (3) look for relationships among the factors; (4) develop raw tables of factors variables and their links for the case study; (5) ensure correct interpretation of the data has been achieved. The first step of this process referred to a line by line review of all the data collected. The key statements emerging from this

review were classified based on the three main concepts of Diffusion of Innovations (see paragraph 3.3). In particular, we distinguished concepts referred to External Factors, those related to Perceptions and ultimately those concepts that referred merely to the actual Diffusion process. As a result, 264 statements fell in the External Factors' category, while for Perceptions and Diffusion 177 and 67 statements arose respectively. Due to the high number of concepts, these needed to be divided into more focused units of analysis. After reading several times these statements, we classified them in ten different clusters that are presented in Table 1.

Cluster	Description	Key Statements
A	External Factors related to Open Data and dataset characteristics	73
B	External Factors related to the organization	67
C	External Factors related to the city	62
D	External Factors related to the Open Data ecosystem	105
E	Service Characteristics	59
F	Other External Factors	12
G	Perceptions about usefulness of Open Data	83
H	Perceptions about Open Data Services business opportunity	42
I	Perceptions about city opportunities	60
J	Perceptions about Open Data Services users	45
K	Other Perceptions	6
L	Diffusion	67

Table 1. Clusters in Case Study Analysis

For each of these clusters, tentative assertions about the case were formulated. In particular, similar statements across different sources were grouped together. When strong evidence (estimated as evidence from at least two sources of information) was found, tentative assertions were formulated about the factors. Related variables and links were explored and defined subsequently. Finally, an additional meeting within the case was undertaken with the purpose of ensuring that correct interpretation of the data collected has been achieved. From this last interaction 1 more factor and 6 more variables emerged as critical.

## 5 RESULTS

In conclusion, from this Case Study 16 general assertions were formulated in relation to 16 different factors (8 External Factors and 8 Perceptions Factors) influencing the Diffusion of Open Data for new service development. Furthermore, in relation to the Diffusion Factor, 8 additional sub-factors emerged. Each of these factors is described by a set of variables, and links between factors were derived as well. The resulting diffusion factors model is depicted in the following page (see Figure 1). A description and discussion upon these factors is provided in the following subparagraphs.

### 5.1 External Factors

In total, 8 External Factors emerged from the case study analysis. As expected, the *Open Data Characteristics* arose as a critical aspect influencing its diffusion for new service design and deployment. In detail, the provision of *Free of Charge Timely Data* that is *Accurate* and provided of a

