CO-CREATION WITH OPEN GOVERNMENT DATA:

A Constructivist Approach Using a Multiple Case Studies Strategy from an Information Systems Perspective

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By

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to

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Declaration

I certify that all work in this dissertation is entirely my own work, except where otherwise acknowledged, and it is entirely original and has not been submitted to any other purpose.

I declare that this research is in compliance with the ethical research requirements of the School of Computer Science and Statistics.

I also declare that this thesis has not been submitted as an exercise for a degree at this or any other university.

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Summary

Open Government Data (OGD) initiatives are spreading worldwide. One use of OGD is the co-creation of applications and web services. Both OGD and co-creation concepts can be viewed from different perspectives as there are multiple definitions for both in circulation. The core concept of OGD is making data available for public use, while for co-creation the core concept is the cooperation in the provision of a product or service; whether that cooperation is between a business and its customers, a local authority and its citizens, or a combination of several parties. In essence, the customer/citizen changes from being a passive recipient of a product/service to becoming an active participant in its creation, design and delivery. In this research, co-creation refers to joint activities by interested parties in creating value (that can be a service, a product, or even an idea) using OGD. This research investigates one specific manifestation of co-creation, i.e. the co-creation process between Local Authorities (LAs) as providers of OGD and other parties who are interested in using these data. This research was carried out in four Irish LAs within the greater Dublin area and explores views from international experts, civil communities, academic experts, developers, and voluntary organisations as well as a number of government agencies.

Although there have been many studies about both OGD and co-creation in recent years, there remains a need for a deeper understanding of the potential, practice and impact of OGD on co-creation. In OGD research, on the one hand, many studies tend to focus on data architecture rather than the uses of OGD. On the other, most studies within the co-creation field focus on its commercial aspects (i.e. between customers and (commercial) companies). A review of the OGD literature shows that there have been no studies to date examining its impact on the phenomenon of co-creation, although a number of studies have discussed the link between the two. The effect of OGD on co-creation in Dublin is not fully understood because this phenomenon is still in its early stages of development. There is, therefore, a gap in the current state of knowledge which opens up opportunities for researchers to address this gap.

This research addresses two questions. First, how and to what extent are different communities making use of OGD in Dublin? Second, how effective are OGD in facilitating co-creation? To answer these two questions this research uses Activity Theory (AT), which is first further developed and then used as a theoretical framework. Classic AT includes six aspects: subject, tools, object, rules, community and division of labour. In this research, AT is extended by adding four more aspects: motivations, barriers, level of awareness, and effectiveness. This modified AT model is then used to create the interview questions and to facilitate the analysis phase by categorising the interview transcripts on themes based on the extended AT constructs.

A constructivist approach is adopted to rationalise the construction of meaning obtained/conveyed from the social context of the interviews and participant observations conducted in this research. The research takes an interpretative philosophical perspective through the usage of multiple qualitative methods (website analysis, semi-structured interviews and participant observation) for the data collection phase. The data are analysed using a thematic analysis technique with the assistance of NVivo software.

The findings are classified into three main categories: people's activities, investigating the concept of co-creation and, finally, investigating the effectiveness of OGD for co-creation. The first category, i.e. people's activities, showed that the four Dublin LAs and other participants held different perspectives about the activities and objectives of using OGD in light of the extended AT model constructs. This research reveals that the participants lacked any uniformity in their views towards the concept of co-creation; different participants understood it differently. Lastly, regarding the effectiveness of using OGD, respondents found effectiveness difficult to define and measure. In general, most of the responses showed a negative perception of the current effectiveness of OGD. Based on the research findings, this research presents three contributions in the IS field: advancing the knowledge of co-creation within the OGD context, enriching and evolving the AT model and building a model of factors that facilitate a vibrant and productive co-creation process. It is anticipated that if the recommendations in the co-creation model are taken into consideration by all the interested parties, this will improve the value generated for all parties of co-creation using OGD in the long term.

Dedication

To King Abdullah Bin Abdulaziz al-Saud,

To my uncle, Suliman Khayyat,

To my close friend, Lubna Ghaznawi,

With a heavy heart, to those who passed away while I was carrying out this PhD research.

Acknowledgements

Special thanks to special people who helped me to complete this degree:

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Finally, this acknowledgement will be incomplete without thanking all the people who supported me in making this work a success, and researchers who made their work accessible to motivate me and others.

I will say as the Irish people say, “Thanks a million” or “go raibh maith agat”!

Abstract

In recent years, many governments have begun to realise the benefits of publishing government data for citizens to access and use. The use of Open Government Data (OGD) has been spreading globally as governments make more of their data available in electronically-accessible formats for the public to use and share. One use of such data is for the co-creation of applications and web services.

The aim of this research is to establish what facilitates co-creation activities when using OGD. Co-creation is here defined as the joint activities undertaken by interested parties to create value (that can be a service, a product, or even an idea) using OGD. In order to take a holistic view of this emerging area of OGD, this study is broadly based on many aspects of publishing and using OGD.

This is a multi-dimensional study covering ten constructs of the extended Activity Theory (AT) as a theoretical framework. Multiple case studies are used to investigate the existence of co-creation using OGD in the city of Dublin. This research adopts constructivist and interpretive philosophical assumptions. It is carried out in two stages. The first stage involves exploring the state of the main two OGD websites in Dublin local authorities (LAs): Dublinked and Fingal Open Data. The second examines in detail OGD activities and projects that have been undertaken by various Dublin communities and LAs. The examination has been achieved by conducting participant observation and semi-structured interviews. This research explores different views about how co-creation can be facilitated using OGD. Views are explored from LAs, international experts, civil communities, academic experts, developers, and voluntary organisations as well as a number of government agencies.

Analysis of the collected data is achieved by using a thematic analysis technique with the use of NVivo software. Based on analyses of the collected data, a model for encouraging, fostering, and enabling the development of co-creation projects is generated.

Abbreviations

OD: Open Data

OGD: Open Government Data

AT: Activity Theory

LAs: Local Authorities

CoCos: County Councils

IS: Information Systems

OKFI: Open Knowledge Foundation International

OKFN: Open Knowledge Foundation Network

FOI: Freedom of Information

PSI: Public Sector Information

TA: Thematic Analysis

Research Outputs

Papers published in journals:

Khayyat, M. & Bannister, F. (2015). 'Open data licensing: More than meets the eye'. *Information Polity*, 20, 231-252.

Papers presented at conferences:

Khayyat, M. & Bannister, F. (2014). 'Open Data Licensing: More than meets the eye'. Paper presented at the EGPA conference, 10-12 September, Speyer. Germany.

Khayyat, M. & Bannister, F. (2015). 'Exploratory Multiple Case Studies to Understand the Phenomena of OGD and co-creation in Ireland'. EGPA conference, 26-28 August, Toulouse, France.

Khayyat, M. (2016). 'A proposed model for the fourth generation of Activity Theory to be applied on the Smart City Research'. AIS Pre-ICIS Workshop on "IoT & Smart City Challenges and Applications" – ISCA 2016. Retrieved from http://iot-smartcities.lero.ie/wp-content/uploads/2016/12/A-proposed-model-for-the-fourth-generation-of-Activity-Theory-1.pdf

Wall, P., Khayyat, M., Lewis, D. & Hederman, L. (2016). 'Combining Critical Realism, the Morphogenetic Approach and Activity Theory: A Proposed Framework for the Study of Mobile Health (mHealth) in Sierra Leone'. Paper presented at the International Association for Critical Realism (IACR) conference. Postgraduate Teaching Centre, Cardiff Business School.

Posters presented:

Khayyat, M. (2015). 'Boost your Open Data with Co-Creation'. Retrieved from http://www.slideshare.net/dublinked/mashael-poster

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Khayyat, M. & Wall, P. (2016). 'Moving Beyond Interpretivism: Combining Critical Realism and Activity Theory to Propose a Novel Framework for Information Systems Research'. ICIS. Dublin, Ireland.

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Chapter 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

This chapter serves as the background for this research. It gives an overview of open data (OD), including open government data (OGD) and the co-creation of ideas, applications and web services using OGD by multiple parties. These parties include data providers, corporate bodies/companies, public organisations, academics, local community groups and individuals. The concept of co-creation is not new (see chapter 2). What is new is the engagement of new groups and players in co-creation processes. Developments in ICT have made possible the involvement of a whole range of players who, heretofore, would have not been in a position to engage in this activity. One of the best-known examples of co-creation is Fixmystreet.com, an application which enables citizens to take pictures of local problems (such as broken street lights or loose paving stones) and post them on a web site. By this means, the local authority can be made aware of such problems and can notify the public via the same website when they are fixed. With the growth of open government data, the number of possibilities for this and other innovative applications has expanded rapidly and, as was found in this research, the co-creation movement in Dublin is thriving.

This chapter provides information about Dublin and its four local authorities (LAs) since they are the four case studies in this research. The research gaps in the co-creation and OGD fields are then presented. Next, it discusses the research problems and questions. Finally, it displays context, theoretical framework, objectives and significance of the study, and the thesis structure of this research.

1.2 Research background

The past decade has seen the emergence of the phenomenon of so-called "Big Data". According to Lee *et al*. (2014, p.18), IBM claims that every day, 2.5 quintillion bytes of data are created which reflect the fact that 90 per cent of the data in the world today had been created in the last three years alone. Jetzek *et al*. (2013b, p.2) claim that the data

generated from surveillance cameras, Internet-based transactions and smart devices boosted the amount of data available in the digital universe to 2.8 ZB[1]. These statistics reveal, with more recent research, a lower amount of data being produced (Lee *et al*., 2014). However, while there is a disagreement about the actual number, there is a consensus that the rate of data being produced and the amount of data being stored over the last decade are reaching unprecedented levels.

Data are collected in various ways. Lee *et al*. (2014, p.18) state that governments collect data, for example, from sensors, environmental data, purchase transaction records, public-transport passenger data, hospital attendance figures, school exam results, health and safety indicators, employment levels and cellular phone GPS signals. One obvious question that emerges is what is the purpose of such data produced from these different sources?

In 2011, a movement towards open government partnership took place when eight governments[2] began endorsing an open government declaration that encouraged the transparency and sharing of data with citizens. Open Government (OG) is a broad term, widely used with various interpretations. One of the benefits of OG is:

> *"establish[ing] a modern cooperation among politicians, public administration, industry and private citizens by enabling more transparency, democracy, participation and collaboration"* (Bauer & Kaltenböck, 2011, p.9).

In this interpretation, Bauer and Kaltenböck (2011) mention the notion of modernity as a characteristic of OG. Their interpretation implies that emergent OG should endorse new ways of collaboration and participation between the government and the public. Kučera *et al*. (2012) claim that one of the most important enablers of OG is to provide free access to data and give freedom to use and reuse such data. This is because being open means, amongst other things, lowering if not removing any barrier that hinders the widest possible reuse of data by the public. Lee *et al*. (2014, p.18) state that governments produce vast

[1] The zettabyte (ZB) is a multiple of the unit byte for digital information. ZB is 10^{21} Bytes.

[2] The eight governments are those of the UK, USA, Brazil, Indonesia, Mexico, Norway, Philippines and South Africa.

amounts of data, some of which are available to the public, and this can be called open government data, while the widely-used term 'open data' (OD) refers to data beyond just governmental agencies. Thus, the concept of OD is broader than just government data because the government is just one source of OD.

According to the United Nations (2013), the concept of OD refers to "*information and data that should be made available for everyone to access, reuse, and redistribute with no restrictions*" (p.6). Government agencies generate a massive amount of information and data. If this information and data are made available following the principles of OD, then it can be referred to as 'Open Government Data' (OGD).

Definitions on OD and OGD vary. However, there are common threads and definitions. These are discussed in detail in Chapter Two.

1.2.2 Dublin

Cities worldwide are generating large volumes of data and facing a variety of challenges in managing infrastructure and providing resources and better services. Dublin, like many other cities, generates large volumes of data as a result of the interactions of its citizens with the city environment (buying/scanning travel tickets, general purchases, mobile phone use)[3]. Some of these data are generated by the LAs and public agencies and some by private companies delivering services in the city (transport, refuse, and retail); others are generated by residents and visitors. Some LAs, such as those in Dublin, publish the data online to facilitate data accessibility.

Dublin is the capital city of Ireland. Approximately 1.3 million people live in the greater Dublin area. Administratively, Dublin is divided into four LA areas: Dublin City Council (DCC), which is responsible for the city core; South Dublin County Council (SDCC), covering the south-west; Dublin Fingal County Council (Fingal CoCo), which covers the north side of the city; and Dún Laoghaire-Rathdown County Council (DLR CoCo), covering the south-east. Both Dublin South and Fingal include rural and farming areas. Figure 1.1 shows the four local authority areas on the map of Dublin.

[3] http://dublinked.wordpress.com/

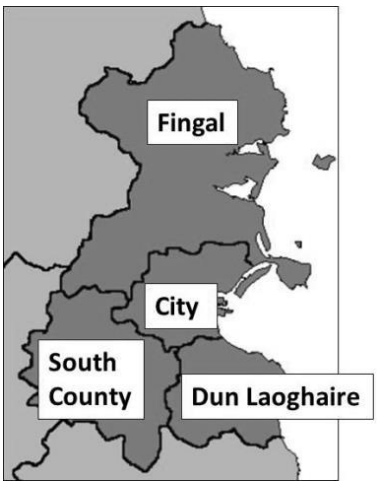


Figure 1.1 Map of Greater Dublin Area

Two of these authorities, Dublin City and Fingal, are the principal subjects of this research; the other two LAs are used as supporting cases. This is because Fingal CoCo has its own OGD portal and DCC started the Dublinked OGD portal which contains OGD from all four Dublin LAs. Table 1.1 shows some of the main portals in Ireland that provide OGD.

Table 1.1 Some Irish OGD portals

Websites	Comments
data.fingal.ie/	Fingal County Council is one of Ireland's leading proponents of OD. Fingal LA's IT department runs this service.
www.dublinked.com	Dublinked includes 250 datasets. It is run by Dublin City LA with coordination support from Maynooth University, infrastructure support from IBM and OGD from all Dublin LAs and other agencies.
data.localgov.ie/	The data.localgov.ie includes 138 datasets. It is a one stop shop for accessing local government services. It is run by the Local Government Management Agency (LGMA) for all LAs in Ireland.
data.gov.ie/data	The data.gov.ie portal includes 4,743 datasets. It is operated by the Government Reform Unit of the Department of Public Expenditure and Reform.

As shown in Table 1.1, there are portals for OGD at the city level and national level. This research covers only the city level (in this case Dublin).

Traditionally, local governments in Ireland have been quite adventurous in their use of information and communications technology (ICT). As far back as 1975, the Irish LAs set up a shared services operation, the Local Government Computer Services Board (Irish Statute Book 1975)[4], something that was in many respects well ahead of its time. In the spirit of this tradition of innovation, the Dublin LAs have been taking a leading national role in both the creation of OGD initiatives and the promotion of co-creation. In this research, co-creation refers to joint activities by interested parties in creating value (that can be a service, a product, or even an idea) using OGD. The team of Dublinked (2011) expresses their vision as follows:

> *"Our vision for Dublin is for a smart open city; open access to public data, open to new technology, open to new ways of working and new collaborations. Smart*

[4] Now part of the Local Government Management Agency

Dublin is a collaboration framework for Dublin that enables the co-creation of solutions to priority city region challenges."[5]

This statement clearly shows that the Dublinked team attempts to foster the co-creation process. Above all, the vision of smart Dublin is to adopt a framework to enable co-creation solutions to the city's problems. However, as soon became evident in this research, there is as yet no available and suitable co-creation model for them to act upon. It is worth noting that, according to the Global Open Data Index 2015[6], when it comes to the availability of OGD, the Irish national government has lagged behind (Ireland is ranked 31st), and at the time of writing this dissertation, it continues to lag behind many other OECD countries[7]. At the same time, the initiatives of local government communities in the city, notably those of technology specialists and developers, have become increasingly interested in exploiting local data to generate new information services, mobile applications, and web-based applications. A typical example of a co-creation initiative is a Dublin version of the well-known application *fixmystreet* called *fixyourstreet.ie*. This website enables citizens to view, report local problems, and share them with their LA, as well as pressurise those authorities to fix such problems and generally make improvements in their neighbourhood. Another example of co-creation is the website for tracking planning applications called Mypp.ie. A commercial company developed this application, which uses OGD to show details of planning applications on an interactive map covering most of Ireland. There are many other applications now available; others are still in the process of design. However, as highlighted in the Independent (2016), Ireland is facing big issues such as geopolitical tensions and debt. Consequently, the country is facing economic uncertainty, according to the Central Bank's latest Macro-Financial Review. In this scenario, one can wonder how the local government in Ireland can work on OGD – something that requires more resources. If the work is voluntary and carried out on an *ad hoc* basis it could be at risk of collapsing. A framework for collaboration between many parties is needed to help all interested parties in their co-creation process using OGD.

[5] http://dublinked.ie/about-us/

[6] http://index.okfn.org/place/

[7] The Organisation for Economic Cooperation and Development

1.2.3 OGD in different countries

While there are many concerns in relation to OGD such as licensing and privacy, in recent times many countries have encouraged the movement towards the opening up and publishing of non-personal data to the public because they acknowledged the benefits of such a movement (Oh, 2013). Lakomaa and Kallberg (2013) state that the first countries and states within a federal framework to open up data for citizens were North America, the UK, and Oceania[8]. They claim that there are:

> *"differences between the Anglo-Saxon common law countries such as USA, UK, Australia and New Zealand, compared to civil law and centralised government countries, such as Denmark, France, and Sweden, when it comes to the degree of access to government sector public information"* (p.559).

According to Lakomaa and Kallberg (2013), Anglo-Saxon countries are more open than others. This is quite surprising because historically Sweden was the first country to implement FOI.

According to dataportals.org, there are 520 portals for OGD around the world. Machado and De Oliveira (2011) list some OGD initiatives around the world, such as:

- USA Portal (http://www.data.gov/)
- UK Portal (http://data.gov.uk/)
- Australian Portal (http://data.gov.au/)
- New Zealand Portal (https://data.govt.nz/).

Some examples of OGD in the Middle East include:

- Saudi Arabian Portal (http://www.data.gov.sa/en/)
- Bahrain Portal (http://www.data.gov.bh/)

[8] Oceania is a region on the Islands of the tropical specific Ocean.

- United Arab Emirates Portal (http://www.government.ae/web/guest/uae-data)
- Oman Portal (http://www.data.gov.om/).

This shows that although the OGD field faces many challenges, many countries can see the potential of having OGD for the benefits of both governments and citizens.

1.3 Research problem

According to some scholars, OGD initiatives are spread worldwide (Davies *et al*., 2013). Yet, a deeper understanding of the potential and practice of OGD is needed in order to efficiently manage OGD. Moreover, in OD and OGD research, many studies tend to focus on datasets and data architectures (Hausenblas & Karnstedt, 2010; Umbrich, 2012; Larkou *et al*., 2013) rather than the impact and use of the data. Fitzpatrick (2012) states that although there is a myriad of active initiatives using OGD found around the world, most are still at the initial stages. Most studies of co-creation focus on the commercial aspects, i.e. between customers and companies (Kohler *et al*., 2011; Chen *et al*., 2012; Grönroos & Voima, 2013; Vernette & Hamdi-Kidar, 2013). A review of the literature shows that there have been no studies to date examining the impact of OGD on the phenomenon of co-creation, although a number of studies have discussed the link between the two (Maier-Rabler & Huber, 2012; Jetzek *et al*., 2014). The impact of OGD on co-creation communities in Dublin is not yet well understood as OGD is still in its infancy. Durugbo and Pawar (2014) state that "*co-creation as a research area is still at an early stage, and there is a need to formalise the co-creation process*" (p.4374). There are, therefore, gaps in current research and this creates opportunities for scholars in both fields. From this early stage of co-creation within the context of OGD, the research questions set out in the following section emerge.

1.4 Research questions

The main research questions posed by this study are:

- How and to what extent are different communities in Dublin making use of OGD?
- How effective are OGD in facilitating co-creation?

Based on the research questions, the following sub-questions are also investigated.

- What are the co-creation communities that are interested in using OGD?
- What are the objectives and motivations for communities or individuals in deriving value and engaging with OGD?
- What rules govern the use of OGD?
- Are there any challenges/issues/obstacles/barriers to publishing or using OGD?
- What tools are being adopted to utilise OGD?
- What is the structure of the co-creation team (the division of labour)?
- What is the level of awareness about using OGD for co-creation?
- What is the community/environmental impact on OGD activities?

By exploring these aspects, the aims of this research are to contribute to the understanding of the phenomena of both OGD and co-creation, and to facilitate the co-creation process among multiple parties.

1.5 Research context of OGD and co-creation

The participant observation component of this research included attending many meetings at which various parties (LAs employees, developers, corporates employees and academics) were working together in order to share ideas and apply them to create phone applications and web services. The participants at these meetings were *de facto* engaging in co-creation even if not all of them were aware of this term. In all cases use of OGD underlay the applications being developed though this was often supplemented with data from other sources.

This study examines OGD and co-creation communities in Dublin. Figure 1.2 portrays these two concepts to facilitate an understanding about how the connection between all parties is formed.

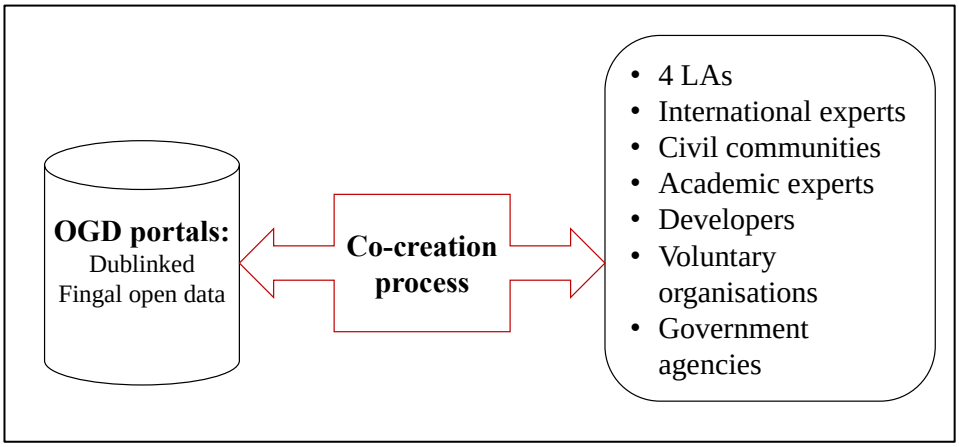


Figure 1.2 The research context.

The co-creation concept is presented in Figure 1.2 where both OGD publishers (the four Dublin LAs) and interested communities are working together to create ideas, applications, and services using OGD.

1.6 Theoretical framework and methods

The theoretical framework used in this research is Activity Theory (AT) because this theory's model includes six particularly relevant aspects of the phenomena to be investigated in order to answer the research questions. AT is discussed and developed. The development of the AT model is described in Chapter Three. AT within this research is used as a lens for designing interview questions, data analysis and structuring the data findings.

To answer the research questions, both primary and secondary data sources have been explored, including an extensive literature review, browsing OGD portals, participant observations, and semi-structured interviews. The literature review was conducted using a wide range of publication databases (including, inter alia, Science Direct, JSTOR, MISQ, the ACM digital library, Springer Link, the IEEE Xplore digital library, and Google Scholar) to identify academic and scholarly publications on OD, OGD, and co-creation. This exploratory study was carried out, adopting a constructivist approach for the construction of meaning obtained/conveyed from the interviews and participant observations. This research takes an interpretative philosophical perspective through the uses of multiple qualitative methods. It employs multiple case studies as the primary research strategy. The data is collected firstly by examining two portals of OGD:

Dublinked and Fingal OD. Second, semi-structured interviews with 48 participants and 11 participant observations were undertaken. Formal ethical approval from the university was obtained before the data collection phase. The data analysis has been completed using the thematic analysis technique employing NVivo software.

1.7 Research objectives and significance

The overall aim of this research is to gain an in-depth understanding of the current status of OGD in Ireland and how that can impact the involvement of urban communities in co-creating public goods using OGD. This includes investigating the processes whereby different communities exploit and make use of OGD, including the factors that facilitate or hinder such activities. This can help in conceptualising and developing a wider understanding about co-creation between government and interested citizens who are presented as co-creation communities in this research. Based on the findings, this research contributes the following outcomes to the field of knowledge:

- Advancing knowledge and understanding of two emergent phenomena, namely, OGD and co-creation;
- Enriching and evolving AT;
- Facilitating collaboration among OGD stakeholders by providing the co-creation model.

1.8 Thesis structure

This dissertation is comprised of seven chapters. The contents of each are as follows:

- **Chapter One** provides a review on the background of the research, introduces key concepts, and describes the research problem and questions. The chapter presents the research theoretical framework, together with the objectives and significance of the research. Finally, it outlines the roadmap for the whole thesis.
- **Chapter Two** concerns the literature review. It discusses the literature related to OD, OGD and their challenges and issues. It also examines research into co-creation. Some sections have been co-authored with Frank Bannister within this chapter and have

already been published in a co-authored, peer reviewed journal article. This applies to all the following sections with some amendments 2.2.2, 2.2.3, 2.2.7, 2.3.4 and 2.5.6.

- **Chapter Three** offers the theoretical framework. It discusses all generations of AT. The chapter proposes the augmented AT which is used as the theoretical model for this research.

- **Chapter Four** describes the research methodology. It underpins the philosophical stance, research design, and the methodology chosen to address the research questions. The chapter also presents how the data collection and analysis process were conducted.

- **Chapter Five** provides the research findings in categories supported with direct quotes and figures.

- **Chapter Six** analyses the findings, compares them with the literature, and presents the co-creation model. Again, some sections have been co-authored with Frank Bannister. This material is drawn from an article that, at the time of writing, is under revision for a peer reviewed journal.

- **Chapter Seven** presents the contributions, implications for practice, and limitations of this research. It also puts forward suggestions for future research. Finally, the concluding remarks of the whole study are presented.

1.9 Conclusion

In this chapter, the background information about key terms such as data, open government, OGD, and co-creation are introduced briefly as they will be discussed in detail in Chapter Two. This chapter showed that, to date, there has only been a modest amount of research into the use of OGD for co-creation and specifically into how and to what extent OGD enables civil communities (as opposed to corporations) to participate in public life and create public value. This research investigates a number of co-creation communities with the objective of gaining new insights into this phenomenon, and in particular how it can be fostered and supported by both government and the engaged communities. To achieve this, a multi-methodological approach is used in order to understand how co-creation can be facilitated by and within Irish local government. The Activity Theory (AT) is developed and used as the theoretical ground for data collection

and analysis phases. The outcome is the formation of the co-creation model to facilitate the work between multiple parties.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This chapter begins with a discussion of the background and definitions of some key terms and concepts. Key terms used include data, openness, transparency, and the notion of community. OGD and co-creation have been used in this research as key concepts. The literature review (LR) is divided into four main sections. The first, 2.2, discusses the OD literature. Section 2.3 explores the literature on OGD while section 2.4 outlines the barriers and challenges faced when implementing OGD. Finally, Section 2.5 examines the concept of co-creation. At the end of this chapter, the gaps identified in the literature lead to the research question. Figure 2.1 illustrates the chapter's structure.

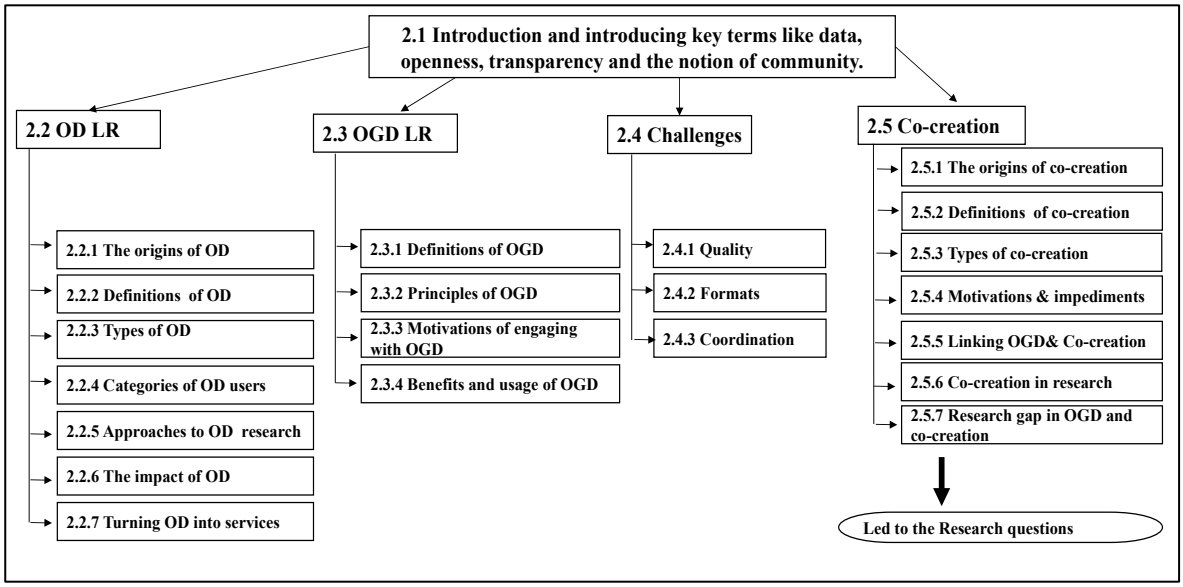


Figure 2.1 Chapter two structure.

2.1.1 Data, openness, and transparency

This section explains a number of concepts that are important in this research. Some are more straightforward to define and/or describe than others. Data, to start with, may refer to spreadsheets packed with numbers as stated by Cooper (2014), but also includes online

product reviews, the results of procedures in medical files, or the detailed data that accompany all online activity (known as metadata). He also highlights the value of providing data freely to any interested party and considers it to be a ‘philosophy’ called open data (OD) where big data and OD are differentiated.

Big data is defined by its size, whereas OD is defined by its use. However, Cooper (2014) fails to define OD by its availability. According to Davies (2012a), data within research is a broad subject as there are different terms that can be used to describe data; which can often create confusion. Different terms such as big data, raw data, OD, linked data, and real-time data are used and refer to different things. Table 2.1 shows the scope regarding the meaning of data.

Table 2.1 Research scope regarding the meaning of data

Source: Davies (2012b)

Data	Definitions	Potential implications
Big Data	Data that requires 'massive' computing power to process.	Companies and researchers can 'data mine' vast data resources to identify trends and patterns in big data.
Raw Data	Primary data, as collected or measured directly from the source, or data in a form that allows it to be manipulated, sorted, filtered and remixed.	Access to raw data can allow journalists, researchers, and the public to 'fact check' official analysis.
Real-time Data	Data measured and made accessible with minimal delay. Often accessed over the web through APIs (Application Programming Interfaces).	Data can support the development of 'early warning systems' (e.g. Google Flu Trends). 'Smart systems' and 'smart cities' can be configured to respond to real-time data and to adapt to the changing circumstances.
Open Data	Datasets that are made accessible in non-proprietary formats under licenses permit unrestricted reuse. If a government is providing the datasets, it can be called OGD.	Third parties can innovate with OD; generating social and economic benefits.
Linked Data	Datasets are published in the RDF (Resource Description Framework) format. Linked Data is a method of publishing structured data so that it can be interlinked and become more useful through semantic queries.	A 'web of linked data' emerges; supporting 'smart applications' that can follow the links between datasets. This provides the foundations for the Semantic Web.

Table 2.1 shows different meanings regarding the term 'data' depending on what adjective is used with it.

Other terms like openness and transparency may look similar, yet have subtle (and sometimes not so subtle) differences. To understand these terms, there is a need to take a brief look at how authors define them. Some authors incorrectly use the term 'openness' and 'transparency' interchangeably. One definition of openness refers to the unrestricted access to knowledge and information as well as cooperative management and decision-making without any restriction from a central authority (Peters, 2010). Peters considers transparency and freedom to be *characteristics* of openness.

The Openness Act in Finland, dating from 1999, reads as follows:

> *"All official documents shall be public, unless specifically otherwise provided in this Act or another Act ... [and] the right of access to official documents is included as a fundamental right in the new Constitution Act of 1999"* (Mäenpää, 2006, p.61).

Mäenpää describes this Act as fundamental since it forms one of the most significant guarantees of openness and transparency of public administration. Furthermore, Bertot *et al*. (2010) do not consider openness as an isolated entity such as OD portals; rather, they assume that openness transpires/occurs through government actions and e-government. Heald (2006) argues that unfortunately, in this era, 'transparency' might have replaced 'openness', though the two words carry distinct meanings. The critical difference between the two terms is that openness implies a willingness to engage, discuss, listen, and cooperate whereas transparency merely means visibility. Openness includes transparency, as Peters says, but is a much wider concept.

There are numerous worldwide transparency and openness initiatives. Bertot *et al*. (2010) list some countries that are adopting the transparency and openness initiatives as shown in Table 2.2.

Table 2.2 Transparency and openness initiatives

Adapted from (Bertot *et al.*, 2010)

Country	Transparency and openness initiatives
India	The Indian government posted rural property records online, which greatly increased the speed at which the records are accessed and updated. At the same time, these online records help in diminishing opportunities for local officials to accept bribes, an activity that had previously been widespread.
Philippines	The Philippines Department of Budget and Management started an e-procurement system for government agencies in order to prevent price fixing and at the same time promote public accountability.
Chile	ChileCompra is an e-procurement system that has been used to allow government officials and citizens to compare the costs of bids and services purchased by the government.
USA	Websites have been created in the United States to allow access to government data to enable the public to monitor government spending with the aim of faster identification and the elimination of wasteful projects. For example, websites of general funds (www.usaspending.gov), expenditure (www.recovery.gov), and information technology funds (www.IT.usaspending.gov) sites.

Table 2.2 shows that there is a movement towards promoting transparency and openness worldwide. Many of the transparency and openness initiatives focus on the importance of reducing government corruption.

Ofe and Tinnsten (2014) claim that with the adoption of European Commission directives in 2003 related to OD, member states in the EU were persuaded to provide citizens with access to previously inaccessible public sector data. If citizens have access to such data, they can use, reuse, and distribute the data free of charge. Ofe and Tinnsten suggest that following these directives, many municipalities in Europe have created OD portals for publishing public sector data as OD.

Finally, Narayanan (2015) connects openness with the concept of co-creation, stating that the common strategy that must come when creating smart and digital cities is a culture of openness, of shared resources, and co-creation. He argues that the two concepts of openness and co-creation complement each other because, without openness, it is impossible for co-creation to exist in any meaningful sense. In other words, openness is a pre-requisite for co-creation within the context of OGD. The co-creation concept is covered in more detail in section 2.4.

2.1.2 The notion of community

The term 'community' is attached to many other terms such as a community of practice (CoP), an online community, smart community, and co-creation community (Holmes & Meyerhoff, 1999; Garrison, 2007; Li *et al*., 2011; Ind & Coates, 2013). Communities have been defined in various ways based on different goals and contexts. Donald (2013) believes that finding an appropriate definition of community is not a straightforward task and refers to Hillery (1955) who identified 94 definitions of community within social science literature (as cited in Donald (2013)). Hillery inferred that one common denominator of all the definitions is their reference to people. Donald states that the term community originates from the Latin 'communitatem' which refers to "*the quality of fellowship or feelings between people*" (Ewalt *et al*., 2001, cited in (Donald, 2013, p.23)). Kamp (2009) endorses that the term community originates from the Latin 'communitas', meaning "a group of interacting people in the same environment" (p.1). While, both Ewalt *et al*. (2001) and Kamp (2009) indicate that the origin of the term community is Latin, Donald uses 'communitatem' while Kamp uses 'communitas'. Both definitions refer to communities as basically consisting of groups of people.

In 1985, Raymond William attempted to trace the etymology of the word community (Williams, 1985). He noted that it is a "*warmly persuasive word to describe an existing set of relationships […] or an alternative set of relationships*" (Williams, 1985, p.76). His observation provides a starting point for identifying a proper definition of a community, although the narrative lacks detail on the kind of relationships he has in mind. Unfortunately, Williams' definition is incomplete and too vague to be a proper definition. Donald (2013) argues that the community is a subgroup of society. He agrees with Toynbee's 1995 definition that describes society as the total network of relations between

human beings. He posits that Toynbee's description of society is a useful and suitable definition for community. Borgmann (2004) notes that a community should be small enough for everyone to know each other (though this would rule out many groups who consider themselves to be communities). Martin (2014) refers to the OGD community, in particular, as actors who engage in OGD activities in a cross-sector network. It is clear that various authors differ on the definition of community, but there is general agreement that the term community is commonly used to describe a group of people with common interests. For the purpose of this research, an OGD community can be defined as a group of either publishers or users who are interested in working with OGD.

The OD concept is discussed in the following section. Note that OD and OGD have been mentioned interchangeably by different authors at times. In this dissertation, they are regarded as distinct, with OGD being a subset of a much wider OD universe.

2.2 Open Data (OD)

In the nineteenth century, an English doctor named John Snow, while utilising available data, discovered the relationship between drinking polluted water and cholera. This was achieved by analysing the locations of wells and the data relating to cholera deaths. This led to an improvement in the general health of the population (Dietrich *et al*., 2012). As a result of his work, completed in 1854, London's sewage systems were built. This is an early example of utilising available public data to create significant and beneficial societal change. The following section looks at the origins of the concept of OD.

2.2.1 Origins of OD

Ideas about the origins of the OD movement vary. Luhtanen (2006), for example, claims that the OD movement emerged in the eighteenth century and had its roots in the Freedom of Information (FOI) principle, which was first established in Sweden. Meijer *et al*. (2014) state that the roots of OD lie in two political acts, namely the 2003 Public Sector Information (PSI) Directive in the EU and the 2009 Open Government Directive in the USA. These two contrasting views which reflect the fact that, more generally, perspectives in addition to definitions of OD vary. Nonetheless, there are common threads and definitions. These are discussed in more detail in section 2.2.2.

Sweden's FOI act was the first in the world and the only one until 1809. Later, many countries adopted the FOI Act model for access to government documents (Mustonen, 2006). Mustonen defines FOI as a human right reflecting government information that can help citizens, such as providing information about the location of schools to every person without discrimination. Thus, citizens have the right to know and have access to official documents in order, *inter alia*, to make governments accountable. As of September 2012, at least 95 countries worldwide had established laws allowing public access to government-held information (Right To Info, 2012).

In Ireland, the FOI Act 1997 led to considerable changes in the relationship between the citizen, public bodies and government departments (Office Of The Information Commissioner, 2008). There were some restrictions on the information that could be made public and the Amendment Act in 2003 introduced fees for requesting information. The enactment of this type of law was only the starting point for FOI and eventually led to the OD concept in Ireland.

In 2000, the Charter of Fundamental Rights of the European Union was established. It includes both freedom of expression and the right of access to documents. The first regulation on access to documents was then adopted in the EU in 2001 (Luhtanen, 2006). Subsequently, the emergence of both Open Government (OG) and e-Government played an important role in the compilation and dissemination of OGD (Fitzpatrick, 2012). In 2009, the term OD became more widely used after President Barack Obama issued a memorandum on transparency and open government in the USA (Ginsberg, 2011).

According to Kimpton (2013, p.1), Barack Obama made an extraordinary move when he officially made open and machine readable data the default setting for the government. Europe has had its own initiatives regarding OD. In 2010, data.gov.uk was launched in the United Kingdom (UK) (Lee, 2012; Davies, 2013). *The Guardian* (newspaper) website, at www.theguardian.com/data, is another example of an open platform in the UK. This website is a data store that encourages others to share government data (such as environmental data) on its open platform, providing data and tools to enable the user to utilise these data. Another website, www.bassetlaw.gov.uk/, provides the academic sector with access to live data (such as car park locations) for research and also provides entrepreneurs with data for innovation and commercial enterprise.

Kassen (2013) claims that the term OD first became popular in the academic and political fields "*as a movement aimed at development of open scientific communities by ensuring a free access to academic data published in special digital depositories*" (p.508). As noted above, in the political field, OD gained popularity with the launch of OD for open government projects such as data.gov in the USA. Kassen depicts the OD phenomenon as part of the e-government concept that may embrace accountability such as governmental blog platforms and participation. OD as a concept may seem straightforward, but is surrounded by several issues and challenges. Common topics of debate, and sometimes controversy, include the impact/use of OD, barriers to its release, licensing and formats (Larsson, 2013; Khayyat & Bannister, 2015).

Having presented a brief history of OD and introduced some basic terminology, the next section presents and discusses some definitions and implications of OD.

2.2.2 Definitions of OD[9]

"*Open data is the public library of the 21st century*"[10] is a motto of this study. Many researchers have studied the phenomenon of publishing OD. For example, some researchers describe OD as a *movement* (Maruyama *et al.*, 2013; Oh, 2013) while others consider it to be an *initiative* (Ginsberg, 2011; Ubaldi, 2013; Foulonneau *et al*., 2014) or link it to *innovation* (European Commission, 2011; Chan, 2013; Lakomaa & Kallberg, 2013).

While the focus of this research is on OGD, it is useful, however, at this stage to explore briefly the wider concept of open data (OD).

According to the Open Knowledge Foundation International (OKFI, 2012) OD is "*... data that can be freely used, reused and redistributed by anyone - subject only, at most, to the requirement to attribute and share-alike*" (p.6).

[9] Much of this section has been published in a peer reviewed journal in an article co-authored with Frank Bannister (Khayyat and Bannister 2015).

[10] http://www.opendata.ie/

This definition appears to be incomplete, at least when it comes to the "subject only" phrase. It is not difficult to think of other desirable requirements that might be demanded of OD other than attribution and share-alike. Thus, the OKFI definition seems unsatisfactory. Another definition is provided by the European Commission (2015) which defines OD simply as something which "*... refers to the idea that certain data should be freely available for use and re-use*" (p.1). By confining itself to OD as an idea, the Commission avoids some of the pitfalls that crop up when a more specific definition is proposed, but in so doing, it comes up with a definition so generic that in practical terms is of limited value. Similarly, the United Nations (2013) defines OD as information and data that ought to be made available for everyone to access, to reuse, and to redistribute with no restrictions.

According to the ODI (Open Data Institute, 2012):"*Open data is information that is available for anyone to use, for any purpose, at no cost*" (p.1). While the ODI states clearly that OD ought to be cost-free, publishing data costs time and money and some reasonable charge could be involved in its provision. This would not make it less open. Making all data cost-free may not be practical or acceptable to governments. On the other hand, the ODI states that OD should have a licence that declares it is OD because the data cannot be reused without some kind of guarantee to protect both source and user. The Department for Education in the UK, for example, provides data on the performance of schools in England as OD. The data are available under the Open Government Licence that requires users to acknowledge that the source of the data as being the Department for Education (Open Data Institute, 2012).

Kassen (2013) defines OD on the assumption that the government is the data provider, by stating that: *"Open data is a concept that governmental data should be available to anyone with a possibility of redistribution in any form without any copyright restrictions*" (p.508). Rosada (2013) refers to OD as:

> "*the idea that certain data should be freely available to everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control*" (p.3).

Rosada's definition does not specify that the data should come from the government. It is worth noting that many of the definitions stated above do not mention the question of

licensing. The evidence suggests that some authors who talk about there being no restrictions on licensing may not have considered this as an issue. In fact, all the above-mentioned definitions neither considered the licensing nor the format of data. Kassen and Rosada's definitions of OD are compatible with the definition of the United Nations, that such data should be accessible without *any* restrictions or limitations. However, the meaning of 'freely available' is not explained. Does it mean that data must be available online in an open standard format or is a hard-copy version sufficient to meet this criterion? In addition, most definitions ignore the timeliness of the data.

Cooper (2014) claims that there are two core components of OD that are publicly available and relatively simple to operate. First, data are made publicly available by being licensed in a way that allows for reuse. Second, data need to be relatively easy to use by being accessible and digitised for free or at low-cost in different usable formats such as .csv (a comma separated values) and .xls (eXceL Spreadsheet). Cooper (2014) comments that "*if two heads are better than one, how much better are dozens, hundreds, or even thousands of minds digging through data, looking for valuable correlations and insights?*" (p.4). Cooper argues that providing free or low-cost data in usable formats can bring great potential.

Alonso (2012) notes that OD means different things to different people and those views are not always known, understood or shared outside of the OD community. There is no consensus about what 'open' exactly means when it comes to data. Cole (2012) points out that there are degrees of openness. For example, data may not be readily available and accessible when specifically requested (the data could be incomplete). Data in their original formats may require specific expertise or resources in order to be accessed fully or considered as OD. Furthermore, even when data are open, there are often limitations which diminish the potential benefits. Sources such as the Open Knowledge Foundation (OKFI, 2012) and Dietrich *et al*. (2012, p.6) are more specific about the requirements for OD and content as follows:

- *"Availability and Access: the data must be available as a whole and at no more than a reasonable reproduction cost, preferably by downloading over the internet. The data must also be available in a convenient and modifiable form.*

- *Reuse and Redistribution: the data must be provided under terms that permit reuse and redistribution including the intermixing with other datasets*.

- *The data must be machine-readable*.

- *Universal Participation: everyone must be able to use, reuse and redistribute – there should be no discrimination against fields of endeavour or against persons or groups*. *For example, 'non-commercial' restrictions that would prevent commercial use, or restrictions of use for certain purposes (i.e. only in education), are not allowed"* (p.6).[11]

OD ought to be open for everyone to use as long as there is no confusion concerning its understanding. The following section sets out some OD principles.

The definition of OD could be confused by what Davies (2012) defines as raw data. He asserts that raw data are primary data in a form that allows datasets to be easily manipulated, sorted, filtered and remixed. Being more pragmatic, open data are expected to have some qualities and characteristics such as:

- having appropriate formats for different users;

- being accessible so data can be accessed without the need for a software license;

- non-proprietary (ownership);

- complete;

- archived (permanent);

- having version tracking/be traceable;

- having easy and clear licensing that seeks to empower the ability for users to use the data and allow them to make modifications as long as they are not misleading others; may require republishing of the resulting work under a different version and acknowledging the source;

- being updated when needed/on time (releasing and updating the real-time data);

[11] Bullets points added by the author of this research.

- being free or at minimum production cost, preferably downloading via the Internet.

Meijer *et al*. (2014) propose four access dimensions for OD (see Table 2.3). They emphasise that OD can be open in some dimensions and to certain degrees. For example, government organisations could make some unavailable data obtainable at limited cost, which generates more openness than previously. However, they claim that such data are still far away from complete openness.