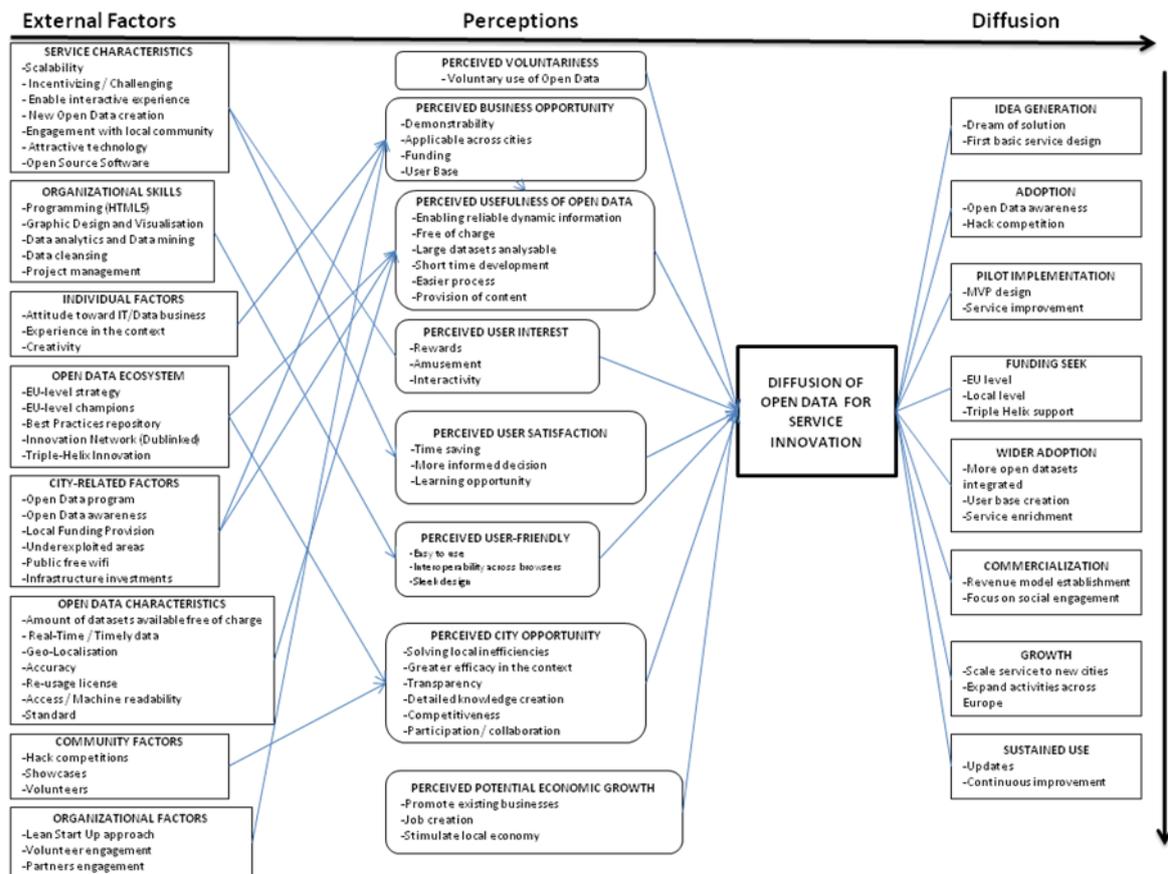


Figure 1. Open Data Diffusion Model for Service Innovation.

*Re-Usage License* and a common *Standard* were key drivers for perceiving Open Data as useful for Service Innovation purposes. In addition, the data had to be assigned of a location and had to be *Machine Readable* in order for the company to develop an effective solution. Such solutions' characteristics also emerged as critical for this process. In particular, the Open Data Service had to attract users (so had to *Enable Interactive Experiences*, had to be *Challenging / Incentivizing*, and had to foster locals to engage with visitors). Secondly, in order to augment a perceived business opportunity, the service had to be *Scalable*. According to the CEO, the “big work has to be done once only” and, from there, growth is enabled by generalizing the first solution to other cities. In other words, once the service is designed for one city, different datasets can be loaded into the system “quickly” making the service available in other cities as well. Critical in this way was the design of a “single Content Management System across datasets”. Finally, another critical service’s characteristic emerged to be crucial is its ability to create new Open Data (see section 4.1). The results of the Analytics step (i.e. discovery of User Patterns, Enjoyment Level, Top Patterns etc.) were described by the CEO as a “crowd sourcing of valuable data for the local authority to be also released as Open Data to foster the overall ecosystem”. In this case, this “secondary” production of Open Data was critical to establish a “win-win” relationship with the local council. Indeed, as a consequence of the company improving local Open Data, the related council was stimulated to efficiently and effectively release the data that is needed to sustainably delivering the service. In addition to this, by investigating how new cities are targeted by the company, it emerged that also *City-Related Factors* influence the diffusion of Open Data for new service development. In this way, cities need to have an established *Open Data Program* in place, as well as an infrastructure (e.g. “wireless sensor network around the city”) to foster the dynamic generation of “near real-time” Open Data. Another variable within this factor emerged to be the presence of underexploited areas from a tourism perspective. Thus, once all these aspects are in place, certain *Organizational Factors* are needed to transform the open dataset into a service with the above mentioned characteristics. These include the internal availability of certain skills, including:

*Programming, Graphic Design and Visualisation, Data Mining and Analytics, Data Cleansing, and Project Management* skills. Instead, from the *Organizational Structure* point of view, it was critical for the case to adopt a *Lean Start-up Approach* and to *Engage with Partners* (i.e. data suppliers) and *Volunteers* (especially at initial stages) “to reduce risks while gaining trust in the data and the council”. Connected to this, it also emerged the importance of having in place a (and be engaged with) *EU-Driven Ecosystem*, for fostering the creation of new Open Data Services. This should include *Funding Provision* (a big emphasis was put on European Horizon2020 Programs, <http://ec.europa.eu/programmes/horizon2020/>), *Best Practices Repositories* promoted by *EU-Level Champions*, and the presence of *Triple-Helix* mechanisms for innovation (i.e. involving governments, industries and universities (Etzkowitz and Leydesdorff 2000)). Finally, *Individual Factors* such as *Creativity* and *Experience in the Context* also emerged as critical for the case to adopt Open Data.

## 5.2 Perceptions

From the 5 clusters defined for the Perceptions’ category, 8 factors described by a total of 27 variables emerged as critical in the case’s Open Data adoption process. First, as a result of city-related issues and from the individual experiences in the context, a *Business Opportunity* was perceived by the case which in turn augmented the *Perceived Usefulness of Open Data* for achieving such opportunity. In particular, it was observed that this perception increases as the *User Base*, the *Availability of Funding*, and the *Applicability across Cities* of the proposed solution increase. Regarding the latter, beside *Scalability* of the service, it resulted critical the ability of the solution to demonstrate its intrinsic added value for the city and the local community. Subsequently, “it was easier for the company to convince other councils to establish a win-win relationship”, and so to foster expansion across cities of the Open Data Services proposed. This set of perceptions, together with the availability of Open Data with certain characteristics (see above) and the presence of a long term Open Data strategy (at both the local and broader levels), contributed to the development of *Perceived Usefulness of Open Data*. Here Open Data was perceived valuable for the design of the final service in relation to its ability to provide the content for the final solution in terms of *Free of Charge Dynamic Reliable Information*. With this structured content, it was then “easy and quick to pull the database into the application” – the CEO stated. Another important factor that emerged as influencing the Open Data diffusion process for new service development is referred to the *Perceived Opportunity by the City*. In fact, the local councils were incentivized to release valuable Open Data (i.e. fundamental requirement for the successful service development) from several points of view. First, cities identified opportunities for improving the overall tourism and cultural sector. Secondly, as a result of the “secondary” creation of Open Data from the company, *New Detailed Knowledge Creation* (that fostered the city to “solve local inefficiencies in the context and to take more informed decisions”) is enabled. Thus, the overall local Open Data landscape results subsequently improved. In this way, it emerged that cities increased their competitiveness in terms of ability to attract new capitals by giving businesses the opportunity to create new Open Data Services. Therefore, *Perceived Potential Economic Growth* significantly contributed to ensuring long-term commitment towards Open Data from the local authorities.