Table 2.3 OD Dimensions

Source: Meijer *et al*. (2014, p.9)

Access dimension	Description
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 it? Are citizens, stakeholders and companies allowed to make a profit out of OD?
Political access	Is access limited to politically desirable issues or does it entail all issues?

Meijer *et al*.'s OD dimensions can assist citizens to investigate their level of access in different contexts. In order for data to be considered as OD, there should not be any restrictions such as technical or political constraints.

In summary, the aim of OD is to make data publicly available as a public asset to everyone without discrimination. It is generally accepted that certain types of data are important to societies and their citizens and that governments and the public sector should allow access to those data. Governments do need, however, to be sure that public access does not harm individual citizens – this is a problem with modern analytic techniques. This is hard to

ensure. Such data can be recycled and reused as required. The following sections provide some information and background about different aspects that can increase our understanding of OD beyond its definitions.

2.2.3 Types of OD

The above discussion of open data implies that these definitions often depend upon the type of data and its potential uses. The OKFN (2015) proposes a list of OD types as follows:

- *Geodata*: geographic locations that are stored in a format that can be used with a geographic information system (GIS) (Arcgis Resources, 2012);
- *Cultural*: cultural works and artefact data such as titles and authors in collections held by galleries, libraries, archives and museums;
- *Science*: data from public scientific research;
- *Finance*: for example, government or local government expenditure and revenue;
- *Statistics*: a wide variety of data including demographic and economic statistics;
- *Weather*: historic and forecasts;
- *Environment*: pollution levels, pollen counts, and so on;
- *Transport*: bus timetables, routes, on-time statistics and traffic conditions.

Figure 2.2 summarises with visual presentations the OD types.

Figure 2.2 OD types

Source: (OKFI, 2015)

Unless one assumes that "Statistics" is a blanket covering everything not otherwise mentioned, Figure 2.2 lacks many types of OGD. For example, to name a few, educational data, public health data, and public safety data are missing. Table 2.4 shows that two of the Dublin OGD websites have a much wider and more diverse range of OD types than in the OKFN classification.

Table 2.4 Dublin OD Types

Dublinked.Ie (2016)	Fingal Open Data (2016)
Amenities & Recreation	Arts, Culture & Heritage
Arts, Culture & Heritage	Citizen Participation
Citizen Participation	Demographics
Demographics	Economy
Economy	Education
Education	Environment
Environment	Housing
Health & Safety	Misc.
Housing	Public Health
Land Use & Zoning	Public Safety
Transportation & Infrastructure	Recreation
	Technology
	Transportation & Infrastructure
	Zoning & Land Use

Table 2.4 includes more OD types than Figure 2.2, such as recreation and technology datasets. Fingal open data includes 14 categories, whereas Dublinked includes 11; this is because in Dublinked some categories are combined such as health and safety, whereas in Fingal open data, they comprise two categories. Furthermore, there are two missing categories in Dublinked: Misc. (miscellaneous.) and Technology. Figure 2.3 shows the top ten most viewed datasets from the Dublinked website.

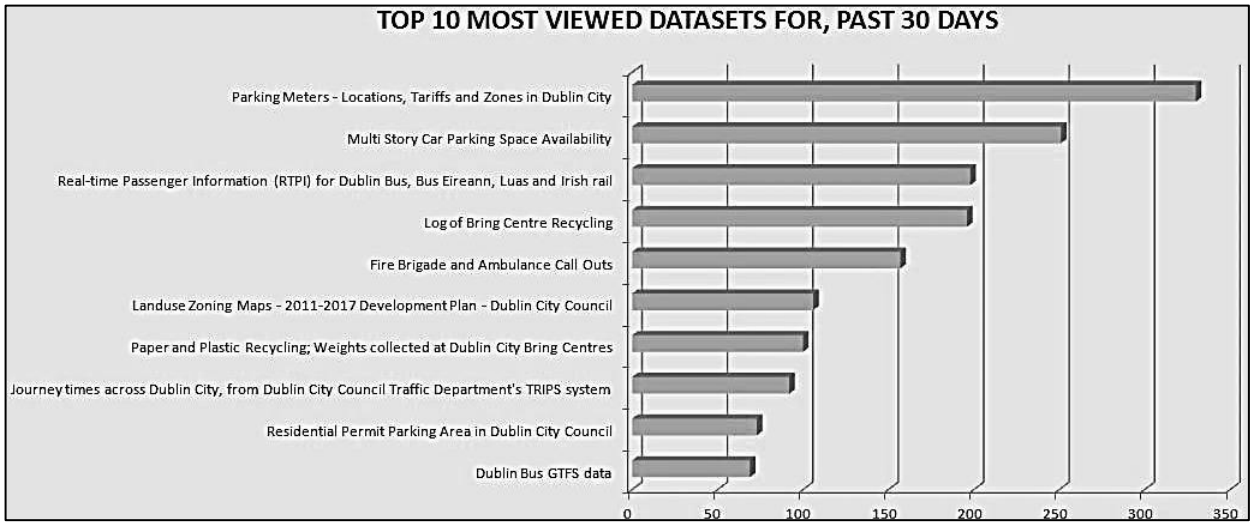


Figure 2.3 The top ten most viewed datasets from Dublinked

Source: Published by Dublinked (2014)

Figure 2.3 shows that parking meters in Dublin City is the most viewed dataset. The parking meters dataset includes useful data for Dublin citizens or visitors such as parking locations, number of spaces per street (PD-Pay and Display D-Disc Parking), tariff (cost per hour), and nearest location of pay and display.

2.2.4 Categories of OD users

OD users can be classified into different categories based on their technical level of knowledge or profession. Oh (2013) groups OD users into three categories as follows:

- **Casual users:** Users who prefer human readable formats since they prefer more user-friendly and easy to understand formats with the minimum effort of manipulating and processing.
- **Semi-technical users:** Users who have some level of technical knowledge or work in a field that requires it, such as journalism. This type of user can undertake some manual manipulations and analysis using applications such as Excel.
- **Technical users:** Users who prefer data in raw/machine-readable formats in order to carry out sophisticated statistical analyses. Some users may prefer data in specific formats, such as Word.

However, other users may be categorised based on their purpose such as academic users

and government users. In addition, the same users may belong to more than one category, for example, a particular user may be considered both as a casual user and a technical one.

2.2.5 Approaches to OD research

OD has gained a lot of attention in the political and research areas. (Davies & Perini, 2016) suggest three broad categories of OD research. These are: OD readiness assessments; OD implementation studies; and OD impact studies (see Figure 2.4). However, this is far from a complete list. Other forms of OD research include open datasets assessment, OD evaluation studies and OD comparison studies. This research fits under OD impact, as it is only concerned about the impact of OGD on co-creation.

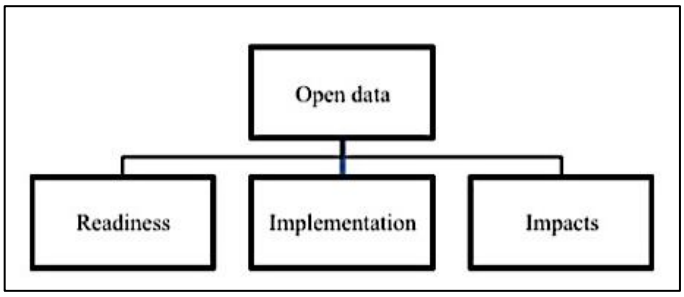


Figure 2.4 Approaches to OD research

Source: (Davies & Perini, 2016, p.9)

According to (Davies & Perini, 2016), readiness studies must have an existing notion of what an OD initiative would consist and decide which factors are important in making an OD initiative a success. Readiness studies seek to assess whether the conditions within a country, a city, or a sector might be appropriate for an OD initiative to be effective and may seek to find what efforts or investments would be needed to get ready for an OD initiative.

Implementation studies attempt to assess whether OD actually exists or is available in a country, city, sector or county. These studies vary in their approach. For example, some examine the proportion of institutions publishing OD (OKFI, 2012). Others focus on the qualities of datasets or OD portals (Braunschweig *et al.*, 2012), While there are those that assess whether appropriate legislation and regulations are in place for OD to operate effectively (Cary *et al.*, 2003; Zuiderwijk *et al.*, 2012; Larsson, 2013; Zuiderwijk &

Janssen, 2013). These studies have defined what 'good' OD looks like, which datasets are important, and how implementation should be measured. Implementation research is used as a general term for research that focuses on the question of what is happening and is sometimes contrasted with impact studies which are concerned with the impact of what is happening. Generally, impact studies focus on whether OD has brought one of the specific benefits suggested by OD proponents, such as democratic empowerment (Davies, 2010) or economic growth (Borzacchiello & Craglia, 2012).

More interestingly, "*impact studies ask whether open data has led to change*" (Lee, 2014, p.7; Davies & Perini, 2016). Davies and Perini (2016) suggest that future studies of OD impacts might take one of two paths, either measuring the impacts at a macro-level or seeking to understand the processes through which OD is used in particular circumstances at a micro-level. The first path seeks statistical correlations between measures of OD implementation and variables that capture some anticipated impact of OD: for example, attempting to measure the relationship between levels of OD publication and economic growth. With regard to the second path, Davies and Perini (2016) suggest that:

> "*… at present the most important area for focus is on understanding the process of open data use, the impacts this can have, and the factors that affect when positive and negative impacts emerge from open data*" (p.10).

They claim that researchers should clarify the type of impact, i.e. whether the research examines the impact of a particular dataset, that of an OD initiative, or of OD in a sector. This research examines the impact of two OGD websites (Dublinked and Fingal OD) on co-creation.

2.2.6 Methods for exploring the impact of OD

According to Tilley *et al*. (2012), many methods can be used to explore the impact of OD such as: "*[N]arratives, cases, best practices, surveys, metrics, indexes, indicators, pilot projects*" (p.6). Some reports suggest that further development in this area will demand a combination of methods and disciplines, engaging particularly the political, economic, social, and environmental impacts of OD (Tilley *et al*., 2012). Foulonneau *et al*. (2014) claim that the success of the OD movement can be assessed by the number of created services delivered via applications. However, they limit the assessment to the number of

created services and disregard the quality of such created services, even though the number in itself will not reflect the success of the OD movement. In contrast, Meijer *et al*. (2014) have a complex perspective on studying the impact of OD, suggesting that it can be studied as a series of complex societal interactions. The authors highlight the importance of understanding OD impact by acknowledging the complexity of societal dynamics and considering a variety of values and desirables. They claim that the impact of OD should be understood as an emerging '*series of reactions*' of a variety of societal factors to OD and cannot be studied as a linear development (p.3). Meijer *et al*. (2014) believe that the complex and multi-value approach for policy-makers means that they should shift their focus from working on '*grand open data designs*' to facilitating smart, local, pluralistic approaches to OD (p.1). They challenge existing impact assessments of OD in the public sector for three reasons:

> *"(1) the exclusive focus on economic effects of open data and not on other desirables such as a clean environment, good education, equitable healthcare, etc.; (2) the assumed linear relation between open data and impacts that ignores the dynamics of the interactions between the various stakeholders that may result in unpredictable and unforeseeable outcomes; (3) the homogeneous perspective on open data in the public sector that fails to acknowledge the variation of open data incentives, practices and consequences between countries and business sectors"* (p.1).

As a result, they suggest an alternative way to study the impact of OD instead of '*naive impact assessments*' as they describe them. Meijer *et al*. (2014) have developed an approach that embraces the complexity of societal dynamics and takes a variety of values into account. Their alternative 'model' to study the societal dynamics of OD is explained as follows:

> *"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 socio-political construction of open data; These interactions takes place in various 'rounds': 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"* (Meijer *et al*., 2014, p.12).

The authors lay stress on using rounds of interactions to study the impact of OD. This research thesis has applied this approach of attending meetings (which can be considered to be rounds) to seek an understanding of the impact of OGD on co-creation, and discover what factors enable co-creation using OGD.

2.2.7 Turning OD into services

Several researchers have addressed the topic of turning OD into services. For example, Jetzek *et al*. (2013b) assert that OGD cannot be sufficient in itself for value generation unless some of its barriers are overcome in order to enable the mechanism that spurs and allows value generation. Accordingly, they suggest that the key enablers for OGD value generation are: "*open access to data, data governance procedures and technical connectivity*" (Jetzek *et al*., 2013b, p.8).

According to Foulonneau *et al*. (2014), thousands of datasets have been released on the web since 2009 when the US government first encouraged an open approach. There are many approaches to encourage people to convert OD into services. Foulonneau *et al*. (2014) suggest nine actions to follow:

1. Facilitate reuse conditions (open license).
2. Harmonise metadata to facilitate datasets discovery.
3. Create a platform to support re-users and assist them to reuse the data.
4. Create APIs in order to lower the technical barrier as well as the time required to develop a new service.
5. Offer training material to help potential re-users obtain data.
6. Develop academic training focused on OD, for example, the University of Southampton runs a module named "*Consuming open data*".
7. Announce competitions to use OD for service creation. For example, the city of Paris organised an OD competition in collaboration with companies opening their data, 'Europeana' organised a number of hackathons consisting of interested parties (such as developers, citizens or public sector employees, researchers) to create services in a

short period of time, usually one or two days. The outcomes of such developments could be individual efforts or the result of joint code development.

8. Introduce a survey to investigate the opinions of potential re-users. For example, in France in 2013, the French ministry of culture launched a survey to investigate the selection of priority datasets for OD release.

9. Include a section in the OGD portal to show the services and applications that use the datasets. This will publicise services and encourage service usage.

Foulonneau *et al*. suggest that these actions are effective at raising the awareness of developers and service creators on the potential for the reuse of open datasets. Yet, most services created in these contexts "*do not lead to the development of actual sustainable services*" (p.34). It is important to find solutions that will lead to sustainable services of OD. The authors propose co-funding from governments to OD projects as a possible solution. For example, the government of Singapore and the European Commission have co-funded OD projects for the sustainable development of OD-based services.

In Singapore, Chan (2013) investigated and explored the strategies involved in facilitating and attracting participation and usage of data portals by the Singapore government's open data initiative. Chan found that citizen participation was encouraged by a competition initiated for innovative e-services using the data from the data.gov.sg portal. This was launched in early 2012 and was called the ideas4apps challenge competition, and offered $500 in prize money award to each of top three e-services developed. The competition generated a total of 500 new e-service ideas. Chan notes that such competitions attracted the participation of 'mainly novices' rather than professionals. The quality of the e-services created by novice participants could be a concern because they are not professionals and the data providers must check the quality of e-services created through such open competitions.

In France, Foulonneau *et al*. (2014) conducted research on the development of services based on OD and how to make the data opening process more effective. They dismissed the potential of services created out of OD, stating that existing studies suggested that re-users were not actually interested in open datasets. It is clearly not a demand-driven initiative, but rather an initiative of data providers who, to a large extent, hope for a

possible impact particularly in terms of service creation. Based on the above-mentioned cases (France and Singapore), the potential for creating value based on OD is still questionable since the quality of products created by novice participants could still be under examination.

2.3 Open Government Data (OGD)

The availability of OGD is growing globally where increasingly governments are providing data to citizens by publishing it in electronically-accessible formats (Sheridan & Tennison, 2010; Fitzpatrick, 2012). Sheridan and Tennison (2010) claim that the most 'notable' OGD initiatives to date have been the launch of data.gov in the USA and data.gov.uk in the UK, pointing out that governments and LAs worldwide are publishing their data on the web. However, other countries in the western world such as Australia, New Zealand, the Netherlands, Sweden, Spain, Austria, and Denmark have also begun to publish data for their citizens. There exist also an increasing number of city and local authority-based OGD initiatives, such as those in Vancouver and London.

2.3.1 Definitions of OGD

As with OD, one of the problems with OGD is defining precisely what is meant by the term. There are various definitions to be found in the literature, not all of which are compatible.

Klessmann *et al*. (2012) define OGD as: "*Open government data are those data of the public administration which are made available to third parties for their reuse*" (p.8). Whereas, Barry (2012) refers to OGD as: "*the idea that data collected and stored by government organisations belong to the country's citizens and, where possible, this data should be released to the citizens*" (p.5). There is, however, an important difference between these definitions. Klessmann *et al*. (2012) confine their definition to data that has been made available, whereas Barry's definition is normative. It defines government data as belonging to citizens and implies the right of citizens, subject to certain constraints, to access such data.

The Open Government Data organisation defines OGD in two parts. Firstly, concerning the term 'open', data is said to be open if it can be freely used, reused and redistributed by

anyone. Secondly, in terms of government data, it refers to data produced or commissioned by government or government-controlled entities (Opengovernmentdata.Org, 2016). This definition carries some deficiencies when it comes to providing more details about data quality such as publishing data in a timely manner, and data licensing.

For the purposes of this research, the definition of OGD is defined as referring to any data that are:

- collected and stored by government and its agencies,
- made available online or in other processable forms,
- by government or government-controlled agencies,
- that are accessible by all citizens without the need for major investment in technology.

In addition to this definition, a number of desirable qualities of such data are listed below. Use of OGD is facilitated by data that:

- can be accessed without the need for a software license.
- are complete except for sensitive personal data or data that could be used to identify individuals.
- are timely (i.e. are released and updated in real, or near real, time).
- are either free or accessible at minimal cost.

This means that OGD must be available with the minimum feasible restrictions (legal, financial, or technological) on their use.

Regarding the point of software licences, the citizen must not pay for software applications (for example Word or Oracle) in order to access the data; further implying that data must be available in open formats or formats such as CSV or RTF. It is important to be aware that the qualities of data are mostly related to its availability and usability without adding any major cost.

2.3.2 OGD principles and qualities

Understanding the principles underlying OGD is a necessary prerequisite for the development of this field. In light of this, a multidisciplinary group of advocates and transparency experts gathered in California in 2007 to understand what OGD means and come up with a basic list of principles that OGD policies must meet to be considered as such. They agreed to define OGD as: "*any data and information produced or commissioned by public bodies, which anyone can use for any purpose*" (Heusser, 2012, p.7). In addition, they also agreed on the list of OGD principles set out in in Table 2.5. Heusser claims that the eight principles listed in Table 2.5 (first column) are the most referenced and are a complete characterisation of OGD that exist in the literature. He points out that government data will be considered 'open' when it fulfils each of the principles. The Sunlight Foundation in 2010 listed ten principles -see Table 2.5 , column 2 (Sunlight Foundation, 2010).

Table 2.5 OGD Principles

Adopted from Heusser (2012, p.8); Open Government Data (2007); Sunlight Foundation (2010, p.1-3)

	The eight OG principles	The ten principles by the Sunlight Foundation
1.	Complete: Data should be available. Public data are data not subject to valid privacy, security or privilege limitations.	Completeness: Data should be at the greatest possible level of detail. Metadata is also important because it defines and explains the raw data, along with formulas and explanations for how derived data was calculated.
2.	Primary: Data are as collected at source, with the highest possible level of granularity, not in aggregate or modified forms.	Primacy: Government data should be the primary source, including the original information with details on how the data was collected to verify its appropriateness and accuracy.
3.	Timely: Data are made available as quickly as necessary to preserve the value of the data.	Timeliness: Data should be available in a timely fashion, whenever feasible. Priority should be given to data whose utility is time sensitive. Real-time information updates would maximise the utility of that information.
4.	Accessible: Data are available to the widest range of users for the widest range of purposes.	Ease of Physical and Electronic Access: Barriers to physical access include requirements to visit a particular office in person or comply with particular procedures. Barriers to automated electronic access include making data accessible only via submitted forms or systems that require browser-oriented technologies.
5.	Machine processable: Data are reasonably structured to allow automated processing.	Machine readability: Machines can handle certain kinds of inputs much better than others. For example, handwritten notes on paper are very difficult for machines to process. Information shared in the widely-used PDF format is very difficult for machines to parse. Thus, information should be stored in widely-used file formats that easily lend themselves to machine processing.
6.	Non-discriminatory: Data are available to anyone, with no requirement of registration.	Non-discrimination: It refers to who can access data and how they must do so. Barriers to the use of data can include registration or membership requirements. Another barrier is the use of a "walled garden", which occurs when only some applications are allowed access to data.
7.	Non-proprietary: Data are available in a format over which no entity has exclusive control.	Use of Commonly Owned Standards: For example, Microsoft Excel is a commonly-used spreadsheet programme which costs money to use. Freely available alternative formats often exist, through which stored data can be accessed without the need for a software license.
8.	License-free: Data are not subject to any copyright, patent, trademark or trade secret regulation. Reasonable privacy, security and privilege restrictions may be allowed.	Licensing: Attribution requirements, restrictions on dissemination acts as barriers to the use of data.
9.	-	Permanence: For best use by the public, information made available online should remain online, with appropriate version-tracking and archiving over time.
10.	-	Usage Costs: Imposing fees for access skews the pool of who is willing (or able) to access information.

While these were initially written as eight principles, two more relevant principles have been added; these are the permanence and usage costs.

2.3.3 Motivations and drivers of OGD

With regard to the motivations necessary in order to engage with OGD, there are differences of emphasis among different scholars and, indeed, on different continents. Fitzpatrick (2012) claims that there are two motivations for publishing government data; the first is a desire to increase transparency. For example, 'wheredoesmymoneygo.org' shows how UK taxes are spent. The second motivation is identified as a desire to realise the economic potential associated with the re-use of these data. These objectives can be achieved by stimulating the creation of new applications, such as smart-phone applications and delivering public services more efficiently by providing data that can help citizens to make decisions. On the other hand, Foulonneau *et al*. (2014) list three motivations; the first and third motivations that have been outlined are also highlighted by Fitzpatrick. The three motivations are:

1. Government transparency: citizens access to government data.
2. Smart city approach: the development of services by third parties for the benefit of both citizens and companies.
3. Development of new services: to stimulate the economy.

These motivations are also considered to be the objectives of OGD by other authors. For example, Ofe and Tinnsten (2014) confirm Fitzpatrick's two motivations, but with an emphasis on countries (Europe and USA). They note that the European Commission places an emphasis on using OGD to generate economic growth, whereas the USA places greater emphasis on transparency. Whatever perspective is adopted, expectations of what OGD can deliver are high and it is expected that by involving more people in joint and cooperative action, public value can be maximised.

The next section examines how OGD might be used and what benefits OGD can offer.

2.3.4 OGD benefits and usage

There are different views on how OGD can (or must) be used. Opengovernmentdata.org, a working group within the OKFN, states on the front page of its website that there are three main benefits from OGD. These are in common with the motivations mentioned in section 2.3.3. The first is transparency, meaning that citizens can find out what their government is doing by being able to access, use, and share government data and information with other members of the public. The second is creating social and commercial value. By opening up data, governments can help drive the creation of new services that deliver social value such as finding the nearest post office or police station. The third is participatory governance. Most citizens only engage (if they engage at all) with the process of government via elections every four or five years. By opening up data, it is surmised that citizens will be better able to engage with their governments and to do so on a more frequent basis, not least because they will be better informed. The public will be able to engage in and contribute to governance. Janssen *et al*. (2012) identify an extensive list of political and social, economic, operational, and technical benefits. This list of OGD benefits was derived to show the potential of OGD (see Table 2.6). Noting that the benefits have a broad characteristic and do not necessarily represent the individual datasets, it can be understood that individual datasets have problems that must be addressed.

Table 2.6 Overview of benefits of OGD

Source: Janssen *et al*. (2012, p.261)

Category	Benefits
Political and social	More transparency Democratic accountability
	More participation and self-empowerment of citizens (users)
	Creation of trust in government
	Public engagement
	Equal access to data
	New governmental services for citizens
	Improvement of citizen services
	Improvement of citizen satisfaction
	Improvement of policy-making processes
	More visibility for the data provider
	Stimulation of knowledge developments
	Creation of new insights in the public sector
	New (innovative) social services
Economic	Economic growth and stimulation of competitiveness
	Stimulation of innovation
	Contribution toward the improvement of processes, products, and/or services
	Development of new products and services
	Use of the wisdom of the crowds: tapping into the intelligence of the collective
	Creation of a new sector adding value to the economy
	Availability of information for investors and companies
Operational and technical	The ability to reuse data/not having to collect the same data again and counteracting unnecessary duplication and associated costs (also by other public institutions)
	Optimisation of administrative processes
	Improvement of public policies
	Access to external problem-solving capacity
	Fair decision-making by enabling comparison
	Easier access to data and discovery of data
	Creation of new data based on combining data
	External quality checks of data (validation)
	Sustainability of data (no data loss)
	The ability to merge, integrate, and mesh public and private data

To harvest the benefits of OGD, it is important to highlight how OGD can be used. Davies (2010) argues that the use of OGD on the data.gov.uk website is not simply a one-way process (such as browsing a bus timetable). He claims that usage falls into one of five distinct processes shown in Figure 2.5:

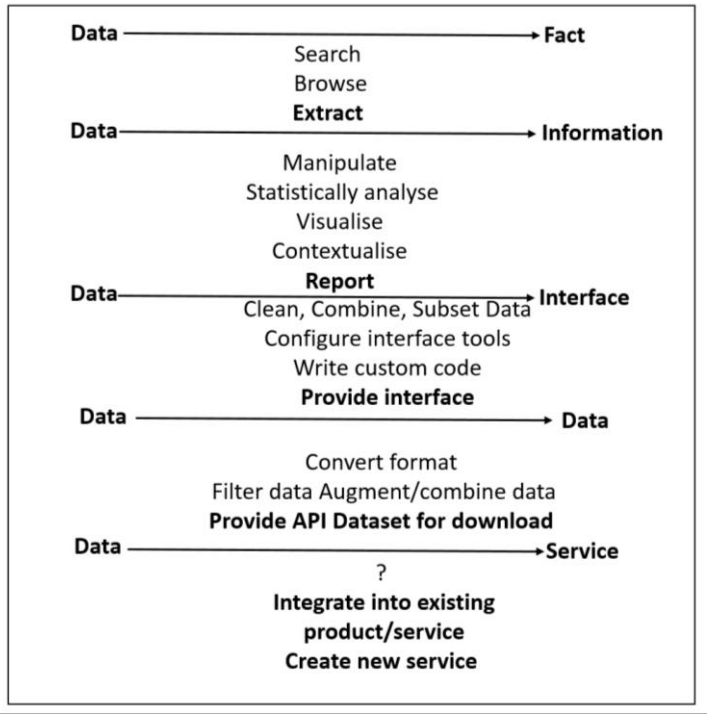


Figure 2.5 Processes of OGD use

Source: Davies (2010, p.3)

Davies (2010) concludes with two key points that can be drawn out of the analysis of how OGD is being used in policy and practice as:

First: OGD are not just for developers, it is important to be clear that data should be available for everyone.

Second: OGD supports innovation in public services. Davies claims that it is not yet clear that there are strong models for the use of OGD in allowing communities to collectively debate and drive local change. However, social and commercial entrepreneurs play a core role in turning OGD into new services or inputs into public services.

Although there is the argument that public data ought to be beneficial and open by default as it is related to the public domain with taxpayers' money, however, in some cases,

opening up data could lead to consequences such as damaging the reputation of some entities or individuals especially if data are misinterpreted. OD and OGD barriers, challenges, and issues are discussed in the following sections.

2.4 OD and OGD barriers, issues and challenges

This section examines the challenges and barriers to OD, OGD, and OGD licensing. These are presented in different categories based on various perspectives. This is followed by a discussion of possible solutions for overcoming OD and OGD obstacles including the suggested solutions by Braunschweig *et al*. (2012) and Martin *et al*. (2013).

Common topics of debate, and sometimes controversy, include the impact or use of OD, barriers to its release, licensing and formats (Korn & Oppenheim, 2011; Khayyat & Bannister, 2015). Despite all of the concerns about OD issues, OGD brings about more problematic issues. For example, Hoxha and Brahaj (2011), writing about the Open Data Albania (ODA) project, reveal that the main concern is the *presentation of datasets* and they question the degree of data reusability from data provided by public offices. They claim that data are rarely made available in a reusable format that can be easily stored and analysed.

Lnenicka (2015) claims that OGD is a simple concept because government data should be a shared resource. However, pragmatically, from users and publishers' perspectives, OGD is not as simple as Lnenicka perceives due to the inherent challenges in both publishing and using OGD. On the one hand, from a reuse perspective, if a user visits an online OGD portal and wants to open a dataset and reuse the data, barriers can still occur such as unclear licensing, lack of user-friendly interfaces, low-quality data and difficulties in data interpretation and understanding due to the lack of required specialist knowledge. On the other, from the publishing perspective, deciding to provide OGD is not always easy because of barriers such as cost.

Zuiderwijk *et al*. (2012) conducted four workshops and six semi-structured expert interviews to investigate users' perceptions of the barriers to OGD. They identified 118 socio-technical barriers. They classify the issues into ten categories: "*availability and access, findability, usability, understandability, quality, linking and combining data,*

comparability and compatibility, metadata, interaction with the data provider, and opening and uploading" (Zuiderwijk *et al*., 2012, p.1).

They argue that some OD publishers publish the data for the sake of getting it published without considering its ease of access or findability (searchability). Having data available to use is not enough unless such data are published to meet the needs of the users. Martin carried out two studies, one in 2013 with other colleagues and another in 2014, examining barriers to OD. Martin *et al*. (2013) classify these into seven categories:

1. **Governance barriers:** inconsistency in public policies.
2. **Economic/cost barriers:** such as high cost for re-users.
3. **Licenses and legal frameworks barriers:** such as intellectual property.
4. **Data characteristics barriers:** such as outdated data or data format required proprietary software.
5. **Metadata barriers:** such as not enough or unclear metadata. They define metadata as follows: "*Metadata are assigned to describe datasets*. *They are very important for the retrieval and reuse of datasets*" (p.356).
6. **Access barriers:** such as the need to register, or install some specialised software.
7. **Skills barriers:** such as unfamiliarity with the data format and the digital divide.

Subsequently, in a study using a web-based survey, Martin (2014) found no less than 33 barriers to OGD. Martin argues that barriers exist in two forms: implementation and usage barriers. He identifies five categories of OGD barriers, which are:

Digital technologies: There are challenges that exist around providing the resources required to supply and use OGD (financial resources, the cultural resources such as the skills, expertise, and knowledge required to supply and use OGD).

1. **User practices:** the processes and procedures that use government data.
2. **Public management practices:** the processes of data and ICT management, and established data-related policies.
3. **Institutions:** for example, the sets of rules that connect data users and government

organisations, including data markets and regulatory frameworks for government data.

4. **Resources:** such as actors shaping the OGD data agenda including: social capital (the networks that connect actors); cultural capital (cultural goods and services, such as skills and knowledge); economic capital (money and other assets that can be directly and immediately converted to money) and symbolic capital - the means available on the basis of perceived prestige or legitimacy.

The key similarities between Martin (2014) and Zuiderwijk *et al.*'s (2012) research results are that the barriers to OGD are perceived as prevalent and related to both social and technical aspects. The list from Martin *et al.*'s (2013) research is less difficult to understand compared to the five categories outlined in his later 2014 study.

Barry (2012) describes six categories of barrier. Her study was conducted using fourteen semi-structured interviews in two types of Irish environments: central and local government. She also studied a number of relevant government documents and investigated barriers from the perspective of senior managers in the public sector in Ireland. She found six main barriers to OGD within both central and local government (see Figure 2.6).

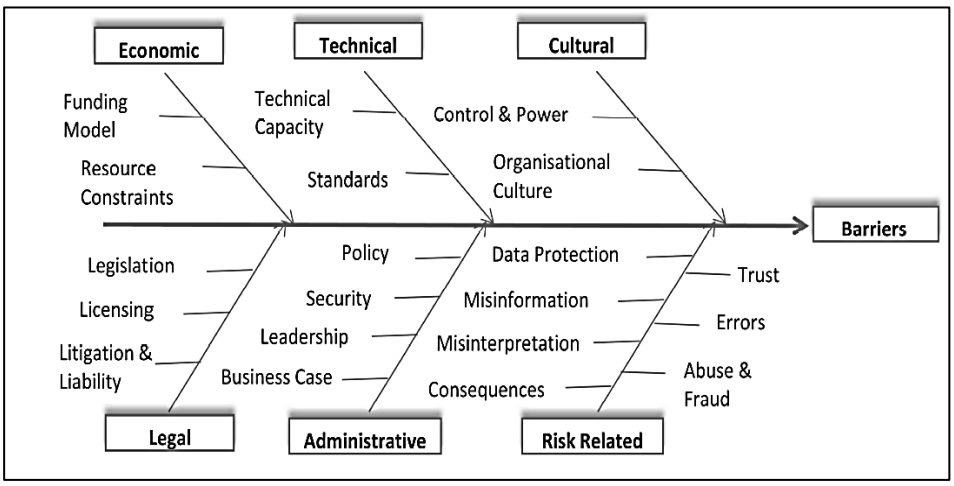


Figure 2.6 Fishbone diagram of OD barriers

Source: Barry (2012, p.43)

Each of the main barriers include more obstacles, indicating that more efforts are required to lessen their negative effects on utilising OGD.

Janssen *et al*. (2012) conducted explorative research using group sessions with nine participants, followed by interviews with fourteen key persons (i.e. individuals representing different organisations, and civil servants at both managerial and administrative levels, as well as users of OD to ensure a variety of responses). They provide a list of six categories of barriers (see Table 2.7).

Table 2.7 OD Barriers

Source: Janssen *et al*. (2012, p.262, 263)

Categories	Barriers
Institutional	Emphasis of barriers and neglect of opportunities Unclear trade-off between public values (transparency vs. privacy values) No uniform policy for publicising data Revenue system is based on creating income from data Debatable quality of user input
Task complexity	No access to the original data (only processed data) No explanation of the meaning of data Duplication of data, data available in various forms, or before/after processing, resulting in discussions about what the source is Difficulty in searching and browsing Data formats and datasets are too complex to handle and use easily No tooling support or helpdesk Focus is on making use of single datasets, whereas the real value might come from combining various datasets Contradicting outcomes based on the use of the same data Invalid conclusions
Use and participation	No incentives for users No time to delve into the details, or no time at all Having to pay a fee for the data Registration required before being able to download the data No time to make use of the OD Lack of knowledge to make use of or sense of data Lack of the necessary capability to use the information No statistical knowledge or understanding of the potential and limitations of statistics Threat of lawsuits or other violations
Legislation	Privacy violation Security No license for data usage Limited conditions for data usage Prior written permission required to gain access to and reproduce data Reuse of contracts/agreements
Information Quality	Lack of information Lack of informational accuracy Incomplete information, only part of the total picture shown, or only a certain range Obsolete and non-valid data
Technical	Too much information to process and not being sure what to look at [Essential] Information is missing Similar data stored in different systems yield different results Technical data must be in a well-defined format that is easily accessible: while the format of data is arbitrary, the format definitions must be rigorously defined Absence of standards No central portal or architecture No support for making data available Lack of meta standards

Janssen *et al*. (2012) state that barriers are related to either data providers or users. Barriers related to data providers reflect their unwillingness to publish data. Those related to data users reflect their inability to use the data in a simple manner due to, for example, a lack of the technical skills required to use OGD.

Conradie and Choenni (2014), in a US study, conducted interviews with participants and organised workshops to discuss emerging themes about data released at local level. The authors identified OGD barriers and divided them into five categories: judicial, social, cultural, economic, and technical (Conradie & Choenni, 2014). Table 2.8 summarises five research perspectives about OD/OGD barriers.

Table 2.8 Summary of barriers from different perspectives.

Research	Barriers
Zuiderwijk *et al*. (2012)	1. Availability and access 2. Findability 3. Usability 4. Understandability 5. Quality 6. Linking and combining data 7. Comparability and compatibility 8. Metadata 9. Interaction with the data provider 10. Opening and uploading
Conradie and Choenni (2014)	1. Judicial 2. Social 3. Cultural 4. Economic, and 5. Technical
Janssen *et al*. (2012)	1. Institutional 2. Task complexity 3. Use and participation 4. Legislation 5. Information Quality, and 6. Technical
Martin *et al*. (2013)	1. Governance 2. Economic/cost 3. Licenses and legal frameworks 4. Data characteristics 5. Metadata barriers 6. Access, and 7. Skills
Martine (2014)	1. Digital technologies 2. User practices 3. Public management practices 4. Institutions 5. Resources
Barry (2012)	1. Cultural 2. Legal 3. Economic 4. Technical 5. Administrative 6. Risk-related concerns.

Table 2.8 shows that Zuiderwijk *et al*. (2012) identify more barriers than other authors. However, there are common barriers in the above studies such as accessibility, metadata, cultural, economic and technical barriers. Most of the barriers are related to data quality and formats. This is because these two categories include other sub-categories, for example, the lack of metadata, availability, findability, and usability are all considered to be data quality problems. Further, data formats can affect usage because lacking proper formats (such as publishing only .pdf files) is a major barrier to use OGD. Other authors

such as (Zuiderwijk & Janssen, 2013) also discuss the coordination barrier between data providers and users. Data quality, formats, and coordination barriers are discussed in further detail in the following sections.

2.4.1 Data Quality

Data quality is one of the key elements for users to consider when making their decision to utilise OGD. According to Masip-Bruin *et al*. (2013) data quality is one of the problems related to OD. Pipino *et al*. (2002, p.218) point out that "*'a one size fits all' set of metrics is not a pragmatic solution*" (p.218). Oh (2013) categorises OD into good and bad OD (see Table 2.9).

Table 2.9 Good and Bad OD

Adapted from Oh (2013)

Good OD	Bad OD
Mostly possess desirable qualities	Possess many undesirable qualities
Clarification of any restrictions, i.e. copyright license is clearly attached. Data is accessible in an easy, simple method, such as access through links. Data is structured in an easy and simple format. Metadata is provided Any relevant data that may affect the interpretation and analysis are provided.	No copyright license Inconvenience or slow user interface, i.e. restrictive online form Data is structured for human reading, i.e. aesthetic appeal rather than ease of data processing. Excessive of data aggregation before release.

In his categorisation of good and bad OD, Oh overlooks some points relevant to good data such as availability, complete, updateable, findable, usable, ease of linking and combining data, comparability and compatibility, downloadability, and the existence of different formats for different users. Oh's view appears to derive from a specific technical

perspective and consequently, the categorisation concerning good and bad OD is not sufficient as a taxonomy. Data formats are discussed in the next section.

2.4.2 Data formats

The concept of OD format is important because it serves a variety of purposes for different users. Oh asserts that "the *data format can significantly influence how the data can be used*" (2013, p.6). Data formats include human-readable and machine-readable formats, and file extensions. File extensions show the type of files, such as .csv, .xml, .kml, .xls, .txt, .pdf, .html and .json. Larsson (2013) suggests that it is better not to share data in a PDF format because it is a static format. Larsson does not favour files to be static; "*lacking in movement, action, or change, especially in an undesirable or uninteresting way*"[12] which make the data difficult to be reused.

Human-readable and machine-readable formats

Braunschweig *et al*. (2012) point out that many government agencies or organisations collect large amounts of data in their original, raw form. Such raw data are often not very useful for end users. Therefore, many datasets must be cleaned and edited before being published. Braunschweig *et al*. (2012) claim that there are two contrasting styles to publishing OD: human-readable and machine-readable. Each format has advantages and disadvantages and both serve different purposes. Machine-readable/raw data can be produced in printed format (published in hard copy, i.e. bar codes) or machine form/softcopy. Braunschweig *et al*. (2012) examined both styles to see which format is more suited to maximise the benefits of OD repositories.

These authors also investigated human-readable OD which usually means that existing raw data are transformed into documents that can include aggregated values, visualisations or, more generally, simplifications to make data more comprehensible. For some users, a good human-readable report is sufficient if it contains the desired information. However, it could miss the required information or some important details since it only contains the information that the report's editor has decided to include. A good deal of raw data is either not readable or, even if readable, is not digestible by humans. The process of regaining

[12] https://en.oxforddictionaries.com/definition/static

machine-readable data from human-readable documents, i.e. data extraction, can be challenging.

Braunschweig *et al*. (2012) also examined machine-readable files that were digitally accessible in order that software tools could process them. In this case, instead of pre-processing the data, users can directly access the raw data and customise them based on their own needs. Braunschweig *et al*. concluded that many people face difficulties in dealing with the machine-readable format. Even though there are challenges in dealing with a machine-readable format, it enables automatic processing which is a necessary requirement for the development of new, end user-friendly analysis tools from which technical users can benefit. Moreover, data can be reused for another case without extra processing, since it is freely available in its raw machine-readable format although such reuse may require specific technical skills.

Based on their research, Braunschweig *et al*. argue in favour of publishing OD in machine-readable format. This is because it does not limit use cases, but rather supports reusability. They conducted their research in Germany and concluded that an ideal OD platform should be optimised towards technical users and programmatic reuse. However, specifying 'technical users and programmatic reuse' reflects discrimination in their thinking which conflicts with the OD principles. Data access should be non-discriminatory by being available to anyone, with no requirement for either registration or highly specialised tools. No discrimination should accrue against fields of endeavour or against persons or groups. Machado and De Oliveira (2011) concur with the view that the publication of raw data in a machine-readable format is the most important feature in OD because it enables the reuse of data in an easily accessible way.

File types/file extensions

There are a vast number of different computer file types or formats. Oh (2013) discusses some of the more common ones, namely .csv, .xls, .html, and .pdf. However, other file types were not mentioned such as .kml which is one of the most useful formats in the OD field. Files with the extension .kml are used for expressing geographic annotation and visualisation within Internet-based, two-dimensional maps, and three-dimensional Earth browsers. The .kml extension was developed for use with Google Earth, so data in this format can be opened in Google Earth. Moreover, Oh fails to mention other file types such

as .txt, .doc, .xml or .json to name but a few. For example, in the US OGD portal (data.gov), there are many different formats (such as .csv, .json, .xml, .html, .txt, .pdf, .kml, .api, .xls, .rss and more) that facilitate the use of OD for different users and needs.

Oh (2013) recommends that the .csv file type should be used when publishing OGD, claiming that it is the simplest format for reuse. However, some data such as geographical data cannot be presented in csv format. At the same time, Oh warns about releasing data in a .pdf format because it limits usage and stifles innovation. A fundamental principle here is the ease of manipulation. Data in a .pdf format is hard to translate into other formats. Braunschweig *et al*. (2012) perceive the OGD format as a 'Zoo' because they found that most OGD platforms have two major problems: 'a plethora' of different file formats and dead links.

2.4.3 Coordination barriers in the OD processes

Coordination mechanisms between OD publishers and re-users can benefit OD providers by improving their policy- and decision-making (Zuiderwijk & Janssen, 2013). Zuiderwijk and Janssen state that it is difficult to coordinate the current OD processes in most portals. The difficulty with coordinating OD processes comes from issues associated with OD such as the complexity of OD processes, lack of structure, uncertainty, and different stakeholders. Zuiderwijk and Janssen state that coordination involves the management of interdependencies between OD activities. Based on this definition of coordination, they analyse interdependencies to determine the coordination challenges in the OD process context, as shown in Figure 2.7. They claim that there are coordination challenges between different stakeholders when opening data. These challenges can be categorised into four main activities, namely creating data, publishing data, finding data, and using data. Coordination flow depicts the main challenge in managing the overall process of opening data through creating, publishing, finding and, finally, using data. However, the authors do not appear to take into account the number of stakeholders, including policy-makers, nor other aspects such as dataset maintenance, metadata standards, and legal aspects like licensing.

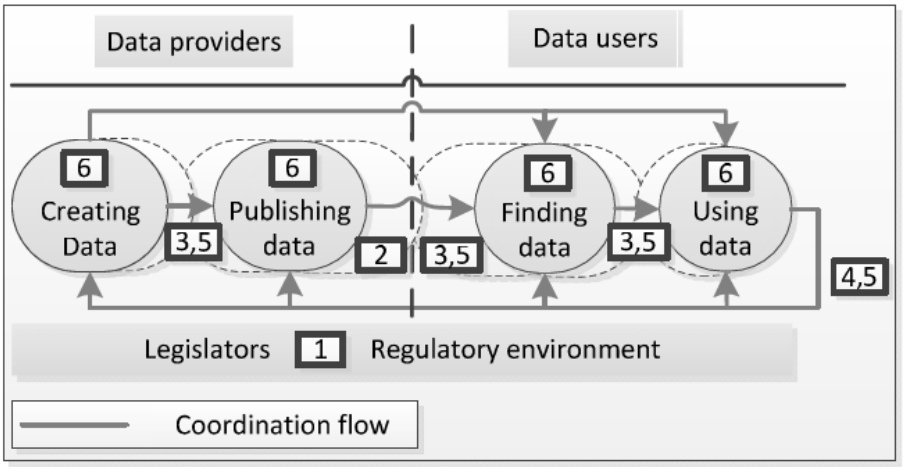


Figure 2.7 Coordination challenges in the OD process

Source: Zuiderwijk and Janssen (2013, p.42)

The challenges in Figure 2.7 are numbered from 1 to 6 as follows:

1 Inappropriate regulatory environment.

2 Fragmentation of open data.

3 Unclear boundaries of responsibilities.

4 Lack of feedback between publisher and re-users.

5 Lack of interconnected processes.

6 Lack of standardised and planned processes.

Based on the coordination challenges shown in Figure 2.7, Zuiderwijk and Janssen (2013) suggest coordination mechanisms to address OD issues. They suggest that coordination requires standardisation, structured data connectivity, modular interconnected process, mutual adjustment, breadth/range and quality of shared information, as well as deep coordination related knowledge (see Table 2.10).

Table 2.10 The coordination barriers and suggested solution approaches

Source: Zuiderwijk and Janssen (2013, p.45)

Coordination Challenges	Coordination mechanisms to solve these challenges
1.Inappropriate regulatory environment	Coordination by standardisation, plan, deep coordination-related knowledge
2. Fragmentation of open data	Coordination by standardisation, plan, structured data connectivity, deep coordination-related knowledge
3.Unclear boundaries of responsibilities	Coordination by plan, modular interconnected processes, deep coordination-related knowledge
4.Lack of feedback and lack of discussion of data use	Coordination by mutual adjustment, modular interconnected processes, structured data connectivity, deep coordination-related knowledge
5.Lack of interconnected processes	Coordination by standardisation, plans, mutual adjustment, modular interconnected processes, structured data connectivity, breadth and quality of shared information, deep coordination-related knowledge
6.Lack of standardised and planned processes	Coordination by standardisation, plan, deep coordination related knowledge

Challenges (such as the coordination challenge) must be addressed at the early stage of opening the data to avoid any negative impact on the utilisation of OD.