Three additional sets of perceptions emerged from the case in relation to the users of the service. In the specific, they refer to three stages of interactions between users and the service, i.e. before, while, and after using the service. In relation to the former, 9 Key Statements referred to the *Perceived User Interest*. Secondly, 11 Key Statements emerged in relation to providing an “easy-to-use” solution. Finally, the latter is referred to a number of Key Statements about the *Perceived User Satisfaction* enabled by actually using the service. Finally, from the experiences of the CEO in the overall ecosystem it arose that also voluntary use of Open Data influences its diffusion for service innovation.

## 5.3 Diffusion Process

The last category refers to the actual Open Data Diffusion observed for the Open Data Services’ company analyzed in this research. In this cluster, 8 sub-factors emerged as an outline of the diffusion

process undertaken by the case. In first place, as a result of the individual experience in the context an idea to solve local inefficiencies and exploit the related opportunity was generated. Awareness and subsequent adoption of Open Data for these purposes were achieved by the case when the CEO took part in (and won) the local Open Data competition. From there, a pilot for the initial local area was designed and deployed. As a result of this step, the company was able to demonstrate the potential value achievable from the Open Data Service developed. Thus, the case successfully applied to a European funding scheme in cooperation with the local government and universities. Hence, with the official start of the collaboration project, more open datasets were released by the local authority and integrated into the service. These enabled a significant enrichment of the solution, giving the case the opportunity of developing revenue models on top of the experience offered. In fact, it was through the new datasets that the company had the possibility to include (and charge) local businesses and people (e.g. restaurants, tour guides, hotels, private transport bodies) as integrative part of the Open Data Service. From there the solution is being scaled to other urban environments where the data is made available and long-term commitment from the public authority is in place and ensured. Finally, as a consequence of this aspect, the Open Data is provided complying with the company's needs and systems, enabling the business to sustainably use Open Data as the base for the services offered and the related business activities.

## **6 CONCLUSIONS, LIMITATIONS, AND FUTURE WORKS**

In this paper an interpretive case study on Open Data diffusion for new service development was presented. The paper contributes to the ongoing Open Data Services academic debate by systematically demonstrating that 16 main factors (described by a total of 68 variables) influence this diffusion process. These results give more structured understanding of the demand side of the Open Data Services ecosystem, filling part of the broad gap identified in (Lindman et al. 2013b). In addition, the identified factors led the case to overcome many of the barriers identified in (Janssen et al. 2012) and (Barry and Bannister 2014). In this way, we believe that also practitioners, from both the supply and the demand-side, can benefit from these results. In particular, numerous insights are provided to local authorities on what actual (not potential alike several other IS studies) valuable Open Data for new Service development is, and how and why they should commit for sustainably releasing it. On the other hand, the analysis of the Open Data Services and the Organizational Characteristics, as well as the overall diffusion stages successfully undertaken by the case, is also expected to be a significant contribution to practice. In fact, we believe that the results achieved will give a useful base upon which businesses and people that want to undertake this journey can evaluate and build their Open Data Services initiatives. Moreover, these findings represent in our opinion several aspects to be further investigated as a potential contribution to the broad Diffusion of IS Innovations literature.

In addition, the suitability of Social Constructionism assumptions, and, particularly, of interpretive case study to inductively generate theory was demonstrated as a suitable way of conducting empirical research in this field. Nevertheless, we also acknowledge a potential limitation for this study. Despite generalized outcomes from one case study are achievable (Flyvbjerg 2006), (Yin 2003), (Eisenhardt 1989), this debate is still ongoing. In this research, by assuming a Social Constructionist philosophical underpinning the process was kept coherent and consistent from its problem definition to the formulation of the final outcome. However, in order to provide a stronger contribution to existing theory, some case study methodologists argue that Multiple Case Study is a more viable option (Stake 2006). Thus, future research will involve more cases with context-related diversities. As a result, additional aspects and stronger assertions are expected to emerge when conducting analysis across cases.

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