2.4.4 Solutions to OGD barriers

After discussing OGD barriers and challenges, it is important to identify solutions to address them where possible. Martin *et al*. (2013) identify some OD risks and provide suggested mitigation and contingency actions, as shown in Table 2.11.

Table 2.11 Risk analysis to overcome barriers to OD

Adapted from Martin *et al*. (2013)

Challenge	Suggested solution
Risks related to governance	
Reluctance of civil servants.	Engage in the early mobilisation of internal and external stakeholders, and of civil society organisations. Involve as many people as possible.
Lack of dialogue between data providers and re-users.	Encourage regular meetings between providers and re-users. Make announcement of updates, and allow users to give their opinions.
Risks related to licenses and legal frameworks	
License is not open enough.	Release data complying with the definition of openness
Heterogeneous licenses across datasets.	Awareness-raising among Stakeholders. Enforce a clear policy to publish terms of use.
Risks related to data	
Data available in heterogeneous Formats.	Publish datasets in various formats but early to create incentive for later standardisation. Develop guidelines and encourage standard formats across government bodies Training in semantic technologies.
Data quality as a result of a high-quality production process.	Stabilise funding for the creation of data and promote crowdsourcing.
Risks related to metadata	
Lack of single standard to describe datasets.	Start with standards as early as possible Participate in the harmonisation of metadata between OD catalogues.
Incomplete metadata.	Gather metadata needs from re-users; implement mechanisms to trace the provenance and use of datasets.
Risks related to user and re-user skills	
The language barrier.	Publish data in multiple languages and/or fix the issue through metadata.
Skills related to information literacy and domain knowledge.	Mention the data provenance and their first use through metadata; provide training to re-users during the events around OD.
Users are unfamiliar with Metadata.	Assessing metadata formats known by users

Table 2.11 presents some useful solutions for different challenges related to five categories, namely governance, legal frameworks, data, metadata, and users.

To sum up, although the OD field is encumbered with barriers, some studies have suggested solutions to a few of them. Proper steps in publishing OGD need to be taken in order to harvest the potential benefits of OGD. Furthermore, overcoming barriers and understanding OGD licensing, in particular, can help in improved utilisation of the OGD concept (see Khayyat & Bannister, 2015).

2.5 Co-creation

The term co-creation can simply refer to the process whereby different parties jointly produce a mutually valued outcome. The concept has been viewed from different perspectives (Payne *et al*., 2008). Co-creation can provide new perspectives, fresh ideas, and create energy because it is about involving the outside world in new ways (Pater, 2009). Pater asserts that there are different approaches in dealing with co-creation that are dependent on the "*challenge and objectives at hand*" (2009, p.2). Such practices of co-creation are not new. Companies such as Toyota and Boeing have long shared data with suppliers and customers with a view to improving supply chains and aid in product design and development (Grönroos, 2012). The origin and definitions of the concept of co-creation are provided in the next sections.

2.5.1 The origins of co-creation

Durugbo and Pawar (2014) claim that the origins of co-creation lie in Chesbrough's pioneering work in 2005 on open innovation, followed by Von Hippel's (2005) work that same year on user-led innovation. Accordingly, co-creation is related to innovation. In contrast, Terblanche (2014) states that the initial introduction of co-creation in the marketing literature was in 1980 by Toffler and it was later introduced again in 1986 when Kotler used the term 'prosumer' to refer to customers who produce some of the goods and services they consume. Here, co-creation seemed to be related to production rather than innovation. At the end of the twentieth century, Kambil *et al*. (1999) claimed that co-creation could introduce a new source of value in the market because in the co-creation process customers actively participated in the creation of value with companies. According to Kambil's point of view, co-creation is about active participation in value creation.

Voorberg *et al*. (2014) claim that the concept of co-creation originated in the private sector. Prahalad and Ramaswamy (2002) describe consumers in the co-creation process as a new source of competency for corporations. This new role for consumers implies that companies should encourage an active dialogue with consumers, mobilise consumer communities, manage customer diversity, and co-create personalised experiences (Prahalad & Ramaswamy, 2002). This is important when co-creation is being transferred to the public domain as it implies that citizens are incorporated in both the design and production process of public services and products (Voorberg *et al*. 2014).

2.5.2 Definitions of co-creation

There are multiple definitions of the concept that are particularly widespread in the fields of marketing and public administration.

First, from a business point of view, co-creation can be identified as:

> *"a business strategy focusing on customer experience and interactive relationships*. *Co-creation allows and encourages a more active involvement from the customer to create a value rich experience"*.[13]

Ind and Coates (2013) introduce the co-creation term as an emerging concept rooted in market research where consumers and organisations cooperate with other stakeholder groups such as governments and citizens. The authors state that the term co-creation describes:

> *"a shift in thinking from the organization as a definer of value to a more participative process where people and organization together generate and develop meaning"* (p.86).

They go on to describe co-creation as a new way of thinking that means changing the traditional understanding towards the relationship between provider and consumer. The expression '*participative process*' suggests that co-creation is considered to be a process or activity.

[13] http://www.businessdictionary.com/definition/co-creation.html

Terblanche (2014) claims that: "*... the term co-creation was used in regard to customer's knowledge input and the interaction between the customer and the firm*" (p.2). Terblanche highlights two aspects at the core of co-creation: knowledge and interaction. Witell *et al*. (2011), as cited in Ind *et al*. (2013), describe co-creation in a somewhat similar way as something that:

> *"... aims to provide an idea, share knowledge, or participate in the development of a product or service that can be of value for other customers"* (p.5).

Both Terblanche and Witell *et al*. include knowledge as an important aspect in the co-creation process. Furthermore, Lorenzo-Romero *et al*. (2014) define co-creation as:"*... the active involvement of customers in the process of new product and service development*" (p.383). This definition places an emphasis on customers being active in the process of generating products and services. On the other hand, Durugbo and Pawar (2014) define co-creation as: "*... a pro-active strategy for enabling firms to create value through co-opting consumer competences*" (p.1).

This contradicts the definition of Lorenzo-Romero *et al*. in two ways. Firstly, they focus on customer involvement, whereas Durugbo and Pawar focus on the firm's strategy. In other words, Durugbo and Pawar assumed that co-creation is a strategy whereas Lorenzo-Romero *et al*. surmised that co-creation is a process of involving customers. Second, Lorenzo-Romero *et al*. discuss the idea of 'active *involvement*' rather than '*pro-active strategy*', the term used by Durugbo and Pawar. Proactive (in terms of a person or action) is defined as creating or controlling a situation rather than just responding to it after it has happened.[14]

According to Kamp (2009), co-creation refers to "*the practice of product or service creation that is collaboratively executed by developers and customers together*" (p.6). Kamp considers the practical aspect of the term co-creation, with regard to the sense of the creation of products or services by more than one party. The parties engaged in co-creation are customers and developers; however, they could be any other party such as government agencies and skilled citizens. Kamp claims that the goal of the co-creation community is to

[14] https://en.oxforddictionaries.com/definition/proactive

create products collaboratively, although it could be argued that this could be extended beyond product creation to also include problem-solving.

It is worth noting that many of the current definitions of co-creation (including a number of the definitions above) are based on a marketing perspective where the focus is on the customer experience.

From a public administrative perspective, co-creation has been defined as "*[T]he involvement of citizens in both the design and production process of public services in order to (co)create beneficial outcomes*" (Voorberg *et al*., 2014, p.8).

Durugbo and Pawar (2014) identify two perspectives on co-creation, the first being in the public sphere. This perception of co-creation sees it as an activity that occurs between citizens/communities and their local authorities. They suggest that while citizens can have different roles ranging from mere passive users to collaborators in creating and extracting value from OGD, only the latter can truly be called co-creation.

The second is from a market research perspective. As mentioned previously, Durugbo and Pawar define co-creation as "*a pro-active strategy for enabling firms to create value through co-opting consumer competences*" (p.1). This definition limits co-creation to firms. They compare the received traditional view with that of the active involvement view, as shown in Figure 2.8.

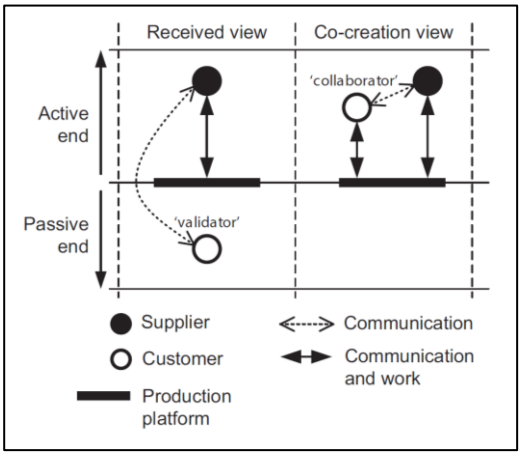


Figure 2.8 A comparison between received and co-creation views

Source: Durugbo and Pawar (2014, p.4374)

Figure 2.8 shows how in the traditional view, the supplier interacts with the production platform and the customer deals with the supplier, i.e. the customer is passive due to the lack of direct engagement with the platform. In the co-creation view, both the customer and the supplier are at the active end, engaging with the platform.

Similarly to the co-creation concept in Figure 2.8, citizens nowadays have different roles ranging from passive users to collaborators in creating and extracting value from OGD, which is referred to in this research as 'co-creation'.

Although research on co-creation has taken place predominantly in the field of marketing, different authors have used it in diverse ways. The term 'co-creation' is used to discuss a value (Chen *et al*., 2012; Grönroos, 2012), an experience (Füller *et al*., 2011; Majdoub, 2014), a product of innovation (Hesmer *et al*., 2011), and a service (Gill *et al*., 2011; Lorenzo-Romero *et al*., 2014). Since the emphasis of this research is on government data and situated in the Irish context, this study focuses on co-creation in the local government context. Some local government authorities, such as Fingal County Council, have expressed an interest in publishing open data to engage interested communities in their city jurisdiction. The role of governments and citizens has changed over the years due to the technological revolution and the need for collaboration to support one another. Some communities such as data analysts and app developers are interested in mining, exploiting and utilising OGD to generate value such as new apps (i.e. planning and parking apps). Communities, along with the LAs who are publishing OGD, are working together to create value out of OGD.

For the purposes of this research, the definition of co-creation is restricted to the joint activities by interested parties for creating value (that can be a service, a product or even an idea) by using OGD. This definition of co-creation is a specific subset of the co-creation world and is grounded in the concept of the value of public goods; it does not focus on either firms or customers. Instead, it is concerned with local government and interested communities within the OGD context.

What the above definitions have in common is that co-creation involves more than one party and, further, it implies changing traditional mind-sets where there is one active party and one passive party.

2.5.3 Types of co-creation

Several ideas on how co-creation works and can be/is initiated can be found in the literature. Not all of these are compatible. Pater (2009) envisages co-creation as having two central dimensions: openness and ownership, defining openness as being open for anyone to join in the process of co-creation, or that there is a selection criterion in the process. Ownership refers to the outcomes and challenges owned by just the initiator or also by the contributors. These two dimensions lead to the four main types of co-creation as shown in Figure 2.9.

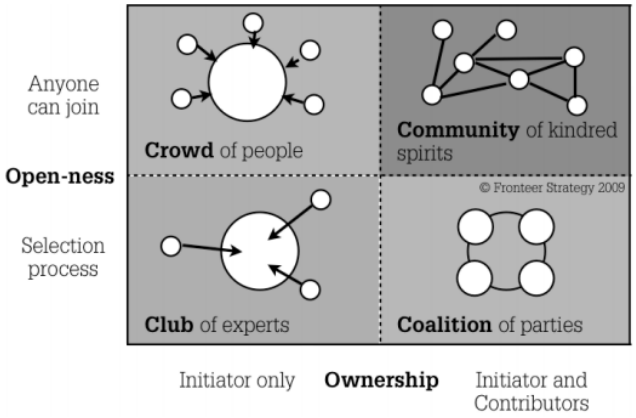


Figure 2.9 Types of co-creation

Source: P2P foundation (2012); Pater (2009, p.2)[15]

The four types of co-creation as shown in Figure 2.9 are explained in detail in Table 2.12.

[15] http://p2pfoundation.net/Four_Types_of_Co-Creation

Table 2.12 Types of co-creation
Source: (P2P foundation, 2012; Pater, 2009, p. 2)

Co-creation Type	Description	Example
Club of experts	The ‘‘Club of Experts” style of co-creation is the most suitable, for very specific, time-pressured challenges that demand expertise and breakthrough ideas. Contributors meet certain specific participation criteria and are found through an active selection process. The quality of input and chemistry between participants are the key to success. ‘No-box’ thinkers are the ones you want to have in any project.	Nokia organises ‘lead user’ and ‘expert’ co-creation sessions to develop visionary new products and services.
Crowd of People	Also, known as “Crowdsourcing”, this form is all about the Rule of Big Numbers: anyone can join. For any given challenge, there might be a person ‘out there’ with a brilliant idea that merits consideration. Using online platforms, people can rate and respond to each other’s suggestions. There is often a marketing and seeding component/objective attached to the process. Crowdsourcing ‘unleashes the power of the masses’, but often takes longer - and there is uncertainty as to whether the best people will (want to) contribute.	Threadless is a successful online t-shirt platform where contributors can send in and rate t-shirt designs. A full 30% profit margin selling t-shirts with no R&D cost, low investments (no stock or debtors) and hardly any employees.
Coalition of Parties	In certain complex situations, a “Coalition” of parties team up to share ideas and investments. Each of the parties brings a specific asset or skill. Technical breakthroughs and the realisation of standards often happen only when multiple parties collaborate and this is especially important when capital expenditures are high. Key success factors include sharing knowledge and creating a common competitive advantage.	Heineken has successfully launched a home draft system called the ‘Beertender’ in co-operation with Krups.
Community of kindred spirits	The “Community” form is most relevant when developing something for the public good. Groups of people with similar interests and goals can come together and create. This model - so far - works mostly in software development.	The Linux open source operating system software was developed by users for users. The software code is free and owned by nobody.

Although there are four types of co-creation in Table 2.12, co-creation takes many forms and squeezing it into only four categories is not sufficient for this research; because it is not practical sometimes to regard them separately.

2.5.4 Motivations of participation and co-creation

According to Lakhani and Panetta (2007), one of the questions asked when people work for no pay is "*Why do people work and participate for 'free'?*" (p.103). The answer includes the role of economic motivations, notions of enjoyment and having fun together with identity and the social benefits of working as a group. They identify the following factors as motivators for user participation and co-creation:

- Cash/monetary rewards.
- Hobbies/having fun.
- Sense of identity and community belonging.

Lakhani and Panetta's list of motivations are both intrinsic and extrinsic but not holistic as other motivations can lead to community participation such as problem solving as in the case of the "fixmysteet.ie". Yang and Kankanhalli (2013) identify several elements that can lead co-creators and innovators to make sense of OGD, such as: "*desire for access to specific facts, having direct relevance and appeal to their needs, and prospects of monetary rewards*" (p.648). Voorberg *et al*. stress the importance of concrete incentives because it is important for public officials to display governmental support to public co-creation to gain more attention for civil participation. In that sense, Voorberg *et al*.'s research offers an explanation as to why concrete incentives are important.

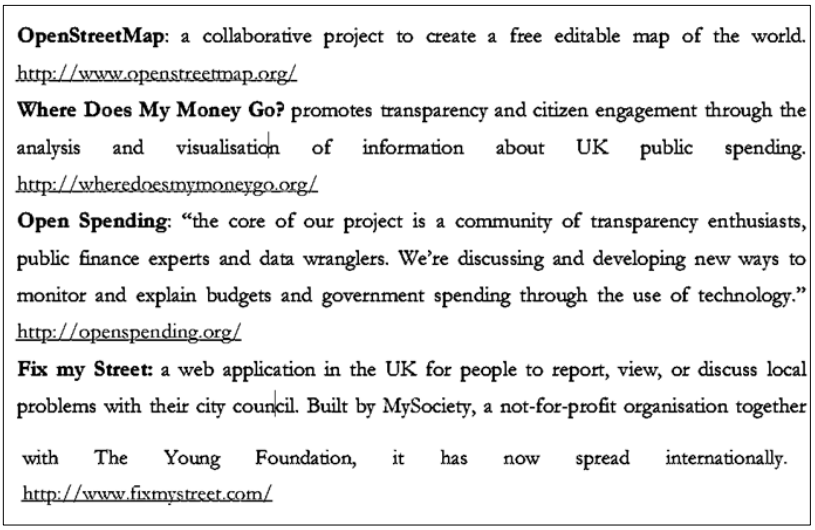
All mentioned elements illustrate that a person (who is interested in co-creating or innovation) must have a reason in order to contribute to either co-creation or innovation. However, this may not always be the case because some people are inclined by their nature to share their time and knowledge with others.

2.5.5 Linking OGD and co-creation

One use of OGD is for co-creation. To date, there has only been a modest amount of research into the use of OGD for this purpose and specifically into how and to what extent OGD enables civil communities (as opposed to corporations) to participate in public life and create public value (Moore, 1995). According to Muente-Kunigami (2012), OD is defined as follows:

> *"open data is nowadays more about information that can be leveraged in innovative ways through technology to improve and co-create public services, but it does not exclude by any means data aimed at making governments more transparent and accountable"* (p.1).

While co-creation could seem to be relevant to consumers and providers in market research, Muente-Kunigami explains the concept of co-creation within the OD context. Bonina (2013) claims local and central governments have both invested in the co-creation of services explaining that the common example of co-creation is the mobile transport apps that flourished in London after the release of real-time transportation data for the Greater London Authority (GLA) in 2010[16]. Bonina (2013) lists OD cases, which are built upon voluntarism, civic engagement and cooperation, as shown in Figure 2.10.



OpenStreetMap: a collaborative project to create a free editable map of the world. http://www.openstreetmap.org/

Where Does My Money Go? promotes transparency and citizen engagement through the analysis and visualisation of information about UK public spending. http://wheredoesmymoneygo.org/

Open Spending: "the core of our project is a community of transparency enthusiasts, public finance experts and data wranglers. We're discussing and developing new ways to monitor and explain budgets and government spending through the use of technology." http://openspending.org/

Fix my Street: a web application in the UK for people to report, view, or discuss local problems with their city council. Built by MySociety, a not-for-profit organisation together with The Young Foundation, it has now spread internationally. http://www.fixmystreet.com/

Figure 2.10 Some OD cases

Source: (Bonina, 2013, p.18)

The cases of civic engagement above prove Kassen (2013) remarks that OD creates an appropriate environment for proactive civic engagement by providing opportunities for developers to create applications using OD with no need for any official permission. However, whether mere availability is sufficient to create an appropriate environment for proactive civic engagement is open to discussion. Kassen goes on to claim that collecting citizens' data for different purposes, such as: "*... mapping, visualizations, ranking of the*

[16] Transport for London's real-time transportation and commuting data.

transportation routes, building permissions, crime data, and environmental pollutions" will eventually create a new environment for cooperation between local government and the public (p.511). While this statement may be true, there is limited empirical evidence to support this claim. Kassen believes that co-creation between government and different communities (such as academics or not-for-profit organisations) is more observable than that between government and ordinary citizens. This confirms Bonina's views (2013) on the importance of investing in co-creation by local and central governments through the provision of OD to citizens. This in turn leads to greater applications and services such as those shown in Figure 2.10.

Research conducted by Voorberg *et al*. (2014) analyses the relationship between the success of co-creation between citizens and local governments in the Netherlands. This investigates two exemplary examples of public co-creation in the Dutch welfare domain through a qualitative case study. Their data consisted of twenty interviews including experts in the field of co-creation. Voorberg *et al*. define successful co-creation as building upon a platform where different stakeholders can have constructive communication, leading to increased participation and an exchange of innovative ideas. They stress that co-creation success is dependent on the external factor of 'citizens' instead of the internal factor 'employees'.

According to a survey carried out on the 'data.gov.uk' website in 2010, 31 per cent of users agreed that OGD projects can make a direct impact on the lives of individuals, while 36 per cent agreed that such projects can contribute to the improvement of local and national democracy (Davies, 2010). Although this survey focused on the social impact, it did not consider it as a co-creation; rather it suggested that OGD led to the co-production of planning and services due to its collaborative community-based participation.

There remains a paucity of studies and findings in published academic research that examines the relationship or impact of OGD on co-creation. Addressing the Open Innovation 2.0 conference in 2014 and talking about *London Smart City,* Kleinman (2014) stated that local government in London uses open data to empower citizens. He also stated that from his experience only groups with high technological skills participated in co-creation, and expressed the belief that the next step for government is to enable and encourage ordinary citizens to participate and co-create.

2.5.6 Co-creation in research

Though most studies have been carried out in the area of co-creation from a marketing perspective (Payne *et al*., 2008; Kohler *et al*., 2011; Chen *et al*., 2012; Grönroos, 2012; Grönroos & Voima, 2013; Ind *et al*., 2013; Vernette & Hamdi-Kidar, 2013; Lorenzo-Romero *et al*., 2014; Terblanche, 2014), the concept of co-creation has also been examined in many empirical studies within a wide range of industry sectors such as in health (Gill *et al*., 2011), retail (Oh & Teo, 2010), tourism (Prebensen & Foss, 2011), sports (Zagnoli & Radicchi, 2010), telecommunications (Matthing *et al*., 2004), aviation (Gössling *et al*., 2009), manufacturing (Zhang & Chen, 2008), automotive, pharmaceutical (Sawhney *et al*., 2005), human Systems (Korhonen, 2013), social innovation (Voorberg *et al*., 2013), and cultural Tourism (Majdoub, 2014).

According to Terblanche (2014), researchers have taken a number of different approaches to examine co-creation from both cultural and economic perspectives. Some studies have explored the co-creation process, but in different contexts and with varied objectives such as:

- Presentation of a unified model of the co-creation process for companies (Durugbo and Pawar, 2014).
- Presentation of a theoretical model for co-creating IT value through the collaboration of organizations (Flak *et al*., 2015).
- Investigation on how best to enable participation among elderly citizens in co-creation (Karahasanović *et al*., 2009).

Although there are many studies about co-creation in different areas, as shown above, there is a lack of co-creation models that can facilitate the collaboration between more than one party. The only model that can be partly useful is by (Flak *et al*., 2015) who propose a theoretical model for co-creating IT value through the collaboration of organisations (see Figure 2.11);

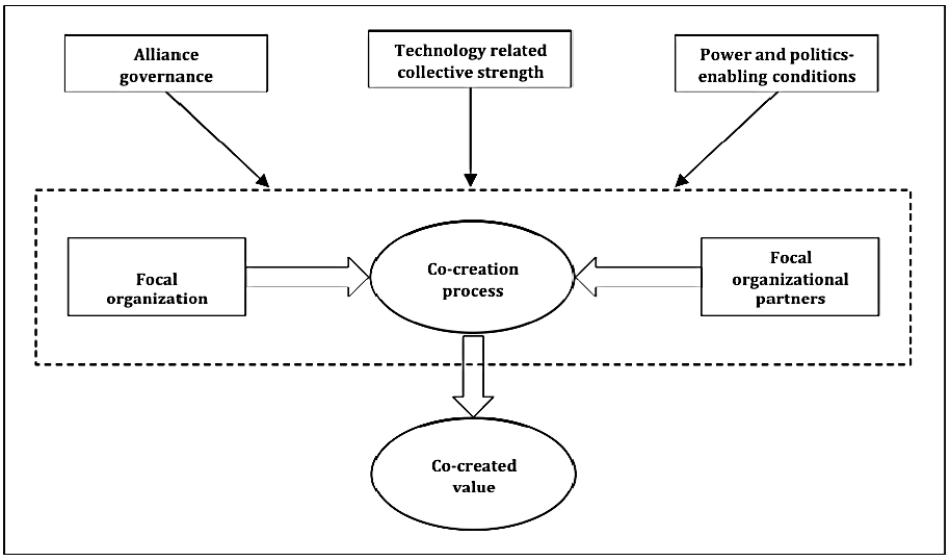


Figure 2.11 Theoretical model for co-creating IT value

Source: (Flak *et al.*, 2015, pp., p.2)

The model in Figure 2.11 provides a structure for co-creation processes where more than one party is working together under some external factors such as alliance governance, technology-related collective strength, and power- and politics-enabling conditions. However, this model by Flak *et al*. (2015) is quite generic and lacks a detailed description of the actions carried out in the co-creation process. In this research, the structure of Flak *et al*.'s model is adopted to create this research model, as described in Chapter Six.

2.5.7 The gap in OGD and co-creation research

In OGD research, many studies tend to focus on datasets and data architectures (Hausenblas & Karnstedt, 2010; Umbrich, 2012; Larkou *et al*., 2013) rather than the use of the data. Larsson (2013) suggests that more research is needed into how open data changes society. Fitzpatrick (2012) states that, although a myriad of active initiatives using OGD are to be found around the world, most are at the "*embryonic*" stage. There is, therefore, a gap in current research which opens up opportunities for scholars in this field. Ind *et al*. (2013) agree, noting that although there are many research studies examining co-creation, there is not enough information on how participation emerges and develops in a virtual co-creation community. In a similar vein, Durugbo and Pawar state that: "*... co-creation as a research area is still at an early stage and there is a need to formalise the co-creation process*" (p.4374).

Some studies have explored the co-creation process, but in different contexts and with specific objectives. (Krabbe & Schmidt Christensen, 2014) state that there is an inauspicious divide in the effort to understand co-creation between performance-oriented scholars on the one side and critical management scholars on the other. They justify this by assuming that many of the contributors to critical management studies seem to be forcing the concept of co-creation into their own research scheme, thereby missing how co-creation relates to an already existing body of thought. Krabbe and Schmidt Christensen claim that scholars within the field of co-creation research typically observe the various business initiatives, structures, and behaviours when they have occurred or been established, without looking at the lines of thought behind such initiatives.

Investigating the concept of co-creation within the OGD phenomenon has not yet been examined sufficiently in the academic literature. To date, most studies on co-creation have focused on commercial co-creation, i.e. between companies and their customers rather than governments and citizens (Kohler *et al*., 2011; Chen *et al*., 2012; Grönroos & Voima, 2013; Vernette & Hamdi-Kidar, 2013). A review of the literature shows that there have been no studies to date examining the impact of OGD on the phenomenon of co-creation, although a number of studies have discussed the link between the two (Maier-Rabler & Huber, 2012; Jetzek *et al*., 2013a; Jetzek *et al*., 2014). There is, therefore, a gap that must be addressed. It is this gap which the present research seeks to address, in addition to contributing to our understanding by investigating co-creation between local government and interested communities through their engagement with OGD in Dublin.

2.6 Conclusion

In conclusion, there is as yet no consensus on the concepts of OD, OGD and co-creation. As discussed throughout the chapter, many researchers worldwide have spent considerable time and effort in recent years debating the benefits and promises, and proposing ways to encourage OGD initiatives. Many of these discussions have focused on defining and setting principles and characteristics of OGD.

This chapter showed that co-creation has been used in diverse ways and by different stakeholders to point to a value, an experience, a product, innovation, and service. Many studies examine co-creation from the perspective of an organisation or brand behind a co-creation initiative. There exists a limited understanding of co-creation and its processes and

no scholars have studied the co-creation phenomenon from a process perspective within the OGD field. In this research in particular, Chapter Six aims to formulate a model that can help multiple parties to join together in activities.

Chapter 3

THEORETICAL FRAMEWORK

3.1 Introduction

This chapter presents theories in IS research and moves on to provide a historical background of AT that describes its three generations. This research takes a critical look at AT and addresses some of its problems and weaknesses. With this in mind, the chapter presents the use of AT in IS research and discusses how it has been criticised. Accordingly, the chapter presents the development of the extended AT model (the augmented AT). Lastly, it presents how AT is used as the theoretical and conceptual framework for this research.

3.2 Theories in IS research

Grover and Lyytinen (2015) argue that the purposes of published IS theory are to classify, predict, and explain IS phenomena. However, there are other purposes such as generating ideas or understanding and discovering phenomena. Grover and Lyytinen (2015) set out levels of theory-building or theory-borrowing which are: instantiation, modifying, and extension (see Table 3.1).

Table 3.1 Types of theory borrowing in IS research

Source: (Grover & Lyytinen, 2015, p. 278)

Theoretical Adaptation	Characterisation	Degree of Change	Rationale
Instantiation	There are no or very minor changes in constructs, configurations, or logic from the borrowed theory.	None—although some relabeling and operationalisation adjustments may be involved.	Application of TAM in a new context with minimal changes in constructs, configurations, or logic.
Modifying	Unlike instantiation, the constructs need to be modified (e.g., a construct like "asset specificity" (AS) in transaction cost economics (TCE) is used to study out-sourcing but modified to "system specificity")	Minor to major, depending on whether only the constructs are modified (minor) to adapt to the context or whether changes in logic are involved too (major).	Subtly adapts each construct to the context. The adapted variables are related to each other in new ways.
Extending	Some new constructs and (therefore) new conceptual relationships must be added to the model and theory as a result of their extension. These typically seek to clarify specific conditions when the abstract constructs of the theory will apply.	Typically, moderate to major changes depending on the number of new constructs conceptualised and configured with new logic.	Develops new "response to resistance" constructs, which fundamentally change the logic of the underlying model.

Table 3.1 shows that there are ways to borrow or utilise other theories, however, if the researcher creates new constructs, configurations, and logic, then this is not borrowing and would rather be considered as building a new theory.

In IS research, building or borrowing a theory requires considering both people and technology. Furthermore, Kuutti (1999) suggests that in order to design and implement a successful Information systems (IS) research context, it is important to take into account people and their relationships. Activity Theory (AT) is one such example of a theory that considers people, their relationships, and technology. AT has been used in IS research, although its use varies. However, in this research AT is used for analysing the data, designing the interview questions, and structuring the data findings. It is used because of its strengths due to its long historical roots as a philosophical and cross-disciplinary framework for studying different forms of human practice (Mursu *et al.*, 2006). This research uses and extends the AT.

With regard to AT in IS research, its first use was at the IFIP WG 8.2 conference in Copenhagen in 1991 (Mursu *et al.*, 2007). Since 1991, AT has been applied to research in

many IS-related fields – e.g. Computer-Supported Cooperative Work (Neale *et al*., 2004), a framework for qualitative analysis (Hashim & Jones, 2007), Management Education (Holman *et al*., 1997), Human-Computer Interaction (Kuutti, 1996; Nardi, 1996; Mwanza, 2002), and Information Science (Spasser, 1999). AT is used in the IS field for understanding and driving IS mediated change in organisations. Its structure has proven to be useful in the IS field (Chen *et al*., 2013) because it considers the interactions, dynamics, and developments of work activities in a social context (Mursu *et al*., 2007).

3.3 Historical Background of Activity Theory

Activity Theory (AT) is based on the cultural-historical school that drew largely upon the works of Vygotsky (1978) and (Karanasios *et al*., 2015). The foundational concept of the AT is that, in any activity, there is someone who wants to achieve something by using tool(s). Further, considering the social context, there are other aspects that can affect the activity; these are rules, community, and division of labour.

3.3.1 Three Generations of Activity Theory

AT proposes that human activity is directed towards an object, mediated by artefacts or instruments, and socially constituted within the surrounding environment (Vygotsky, 1978). In other words, the interaction between the subject (human doer) and object (the thing being done) is mediated by tools and signs (Hasan & Kazlauskas, 2014; Karanasios *et al.*, 2015). The subject is the active element of the activity process and can be either an individual or a group (see Figure 3.1) (Chen *et al*., 2013). The **first generation** of AT is defined as 'mediated action', and was set out by Vygotsky (Yamagata-Lynch, 2010). During this early period, AT studies tended to focus on individuals[17].

The basic model of mediation proposed by Vygotsky was illustrated with the use of bi-directional arrows that for Bakhurst (2009) represent contradictions. In some research, such as (Hashim & Jones, 2007; Chen *et al*., 2013), the meaning of the arrows is not always explained.

[17]http://www.bath.ac.uk/research/liw/resources/Models%20and%20principles%20of%20Activity%20Theory.pdf

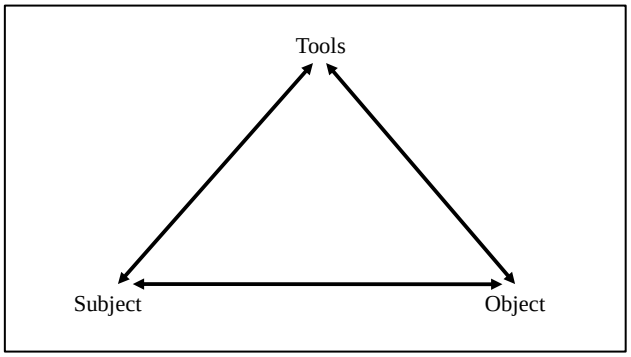


Figure 3.1 First-generation activity theory's (Vygotskian) model of action

The basic model is also used without arrows, as shown in Figure 3.2.

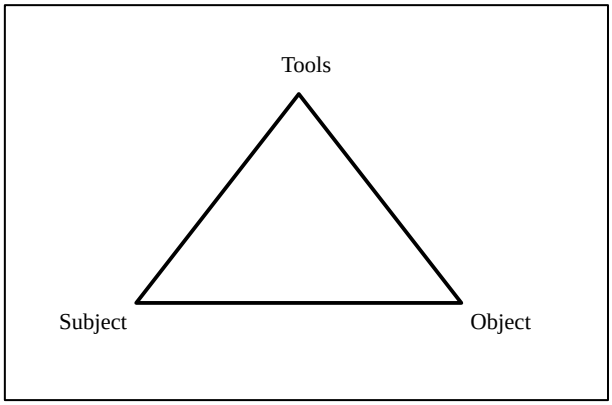


Figure 3.2 Basic structure of activity

Based on Vygotsky (1978, p.40)[18]

As shown in Figure 3.1 and Figure 3.2, the first-generation of activity theory focused on individual action and studied the concepts of subject, mediating artefacts, and object (Vygotsky, 1978). This basic model does not include a social context (Montoro & Hampel, 2011). In order to address this problem, Engeström (1987; 1999), as cited in (Bakhurst, 2009), developed the model further by adding more elements and complexity to the basic structure.

The **second generation** of AT is attributed to the works of Leontiev and Engeström (1987). They considered the collective nature of human activity (Yamagata-Lynch, 2010) by adding three more aspects to AT, namely rules, community and division of labour.

[18] http://sisaljournal.org/archives/sep11/montoro_hampel/

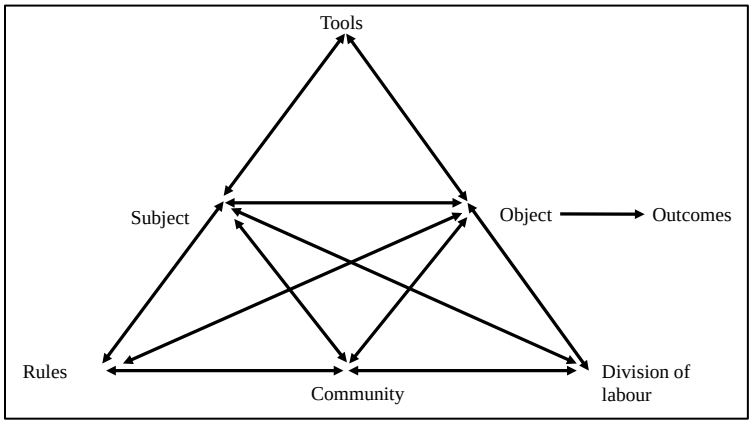


Figure 3.3 Second-generation activity theory's model of an activity system

Source: (Bakhurst, 2009, p.201))

Figure 3.3 shows that in any activity, subjects or people use tools to achieve and reach their objectives and the overall activity will have an outcome or outcomes. This process can also be mediated through an organisation or community which may impose rules or regulations that could affect the activity. Individuals can work as part of a community to reach their objectives. Activity can feature a division of labour, which means the way in which the work is divided into tasks, or identifying who is responsible for carrying out each task and how the roles are organised. Not all activities require the division of labour, because if the activity is based on voluntary work there may be no clear division of labour.

The second-generation of activity theory focuses on the social context of a single-activity. However, there are some problems with this model. It is difficult to know when AT is depicted with arrows what purpose the various arrows serve, as shown in Figure 3.3. For example, the meaning attributed to some arrows is clear and make some sort of sense, such as that between the subject and tools. The meaning of others, however, is not entirely clear (e.g. the arrows linking rules and division of labour - why is the community in the middle? What does this arrow indicate?). There is also the oddity that the three items on the sides have arrows to everything else, but those at the corners do not. It is not clear if this is intentional as there is a lack of a detailed discussion and explanation of this in the literature. Furthermore, the arrows do not have any accompanying text to explain their roles (e.g. the arrow between Rules and Community). The arrows' functions are discussed critically in section 3.3.1.

Despite these ambiguities, Yamagata-Lynch (2010) states that many studies in the USA (Engeström & Middleton, 1998; Engeström *et al*., 1999) using AT have predominantly focused on the descriptive nature of second-generation activity theory, and used AT as a supplementary tool in qualitative research.

The **third generation** of AT was developed by Engeström (2001) for applications of activity systems analysis wherein the researcher takes a participatory and interventionist role in the activity of participants, see Figure 3.4 (Yamagata-Lynch, 2010).

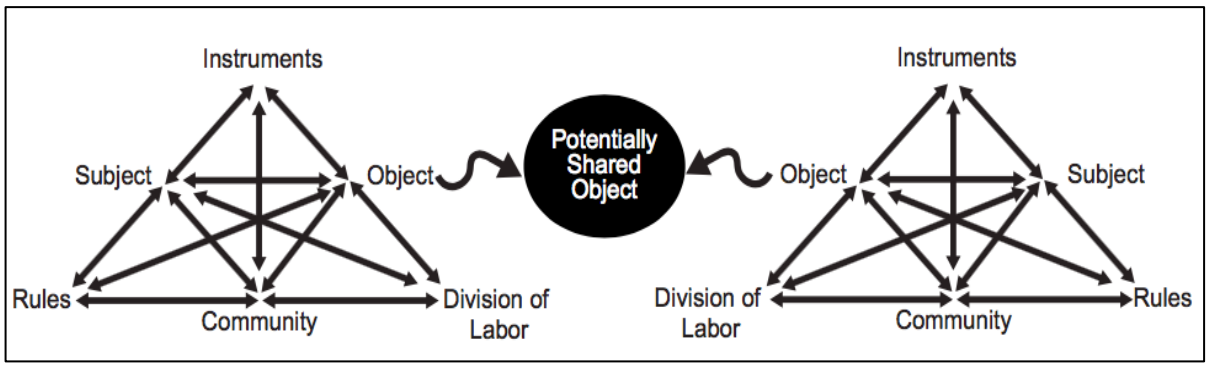


Figure 3.4 Third-generation AT's model of two interacting activity systems

Source: (Bakhurst, 2009, p.201)

In Figure 3.4, the researcher observes a potentially common object between two activities that are comparable. According to Yamagata-Lynch (2010), many researchers encourage the use of the third generation AT in order to engage in new work within an interventionist framework.

Yamagata-Lynch (2010) claim that researchers who have used AT have found it to be helpful and can offer insights to their research. For example, Mwanza (2002) uses AT in her research within the field of Human-Computer Interaction (HCI) and creates six research questions based on AT which are:

- *"What tools do the subjects use to achieve their objective and how?*
- *What rules affect the way the subjects achieve the objective and how?*
- *How does the division of labour influence the way the subjects satisfy their objective?*
- *How do the tools in use affect the way the community achieves its objectives?*

- *What rules affect how the community satisfies their objective and how? and*
- *How does the division of labour affect how the community achieves the objective?"* (p.155).

Mwanza (2002) found that AT was an appropriate theory for conceptualising IS research and, in particular, within the field of HCI.

3.3.2 Criticism of AT

Although AT has been used as a framework for qualitative analysis in multiple research papers in different disciplines, it has been subject to some criticism (Blunden, 2009). One such criticism is that although AT considers context to be important, it is quite restricted regarding the broader socio-economic context (Murse *et al*., 2007). Criticism of AT is predominantly influenced by Bakhurst's (2009) paper entitled "*Reflections on activity theory*". Four main points are presented as being some of the weaknesses of AT, as follows:

First, the catalyst which motivates people to achieve their object is absent in the AT model. On this, Brown (2011) comments:

> *"The premise of activity theory is that a collective work activity, with the basic purpose shared by others (community), is undertaken by people (subjects) who are motivated by a purpose or towards the solution of a problem (object), which is mediated by tools and/or signs (artefacts or instruments) used in order to achieve the goal (outcome). The activity is constrained by cultural factors including conventions (rules) and social organisation (division of labour)"* (p.1).

Brown suggests that people are motivated by a purpose or to solve a problem, however, the factors that spur motivation are not discussed clearly.

Second, any acknowledgment of difficulties that people may face when conducting any activity is absent in the AT model. It is important to be realistic when investigating an activity as any activity can be surrounded by obstacles and challenges. Bakhurst (2009) states that:

> *"It is also interesting that there seems to be no obstacle whatsoever, apart from ideological ones, to employing any one of a number of other methods in conjunction with an activity-theoretical approach […] But there appears to be no obstacle to doing this in any one of a number of ways. This might […] be a symptom of its [activity theory] emptiness"* (p. 207).

Based on Bakhurst's quote, the need to add the barriers aspect is clear in order to make the model more realistic.

Third, the vagueness of the term 'object' in the AT model must be clarified. It is unclear whether the term means objective or literally an object. Leontiev (1981, cited in (Bakhurst, 2009), argues that in a (non-human) animal's case, the object of an activity and its motive coincide. The animal's activity is directed to objects of biological need and catalysed by those objects. For example, hunger can be the cause of the animal's activity to satisfy its needs. On the other hand, in the human case, object and motive can be distinguished. The person's motive is the need, for example, for food or clothing, but his/her action does not always address this directly. Instead, it is a contribution to a wider social activity where each participant supplies some part to the realisation of a common end. Bakhurst (2009) draws attention to the fact that the Russian and German languages have two words for 'object'.

> *"[объект] – the term typically counterposed to subject, with connotations of brute objectivity and otherness, and "predmet" [предмет], with connotations of a conceptualized object – an object of inquiry, situated in a space of intention and purpose. What kind of thing should we be talking about when we are modelling activity systems?"* (p.208).

Based on the Russian translation, "*объект*" means an object and *"предмет"* means a thing or a subject. While in English it is not always clear what the difference is between an 'object' and a 'thing', it could be that the *object* means a physical item and *predmet* is something more abstract. This transition or translation from Russian philosophy renders ambiguous the term "object of activity" in English. One interpretation of an object is that it means the purpose or aim of the activity. The second interpretation of an object is that the object of the activity can indicate upon what the subject is acting (Bakhurst, 2009). Hence, when investigating an activity, the two questions in both cases revolve around what are

people trying to achieve by conducting their activity, and what are people working on? Bakhurst (2009) points out that "*once we sort out the ambiguity manifest in the English, we are home*" (p.208). Thus, the term 'object' is altered to 'objective' and will be presented later in Figure 3.6.

Fourth, as discussed in section 3.2.1, that there are unclear contradictions/relationships in the AT model. The reshaping of the model was stimulated by Bakhurst (2009) who stated that:

> *"The model also says almost nothing about the relation that the various components bear to one another. The points of the triangles are joined by lines, but what do the lines represent? This is an important question because the items at the nodes are not just given: the relations they bear to each other will to some degree constitute them"* (p.207).

Bakhurst (2009) described AT as a framework that is "still-emerging" (p.197). He encourages researchers to rethink AT and engage in a self-critical dialogue between the different styles of thinking within the activity theory tradition. Engeström argued that the dynamics of the activity system result from "contradictions" between its elements (Bakhurst, 2009). The arrows that indicate the contradictions are not apparent. Bakhurst (2009) further adds that in terms of understanding the dynamics of the activity system, the idea of contradiction is vague. He asserts that:

> *"Within Russian philosophy and psychology, the concept of activity was always seen as problematic and open to multiple interpretations. It is important that Vygotsky's interest in mediation quickly led him to become preoccupied with meaning as he recognized that mediating artifacts do not influence us simply as artificial stimuli, but in virtue of their significance, which cannot be understood causally"* (p.201-202).

Bakhurst admits that AT contains a significant 'degree of truth'. However, it requires more work to make it 'plausible' (p.204). What is needed is critical rethinking in order to develop AT in ways that would make it conceivable.

In this research, three steps have been taken to make AT more meaningful or more realistic. First, four more elements have been added to the AT model (motivations,

barriers, level of awareness, and effectiveness). Second, some terms have been changed; the subject has been changed to people (publishers and users), and object has been changed to objective. The reason for changing the names is to remove the ambiguity of both terms when translated from Russian. This makes it easier to understand that this model is specifically viewed from a human context in a parallel manner to that in which it has been used for both human and animals by Leontiev. The third step involves reshaping the relationships in the triangle and changing the positions and arrows that indicate their relationships (see Figure 3.6). AT has both theoretical and conceptual stands. Bakhurst (2009) encourages researchers to rethink the two strands before using them.

3.4 The augmented AT

Considering the critiques about the three generations of AT, the augmented AT is offered in this research as follows:

3.4.1 The rationale behind adding each aspect to the AT Framework

Motivations

The predominant factor in influencing an individual's goals or aims is their drive; this is known as motivation (Singh, 2011). Singh claims that motivation may come from an internal or external source and can be a combination of factors that lead people to attempt to achieve their goals. Motivation is derived from the Latin meaning "to move" (Weiner, 1992, p.1, cited in (Eccles *et al.*, 1998). Motivational psychologists study what moves people to act and why people do what they do (Weiner, 1992).[19] Singh states that:

> *"According to various theories, motivation may be rooted in the basic need to minimize physical pain and maximize pleasure, or it may include specific needs such as eating and resting, or a desired object, hobby, goal, state of being, ideal, or it may also be attributed to less-apparent reasons such as altruism, selfishness, morality, or avoiding mortality. Conceptually, motivation should not be confused*

[19] http://psycnet.apa.org/psycinfo/2005-03132-015

with either volition or optimism. Motivation is related to, but distinct from, emotion" (p.162).

Motivation is divided into two types: intrinsic or extrinsic (Singh, 2011). According to Montoro and Hampel (2011), human activity is driven by needs that account for a general motivation. Wertsch, Minick and Arns (1984, cited in Montoro and Hampel, 2011) claim that motives are socioculturally determined. Allen *et al*. (2011) and (Allen *et al*., 2013) added the motivation aspect to the AT model (see Figure 3.5).

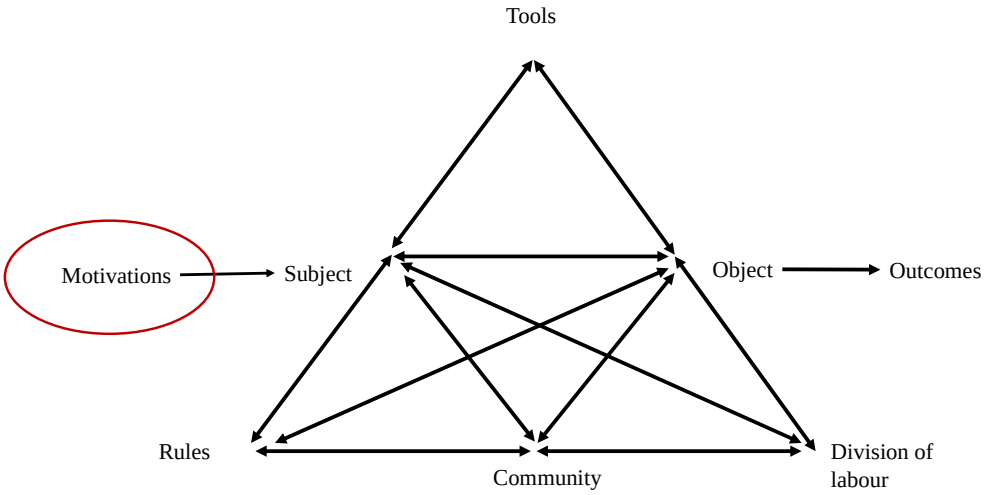


Figure 3.5 Example of using AT with adding the 'motivation' aspect

Source: (Allen *et al.*, 2013, p.840)

In keeping with this broad view of motivation, this aspect was added to AT with the intention of drawing attention to what motivates communities to utilise OGD. Understanding the motivations of people can enable the researcher to address the question of why some people invest time and energy in engaging with OGD, be they either publishers or users. The importance of understanding their motivations will assist in providing ways to promote and increase the utilisation of the OGD phenomenon.

Barriers

OGD barriers have been highlighted in recent research papers (Zuiderwijk *et al*., 2012; Barry & Bannister, 2014; Martin, 2014). The main reason for including the aspect of barriers in AT is that they are an important factor in any situation, and particularly so in co-creation within the OGD field. The barriers aspect is important in order to understand the

activity of engaging with OGD at a deeper level to provide solutions and recommendations to overcome them.

Awareness

The main reason for discussing the level of awareness in the AT is that knowledge plays a significant role in the use of OGD which is considered a new phenomenon. Understanding the level of awareness within communities can assist in justifying the findings of this research and give a clearer picture of OGD in the Irish context. The lack of awareness results in negative consequences, such as the loss of desire to engage with OGD. This aspect is added to draw the attention of researchers to consider examining the level of awareness of any activity in order to justify the outcomes of that activity in a clearer picture of its status.

Effectiveness

Grover and Lyytinen (2015) suggest that 'Effective' means "*any dimension of improvement in the human condition in which the uses of IT can be evaluated*" (p.272). There are no studies that investigate the effectiveness of OGD in order to facilitate co-creation. A lack of understanding has been identified as to how activity effectiveness can be investigated. Even though the AT includes factors that affect the activity, it does not consider an examination of the overall effectiveness of all factors in order to achieve the objectives or outcomes. To draw the attention of scholars and researchers to a consideration of effectiveness when examining any activity, the aspect of effectiveness is added to the AT model.

The evolved model of AT is shown in Figure 3.6.

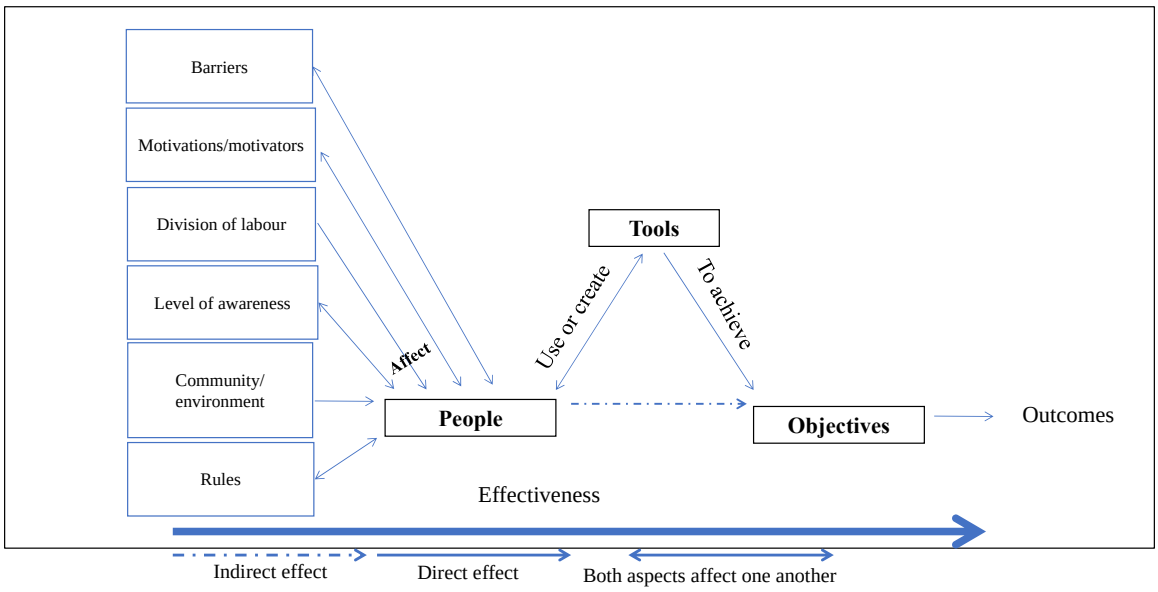


Figure 3.6 The augmented AT Model

The augmented AT is presented in Figure 3.6 and shows that in any activity, people must use mediators or tools to achieve their objectives and outcomes, as explained by Vygotsky (1978). Other aspects have been taken into consideration in the new model, with a clarification of the arrows' functions as follows:

- Motivations (drivers to achieve people's objectives) where both people and motivations affect one another. This is because people can motivate others and others can in turn be motivated, thus, it is appropriate to assign the forward arrow.
- Level of awareness, which is about what datasets people have (OGD) and what they can do with them. It is also characterised with the double-headed arrow because people can run training sessions, for example, to increase levels of awareness around OGD.
- Environment and the surrounding community can have a direct impact on people's activities; thus, it is appropriate to assign the forward arrow.
- The aspect of rules or regulations has the double-headed arrow because people create rules and others are affected by these rules.
- Division of labour is affecting the activity directly based on the input from each one; thus, it is appropriate to assign the forward arrow.

- The aspect of barriers which affect the outcomes of the activity is characterised by the double-headed arrow because individuals can create barriers, such as cultural obstacles, which can hinder others to engage with OGD.

- The aspect of outcomes is presenting the projects which have been used to investigate the effectiveness of OGD. For example, one of the outcomes of the activity of utilising OGD is Code for Ireland initiative which considered as a proof of OGD being effective.

- Lastly, regarding the aspect of effectiveness of the overall activity, the arrow of effectiveness is assigned to the overall activity; if people achieve their objectives, the activity can be considered effective.

There is only one arrow in the model that reflects the indirect effect between people and their objective. It is indirect because individuals cannot achieve their objectives without being affected by many other aspects including tools, motivations, barriers, division of labour, rules and community. This new presentation clarifies whether the arrows mean a direct effect, indirect effect, or both aspects affecting one another.

Here, the evolution of AT theory is applied to enhance research and practice as Gregor (2006) asserts that "*thinking clearly about the nature of theory in Information Systems has significance for research and practice [and] developing a theory is what we are meant to do as academic researchers*" (p.613). She further added that theories allow knowledge to be collected in a systematic way and this collected knowledge enlightens professional practice.

3.4.2 AT in this research (the theoretical and conceptual framework)

The case of using AT to investigate the impact of OGD

AT offers a socio-technical perspective and does not give precedence to the social over the technical or vice versa (Allen *et al*., 2013). Although Allen *et al*. (2013) describe AT as socio-technical, others have describe it as a socio-cultural theory (Baran & Cagiltay, 2010). The context of activity being taken into consideration has enabled researchers to investigate an individual in a large activity system rather than examining the individual separately from his or her surroundings. Hashim and Jones (2007) assert that AT can offer

a contextual and holistic approach to discovery that can be used to support qualitative and interpretative research. The ten aspects of AT in the extended model are used in this research to understand how people (publishers and users) engage with OGD portals (tools) and co-create value as objectives or outcomes, and how other factors like motivations, barriers, rules, level of awareness, community, and division of labour affect the activity. Finally, the effectiveness of the overall activity is investigated. Using either the second or third generation of AT to attempt to answer this research question proved unsatisfactory; hence the need for the extended AT model. AT in this research is used as a lens for designing interview questions, data analysis, and structuring the data findings. This research aims to stimulate discourse and advance the use of AT in IS research and develop it further.

Analysis of activity and actions in OGD and Co-creation

To portray a clearer picture of the roles in co-creation using OGD, an 'ideal' analysis of activity and actions in OGD and Co-creation following Leontiev (Hasan & Kazlaukas, 2014) will briefly presented. Hasan and Kazlauskas (2014) explain the activity hierarchy of Leontiev (1981) by pointing out that activity is a holistic construct such as doing a Ph.D which must not be mixed up with more everyday uses of the word 'activity' (such as arranging an interview). Furthermore, under any activity there are actions and operations. Based on this hierarchy, the roles of subjects (person) and community in AT can be explained as follows.

The activity of utilising OGD by LAs, academics, corporates and interested citizens will include actions and operations. On one hand, LAs as (subject) can be affected by the actions of the surrounding environment (community). For example, DCC was encouraged to initiate Dublinked because (1) there was support from Maynooth university academics with the coordination between the four LAs and (2) IBM supported Dublinked with the infrastructure by providing the servers for data storage. On the other hand, citizens who are interested in utilizing OGD (people) were affected by the LAs (here as an environment/ community) actions. For example, the community Code for Ireland was encouraged to utilise OGD because they were supported by the Fingal IT manager and staff from the other LAs who provided them with the required datasets in convenient and usable formats. The operations in these actions include contacting each other by telephone and via e-mail as well as holding meetings and discussions. The collaboration between the parties is part

and parcel of the co-creation of the various projects that use the datasets from Fingal OD and Dublinked.

3.5 Conclusion

This chapter outlined the theories in IS research, discussed the three generations of AT and presented the augmented model of AT. This new model contains four additional components that assist researchers in exploring more constructs with clearer terms and relationships. AT is used in this research because it provides a systematic approach to the research problem with a wide lens that includes both technical and social aspects in relation to OGD activities.

Chapter 4

METHODOLOGY AND DATA ANALYSIS

4.1 Introduction

Choosing an appropriate research process requires investigation of research methods and data analysis techniques. This chapter provides information about the research process adopted in this study by viewing the overall process including research philosophical assumptions and underpinning the research strategy. Furthermore, the chapter explores the method of collecting the data gathered during this research. It then proceeds to explain the procedures used to conduct the data analysis. Finally, the chapter covers the ethical considerations and the research rigour. The summary of this research process is shown in Figure 4.1.

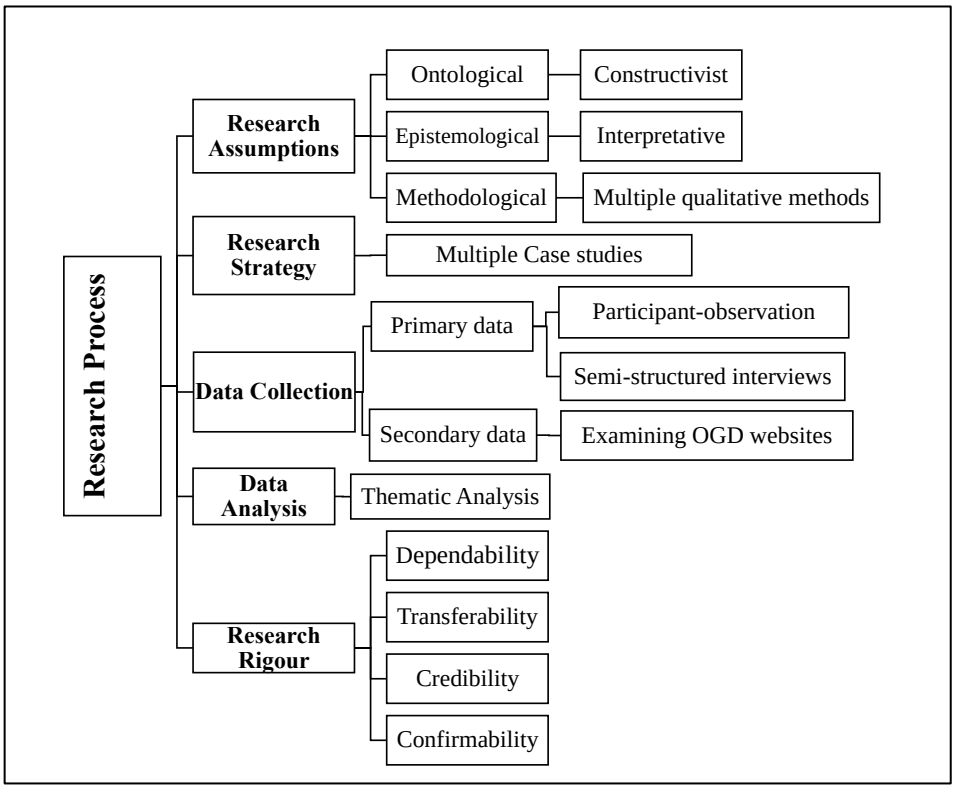


Figure 4.1 Summary of this research process

The definitions and details of the summarised research process in the above figure are discussed in the following sections.

4.2 Research philosophy

Research is defined as a systematic process of collecting, analysing and interpreting information in order to increase the understanding of the research subject (Leedy & Ormrod, 2005). There are three main sets of assumptions essential to any research process, specifically, ontological, epistemological, and methodological.

First, a set of ontological assumptions is adopted as a response to the question about the nature of reality (Antwi & Hamza, 2015). Antwi and Hamza state that the term 'ontology' is derived from two Greek words: 'onto', which means 'being' and 'logia', meaning 'a science, a study or a theory'. Ontology, then, refers to the *"science or study of being"* (p.218). Ontology reflects the form and nature of reality and what can be known about it. Ontology includes two broad contrasting positions: objectivist and constructionist. The objectivist refers to the view that there is an independent reality, while the constructionist assumes that reality is the product of a social process (Antwi & Hamza, 2015, p.218). In this research, a constructivist approach is adopted as it is based on constructing the meaning conveyed within the various social contexts by conducting interviews and participant observation.

Second, the epistemological assumptions to any research process are related to the nature of knowledge. Epistemology is *"the process in which the investigator comes to know the truth and reality"* (Antwi & Hamza, 2015, p.218). Antwi and Hamza assert that meaning is not discovered, but produced from a social context. Chua (1986) and, later, Orlikowski and Baroudi (1991), suggest three categories based on the underlying research epistemology, namely positivist, interpretive and critical as cited in Myers (Myers, 1997). Although there are more research approaches, these are the most commonly accepted, see Figure 4.2.

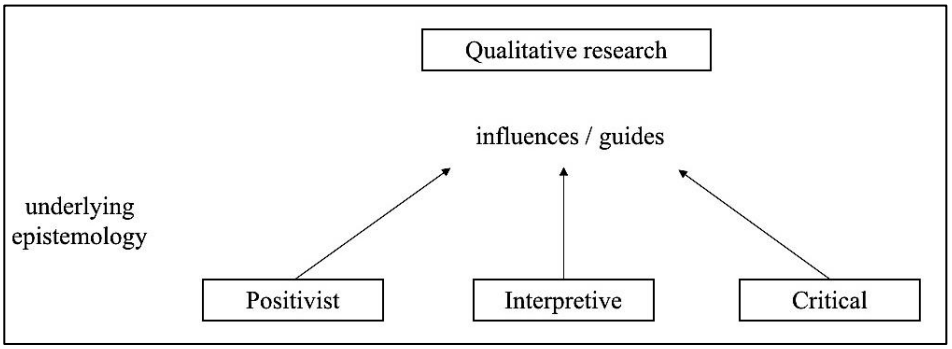


Figure 4.2 Underlying philosophical assumption[20]

The following table elaborates on the three mentioned philosophical assumptions.

Table 4.1 Philosophical Assumptions

Adapted from Myers (1997); Raddon (2010); Antwi and Hamza (2015)

Positivist Research	Interpretive Research	Critical Research
Positivists assume that reality is objective and 'out there'. It can be described by measurable properties that are independent of the researchers and their instruments. Positivist researchers attempt to test the theory for the predictive understanding of phenomena.	Interpretive researchers assume that reality is subjective and is understood through 'social constructions' (e.g. language). Thus, interpretive researchers attempt to understand phenomena by generating meanings of the data and aim at producing an understanding of the context and the process of the information system.	Critical researchers assume that social reality is produced and reproduced historically by people. Critical researchers recognise the ability of people to change their social and economic circumstances. However, the social reality is constrained by various forms of political, social, and cultural dominations, which people use to figure out to change.

[20] This categorisation is mentioned in Orlikowski and Baroudi (1991), but the figure is taken from Myers (1997, p.25).

The positivist assumptions are not appropriate for this research because they do not aim at producing an understanding imparted by the social context. Further, the critical assumptions are not appropriate for this research because this research does not aim at changing people social and economic circumstances. As Myers (1997) states, the qualitative research in IS utilises qualitative data to understand and explain social phenomena. This qualitative research is based on interpretive epistemology that aim at understanding phenomena by generating meanings of the data and producing an understanding of the context and the process of the investigated system.

Thirdly, the methodological assumptions help in choosing the suitable techniques and methods for collecting data. Choosing the appropriate methods depends on the nature of the research inquiry. For example, positivists typically use surveys and experiments as suitable research methods, while interpretivists tend to use in-depth interviews (Orlikowski & Baroudi, 1991). Adopting only one epistemology does not necessarily entail using one single methodology. In other words, one epistemology may employ several methodologies. For example, positivists use scientific experiments and survey research as methodologies, whereas interpretivists may use ethnography and grounded theory.

Several methodologies exist: quantitative, qualitative, and mixed. There has been an extensive debate in the literature for many years concerning the relative merits of quantitative and qualitative methods for research (Hughes, 2006). Some view quantitative and qualitative methods as entirely separate, while others prefer to combine them (Hughes, 2006). Qualitative and quantitative methods differ in their approaches to data collection and data analysis (Saunders *et al.*, 2007). Donald (2013) highlights the importance of understanding qualitative and quantitative individually in choosing the appropriate approach. According to Myers (1997) and Saunders *et al.* (2007), quantitative research was originally developed in the natural sciences to study natural phenomena. Conversely, qualitative research was developed in the various fields of social sciences which enabled researchers to study different aspects of social and cultural phenomena. Qualitative data sources include documents, archival records, interviews, direct observations, participant-observation, and physical artefacts (Yin, 2004).

In this research, a quantitative approach is not appropriate because understanding of a phenomenon from the participants' point of view can be lost in the process of quantifying the data. The qualitative method is applied because it provides tools for researchers to

understand various phenomena in their contexts. The key philosophical assumption of qualitative research views reality as being constructed by individuals interacting with their social worlds. Thus, the qualitative method is considered to be an appropriate method for use in this research.

It is worth noting that some researchers use the triangulation method which refers to the use of multiple techniques used to seek confirmation of apparent findings (Fenech Adami & Kiger, 2005). Patton (1987) claims that there are different types of triangulation, as follows:

1. Data triangulation, which involves collecting data through various sampling strategies at different times and places.
2. Investigator triangulation, referring to more than one researcher in the field to gather data.
3. Theoretical triangulation which involves the use of more than one theoretical position in interpreting data.

This research employs the data triangulation by using a multi-methodological approach. This is because the data were collected by three sampling strategies at different times and places: examining OGD portals, participant observation, and semi-structured interview.

4.3 Data Collection Instruments

Collecting data for any research can be undertaken through primary data, secondary data, or both. Primary data means the raw data collected by researchers for a specific purpose. Such data might, for example, come from interviews. Secondary data means the data taken from different sources such as books, journal articles, and reports. In this research the primary data were collected via semi-structured interviews and participant observation; the secondary data were collected via examination of the two OGD portals.

4.3.1 Analysing OGD portals

Many portals have been briefly examined to gain a wider picture of the international and national OGD portals. Furthermore, in order to be familiar with the Irish OGD portals

contents, two national portals were examined in detail: Fingal open data and Dublinked. Each portal was analysed. The analysis involved several steps including the following:

- Reading the information (about us) available on the portal itself.
- Checking all links to see that they worked and where they went.
- Identifying all datasets available.
- Assessing how up-to-date these datasets were (i.e. how recently had they been updated).
- Assessing their completeness.
- Looking at the formats in which they could be downloaded.
- Assessing how easy accessing and downloading each dataset was.
- Checking for the availability, visibility and understandability of any licencing terms for use of data.
- Assessing how easy it was to contact the organisation (source of data).

Following an initial detailed analysis, portals were subsequently examined monthly to see what changes had been made (in terms of new data available, new features, changes in format or design).

The information gathered from these analyses informed the subsequent research. For example, where datasets appears not to be updated frequently, the importance of or problems created by this was raised with informants. The manner of examining the portals is shown in Figure 4.3.

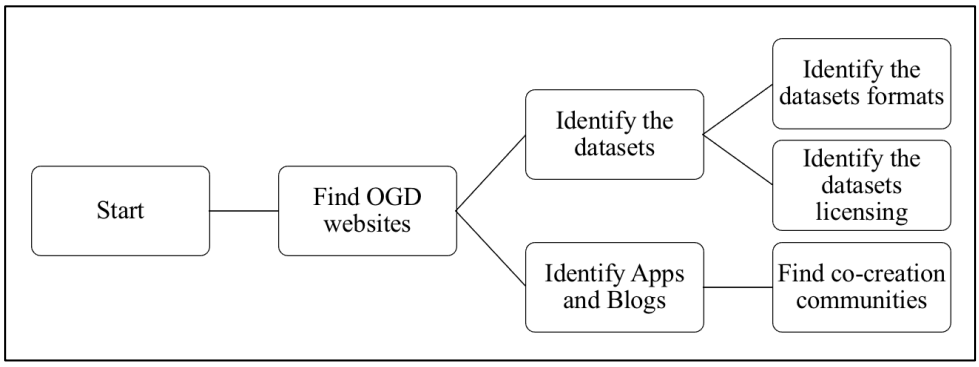


Figure 4.3 Units of analysis for OGD websites

As shown in Figure 4.3, examining the two portals included checking the dataset's formats and licensing types. For example, after Dublinked and Fingal OD were initially identified,

then their datasets categories examined with regard to formats and licensing. Dublinked uses over 14 different dataset formats including .csv, .xml and others (see Appendix A for more information).

4.3.2 Participant Observation

Participant observation is a method where the researcher takes part in activities and events to learn *explicit* (what people can articulate) and *tacit* aspects of their life and their culture (Dewalt & Dewalt, 2011, p.1). Dewalt and Dewalt (2011) identify three advantages of participant observation: it enhances the quality of the data obtained where it is difficult to obtain some acts through words; it enriches the quality of the data interpretation, and encourages the formulation of new research questions and hypotheses based on the scene observations. The authors conclude that participant observation is a data collection and analytic tool.

In this research, participant observation involved attending OGD community meetings and events that included engaged communities and employees within the LAs. These observations generated insights and better understanding of the phenomena of OGD and co-creation. Furthermore, the observations facilitated the creation of a network of people who were selected as potential interview participants. The participant observation activities provided an opportunity to become acquainted with OGD community members and LAs employees. The observations involved absorbing the environment through intensive involvement and engagement with the various OGD communities over an extended period of time which lasted more than three years and five months.

During the observation period, insight into on-going projects using OGD was gained. Furthermore, the relationship between the LAs employees and interested communities in using OGD was carefully observed to investigate the co-creation concept. In each participant observation, event notes were taken and compared with what was actually occurring in the interviews.

Despite the benefits of using participant observation, challenges do exist. As Schensul *et al*. (1999) note, one of the challenges in participant observation is that its quality depends on the researcher's ability to observe, document, and interpret what happens. They also highlight the importance of making accurate observation field notes without imposing

preconceived categories from the researcher's personal or theoretical perspective, instead, allowing them to emerge from the community under study. In this research, two main challenges were encountered through the use of participant observation which were found and related to culture and time. First, taking into consideration the cultural challenge, participant observation was not easy for a non-Irish, female from a conservative Middle Eastern culture. For example, in Saudi culture, men and women do not normally shake hands. This led to a slightly awkward initial situation during the introductory phrase with participants. However, when it was explained, the situation was respected and understood. Second, keeping in mind the time challenge, community meeting times were not always convenient for the researcher, as meetings tended to take place after work hours.

Table 4.2 presents the participant observation schedule which includes eleven events.

Table 4.2 Participant observations

Event	Time	Date	Location	Objective of participation
Open innovation	Most the events started around 6 pm.	20/05/2013	Dublin Castle	To meet people in the technical and governmental fields and start the network.
Launching Code for Ireland		16/01/2014	Dublin Castle	To establish the target sample and learn from the American experience.
Code for Ireland (meet-up) meeting		20/03/2014	Facebook HQ	To observe the co-creation communities.
Open innovation 2.0		12/06/2014	The Convention Centre	Again to meet people in the technical and governmental fields and start the network.
Code for Ireland (meet-up) meeting		26/09/2014	Google Docks Building	To observe the co-creation communities.
Code for Ireland (meet-up) meeting		27/11/2014	Amazon offices	To observe the co-creation communities.
BT Young Scientist and Technology Exhibition		10/01/2015	RDS: 550 great projects, BT Young Scientist & Technology Exhibition 2015	To observe the young students who are interested to use OGD.
Dublinked Innovation Network - Data Analytics Event		21/01/2015	Dublin Institute of Technology, Grange Gorman Campus	To meet the co-creation communities.
The UK Future Cities Catapult discussion in Dublin		04/03/2015	Mansion House	To learn from the British experience
Smart Dublin collaborating to solve challenges		05/10/2015	Google Foundry	To participate in solving the city problems by identifying the challenges and suggesting solutions as part of the interested community in OGD.
Smart Dublin Showcase		12/10/2016	Dublin City Hall	To observe the outcomes (projects) using OGD.

As shown in Table 4.2, the meeting times were scheduled for after work hours and in Dublin which considered as barriers for others who are out of Dublin and cannot attend evening meetings such as parents. Table 4.3 shows the visits and conferences which enriched the researcher's knowledge in the areas of OGD and co-creation.

Characteristics of those interested in engaging with OGD

In the events attended, the characteristics of gender, age and technical background of the individuals interested in engaging with OGD was catalogued. The majority of OGD community members were:

Mixed in gender: there was a good balance of males and females.

Skills: not all participants had high ICT technical skills. Many were, however, graduates who had a particular interest in a particular subject area such as geography, environment, climate or economics.

Age: This varied from young students who started using the data for competitions such as Apps4gaps.ie to retired people who had time to work on a voluntary basis. Notably, while students and younger people are significant users of the data, the majority of people who consistently attend meetings and who are interested in OGD are aged over 30. The reason why older people are more interested in OGD could be due to the fact that they are more financially secure, and have a greater degree of experience of life. They may also have more free time to attend weekday meetings and work on a voluntarily basis.

Table 4.3 Visits and conferences

Events	Date	Location
IBM visit	13/02/2013	Mulhuddart - Dublin
IFIP EGOV2014	1st, 2nd, and 3rd September 2014	TCD - Dublin
EGPA Conference	Paper presented on 11/09/2014	German University of Administrative Sciences - Speyer – Germany
EGPA Conference	Paper presented on 25/08/2015	Toulouse, France
IFIP WG8.2 Working Conference	Poster presented on 09/12/2016	UCD, Dublin, Ireland
AIS pre-ICIS workshop on "IOT & smart city challenges and applications"	Paper presented on 09/12/2016	Dublin Docklands, Customs House Quay.

All participant observation events, visits, and conferences strengthened the research data through the notes taken and compared with the website analysis and semi-structured interview data.

4.3.3 Semi-structured interviews

There are three basic types of interviews: structured, semi-structured and unstructured. A structured interview is a quantitative research method usually used in survey research. An unstructured interview is one with only a few questions prepared in advance to reveal information in a more neutral environment with less attached guidance from the interviewer. The advantages of the unstructured interview over the structured one are that it opens the possibility of learning about experiences and knowledge that the interviewer may not have previously considered and to let interviewees develop their ideas and thoughts in their own way without too much (or any) interruption from the interviewer. Third, semi-structured interviews assist the researcher in gaining comprehensiveness of the data

collected and in making the data collection more systematic and flexible (Patton, 2001). Cohen and Crabtree (2006) note that many researchers prefer to use semi-structured interviews because they can prepare questions ahead of time, giving them the chance to be more prepared. Moreover, semi-structured interviews give participants the freedom to articulate their views in their own words with a framework of themes to be explored.

The structured interview method was not chosen for this study for the reason that it is more about filling in questionnaires rather than gaining a deeper understanding of the phenomena. The unstructured interview method was not chosen because it can lead to interviewee straying from the intended topic and purpose. The choice of the semi-structured method was employed because it offered sufficient flexibility to explore the participants' answers in greater depth and within a specific framework.

The overall advantages in using interviews as a data collection technique were that they provided an opportunity to observe and listen to the participants' responses in person. In addition to this, more complex questions were formulated to probe the participant's responses and gain clarification when required.

The interview process

Jacob and Furgerson (2012) provide tips to conduct interviews which advise researchers to:

- Employ an interview protocol (see Appendix B for this research's protocol which considered all the suggested tips);
- Use open-ended questions which are expansive in nature;
- Start with basic and simple questions and then move towards the more difficult or controversial ones;
- Begin the questions with an effective phrase such as "tell me about";
- Use prompts or list such bullet points;
- Note that for six to ten well-written questions, do not take more than an hour and a half;
- Make a pilot test to examine the interview questions;

- Ask permission to use a recording device;
- Interview your respondents in a quiet, semi-private place;
- Minimise distractions: clear your schedule;
- Turn off cell phones and making sure to block more time than is likely to be needed;
- Use counselling techniques when required.

All the above tips were followed in conducting the interviews. Even though the interviews questions were created based on the Eight-Step-Model of AT and were amended based on the research questions (see Table 4.4), the interview questions were influenced mainly by the augmented AT by asking the participants about four extra areas as follows (see Appendix B for the full interview questions):

•*About OGD Effectiveness*

Talk to me about the effectiveness of the current datasets, and how do you measure their effectiveness?

•*About Motivations and incentives to investigate co-creation drivers*

Do you provide any incentives for users (communities/individuals) to use open data for co-creation? And how do you do it? If you do not do it why not? How might you go about it? (for LAs)

What do you think motivates/stimulates communities or individual to create value from OGD? (for LAs)

Why is this activity taking place? What motivates/ drives the use of OGD? What benefits do you get or anticipate from this activity? Have you any stories illustrating successful OGD initiatives? (for citizens)

•*About Barriers/ challenges / obstacles or concerns (publishing and using)*

Have you experienced any barriers/ challenges / obstacles or concerns either in publishing data or that users face using these data? How were they (or might they be) solved? (for LAs)

Do you face any barriers / challenges / obstacles or concerns in using OGD? (e.g. data formats, licensing terms). How might they be solved? (for citizens)

•*About OGD awareness*

Do you think Irish citizens (generally) are well informed about OGD? How can people's awareness about the potential uses of OGD be improved?

The above illustrates how the proposed AT extended model has influenced the data collection stage (and, by implications, the subsequent analysis stage).

Table 4.4 The Eight-Step-Model

Source: Mwanza (2002)

The Eight-Step-Model		
Identify the: -		Question to Ask
Step 1	*Activity* of interest	What sort of activity am I interested in?
Step 2	Objective	Why is the activity taking place?
Step 3	Subjects	Who is involved in carrying out this activity?
Step 4	Tools	By what means are the subjects performing this activity?
Step 5	Rules and Regulations	Are there any cultural norms, rules or regulations governing the performance of activity?
Step 6	Division of labour	Who is responsible for what, when carrying out activity and how are the roles organised?
Step 7	Community	What is the environment (context) in which this activity is carried out?
Step 8	Outcome	What is the desired *outcome* from carrying out this activity?

The Eight-Step-Model[21] was used by Mwanza (2002) to guide data gathering and communication (modelling), which help in acquiring insights about work practices in her research case studies.

Online interviewing can be organised in two-ways: a synchronous form or asynchronous (Flick, 2009). First, the synchronous form can be undertaken via an online chat room where the researcher can directly exchange questions and answers with participants. Whereas, the asynchronous form involves sending questions for participants that are responded to through e-mail. In this research, both forms - synchronous and asynchronous

[21] Note that the Eight-Step-Model is generated by Mwanza (2002) and it helped with the augmented AT model to generate the interview questions in this research.

- were used (see Appendix C for further details). With the participants' permission, the interviews were recorded. Face to face, telephone and online (email/Skype video) interviews were conducted. The interviews were transcribed verbatim. Express Scribe transcription software was used to facilitate the transcribing phase and WavePad sound editor was used to edit some soundtracks.

There were 48 informants interviewed in 44 interviews, taking into consideration that four interviews included two participants. The interviews were carried out over a period of five months beginning in December 2014 and concluding in April 2015.

4.3.4 Selection process

The selection of participants is a critical part of this research because the findings were based on their point of view. The selection process began with the creation of a list of potential participants attending the OGD meetings and their expressed interest in OGD in social media. The communities examined in this research are people who share the common interest of engaging with OGD. Some informants were selected by purposeful sampling because they were the key players in the publication of OGD in Dublin. These include the Senior Executive Officer at Dublin City Council and the IT manager of Fingal County Council. According to Mack *et al*. (2005), purposive sampling is one of the most common sampling strategies used. The remainder of the samples for both data providers and co-creation communities were selected using snowball sampling where participants refer other potential participants to engage with or contribute to the study. Both purposive and snowball sample sizes were determined on the basis of theoretical saturation (the point in data collection when new data no longer brings additional insights to the research questions).

4.4 Research strategy

The research strategy deals with how the research will be carried out. A research strategy can include ethnography, case study, surveys, grounded theory or action research (Biggam, 2008; Mark *et al*., 2009). Others have used the term research design instead of research strategy (Orlikowski & Baroudi, 1991). Myers (1997) gives a brief explanation of four

types of strategies used in IS (Information Systems) research as shown in Table 4.5.Table 4.5 Research Strategies

Source: Myers (1997, p.69.)

Action Research	Case Study	Ethnography	Grounded Theory
Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework (Rapoport, 1970, p.499).	Case study research is the most common qualitative method used in information systems.	Ethnographic research comes from the discipline of social and cultural anthropology where an ethnographer is required to spend a significant amount of time in the field.	Grounded theory is a research method that seeks to develop a theory that is grounded in data systematically gathered and analysed.

Action research is only practical in certain situations. It requires the researcher to be able to determine or dictate actions. Clearly this was not feasible in this research. Since ethnography requires a significant amount of time within the setting and grounded theory seeks mainly to create a theory, neither of these were chosen as they did not fit with the aim of this research. The case study strategy is deemed to be a more suitable one which takes into consideration both time and financial constraints.

4.4.1 Case study

Qualitative case study research is appropriate for the study of any phenomenon in its natural context (Houghton *et al*., 2013). Yin (2002) defines the scope of a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context. Myers (1997) states that case study research can be positivist, interpretative, or critical, depending on the underlying philosophical assumptions of the researcher. Yin (2009) notes that the method of the research depends upon the research question, as shown in Table 4.6.

Table 4.6 Types of questions for different research methods

Adapted from Yin (2009)

Method	Form of research question
Case study	How and why?
Survey	Who, what, where, how many and how much?
Experiment	How and why?

In order to address the research question posed in this study, there is a need to employ a method that conveys extensive and in-depth descriptions of both the OGD and co-creation phenomena. Yin (2009) states that the more information the question seeks to explain, the more relevance the case study acquires. A case study can include different techniques for data collection, such as interviews, observations, documentary analysis, and even questionnaires. The case study can be single or multiple. This point will be developed in the next section.

Multiple Case Study strategy

Stake (1995) noted that the number and type of case studies depend upon the purpose of the inquiry. Yin (2003) identifies four types of case study, namely: single-case, multiple cases, holistic cases and embedded cases. Later, Yin (2009) differentiates between single-case studies - which include multiple components described as embedded cases - and true multi-case studies considered as separate studies. A case study strategy can include *multiple cases*; the reasons behind this are, for example, to test whether the findings of the first case occur in other cases and discover if there are common patterns in the case. Alternatively, it may be for other purposes like theory building (Yin, 2009). For this purpose, Yin (2003) claims that multiple case studies may be preferable to a single-case study. Stewart *et al.* (2012) state that in practice, researchers are usually trying to understand patterns across organisational boundaries. Thus, the multi-case study will be appropriate for this research as it seeks to understand patterns accruing across multiple cases (i.e., the four LAs).

The chosen strategy for this research

Multiple case study research is suitable in addressing research questions that are closely connected to their contexts or situations. Research questions can be examined from multiple perspectives (Esposito, 2014). Four case studies were used: the four Dublin LAs, as described in Chapter One. As noted in that chapter, the two main case studies are Dublin City Council and Fingal County Council because they both have operational OGD websites (Dublinked.ie and Data.Fingal.ie, respectively). At the time of writing, South Dublin and Dún Laoghaire–Rathdown County Councils did not have OGD websites up and running. Therefore, the latter two were used as supporting cases. Also at the time of writing, Dublinked supported all of the other Dublin authorities with data management. Support from the private sector was also provided by IBM Research, which supplies a platform offering various open collaboration technologies and research tools to enable and facilitate publishing open data[22].

A unit of analysis can be defined as the major entity that is being analysed in a study and it is the 'what' or 'who' that is being studied. In this research, the units of analysis under the four LAs case studies are the ten constructs of the augmented AT.

4.5 Data analysis: thematic analysis

In qualitative research, data analysis can include three main steps (Creswell, 2007). These three steps can be summarised as follows:

1. Preparing and organising the data for analysis such as text data (transcripts).
2. Reducing the data into themes through a process of coding and condensing the codes.
3. Representing the data in figures/tables, or in a discussion.

Different authors suggest variations to this approach. In this research, the analysis of informants' opinions was conducted using thematic analysis and NVivo software.

[22] http://www.dublinked.com/?q=aboutus

Lewins and Silver (2007) encourage the use of software in supporting research analysis to facilitate dealing with large amounts of qualitative data. Using NVivo in this research had some advantages: the first lay in acquiring the ability to quickly generate coding using nodes facilitated through using queries to find themes. The second advantage is that having the data as a single project file made it more easily accessible in multiple locations. NVivo also facilitated the ability to see the data cloud and organise the codes and node structures efficiently and effectively. However, coding based on query searches can dilute the thickness of the data and the researcher can lose the sense of ownership while engaging with the data which is often achieved through a more tactile manual approach. While NVivo can assist researchers in validating or correcting how data is arranged, the software is less useful in addressing how themes develop and emerge during the data analysis process.

The transcripts have been analysed in terms of categories drawn from activity theory, namely, subject, tools, objective, rules, community, motivations, barriers, level of awareness, division of labour, and effectiveness.

The Thematic Analysis (TA) method is employed in this research; this is a method for identifying and analysing patterns in qualitative data (Braun & Clarke, 2013). Informant opinions were analysed thematically. Clarke and Braun (2013) claim that TA is appropriate for a wide range of research problems and theoretical perspectives for four reasons:

> *"(a) it works with a wide range of research questions, from those about people's experiences or understandings to those about the representation and construction of particular phenomena in particular contexts;*
>
> *(b) it can be used to analyse different types of data, from secondary sources such as media to transcripts of focus groups or interviews;*
>
> *(c) it works with large or small data-sets; and*
>
> *(d) it can be applied to produce data-driven or theory-driven analyses"* (p.120).

Given the flexibility and ease of organising large volumes of data, it was decided that TA was the most suitable method for data analysis. In analysing the data generated by the

interviews, participant responses were grouped according to pre-defined categories with the identification of some new categories of meaning and the relationships between those categories emerging during the process. TA is applied in six phases. Clark and Braun (2013) note that this six phase analysis is a recursive process and should not be applied as a linear model. The six phases are as shown in Table 4.7.

Table 4.7 Six stages of analysis

Adapted from Braun and Clarke (2006)

Analytical Process	Practical Application in NVivo of Braun and Clarke (2006)
1. Familiarisation with the data	Transcribing data, reading and re-reading the data, noting down initial ideas, Import data into the NVivo data management tool. This is carried out by again re-reading the data, listening to audio-recorded data and noting any initial observations
2. Generating initial codes/ Coding	Open coding in a systematic fashion across the entire data set by collecting data relevant to each code. In this research, this involves generating labels for the data for both data reduction and as an analytic process.
3. Searching for themes	Categorisation of codes into potential themes by gathering all data relevant to each potential theme (see Appendix D). Themes were guided in terms of the six constructs drawn from activity theory, and the four additional constructs described in the proposed augmented AT. 630 items were identified in the open coding. This phase ends by collating all codes and relevant data extracts (see Appendix D).
4. Reviewing themes	This consists of checking that the themes tell a convincing story about the data. This step also includes defining the nature of each theme and the relationship between the themes.
5. Defining and naming themes	Data reduction by refining the specifics of each theme, and generating clear definitions and names for each. The reduction of the codes resulted in having three main themes. These are people, effectiveness, and co-creation (see Appendix D)
6. Producing the report/Writing-up	This is the integrating element of the analytic process in the TA, which creates a coherent and persuasive story out of the themes and links this theme to the existing literature.

Data analysis was conducted from March 2015 to Dec 2015.

4.6 Research ethics

Researchers must employ ethical research practices to ensure that the participants are not harmed as a result of their participation (Donald, 2013). Ethical research guidelines include forms such as ethical approval forms, participant information sheets, and participant consent forms. In this research, ethical approval was obtained from the university Ethics Committee before data collection took place. This can be viewed in Appendix E. The participants were informed about the nature of the research and the participant anonymity was preserved by using pseudonyms. Participants were also informed that they could withdraw from the study at any time.

4.7 Research rigour and trustworthiness

Reliability and validity are key requirements for attaining rigour in qualitative research (Morse *et al*., 2002). Lincoln and Guba (1985) and Shenton (2004) state that researchers using a qualitative approach can ensure their research rigour by seeking to satisfy four criteria. These include credibility, transferability, dependability, and confirmability.

4.7.1 Credibility (internal validity)

Shenton (2004) suggests that credibility can be investigated in many ways, such as: "*Debriefing sessions between researcher and superiors. Peer scrutiny of project. Use of reflective commentary […] and member checks of data*" (p.73). This project was developed through a reflective commentary, with the approach applied by checking with participants the outcomes of the research, such as presenting the generated model in meetings. Transcriptions were sent to informants for data validation before they were analysed. Care was taken to ensure data accuracy, so the analysis phase was done after sending the interview scripts back to informants for data validation.

4.7.2 Transferability (external validity/generalisability)

Shenton (2004) claims that in order to allow transferability, researchers must provide sufficient detail of the fieldwork context in order that a reader can decide whether the

findings can justifiably be applied to another setting and whether the prevailing environment is similar to another. Shenton points out that some information must be considered before any attempt at transference are made. These are:

1. The number of organisations taking part in the study and where they are based;
2. Any restrictions on the type of people who contributed to the data;
3. The number of participants involved in the fieldwork;
4. The data collection methods that were employed;
5. The number and length of the data collection sessions;
6. The time period over which the data was collected (p.70).

All the organisational and community group details are provided in Chapter Five. There were no restrictions on the type of people who contributed to the data so long as they were interested in engaging with open data. 48 interviewees were involved in the fieldwork. Each meeting for the participant interview was on average two hours in length and each interview was around 45 minutes to one hour. The time period over which the data was collected is around three years (from 2013 to 2016).

4.7.3 Dependability (reliability)

Shenton (2004) claims that meeting the dependability criterion is difficult in qualitative work. However, researchers should at least strive to enable a future investigator to repeat the study. This can be done if the researcher provides the processes within the study in detail so that the work can be replicated. In-depth methodology discretion allows the reader to assess the extent to which proper research practices have been followed.

4.7.4 Conformability (objectivity)

Conformability is achieved when researchers adopt steps to demonstrate findings based on the data itself and not on the researcher's own predispositions or personal opinions (Shenton, 2004). This can be conducted by using a triangulation approach to assist in

reducing the effect of investigator bias. Triangulation has been applied in this research by the use of different methods with informants of various profiles.

4.8 Conclusion

This chapter has identified the different research approaches and justified those chosen. This is achieved, first, by providing information about research philosophical assumptions, second, by explaining the research strategy and data collection techniques. Third, the chapter investigates the procedure of data analysis which is thematic analysis. Finally, the ethical considerations of the research rigour are explained. The chapter which follows presents the harvests of the research process and the findings.

Chapter 5

FINDINGS

5.1 Introduction and background

This chapter presents the findings of the research study for this dissertation in three main categories: people's activities, investigating the concept of co-creation within people's activities and, finally, investigating the effectiveness of OGD for co-creation (see Figure 5.1).

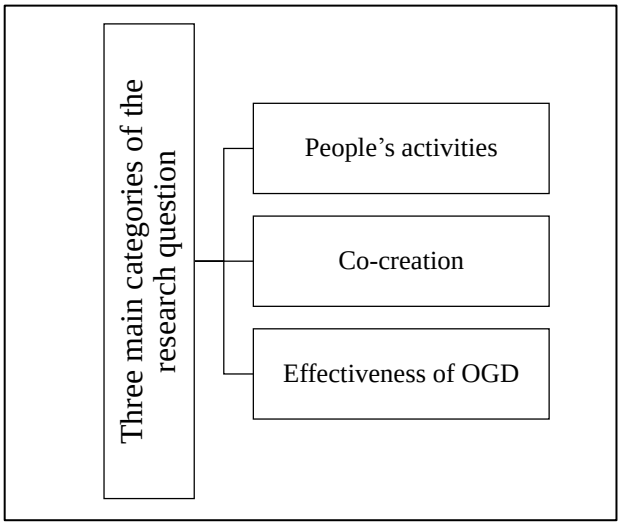


Figure 5.1 The three main categories in this research

The first category - people's activities - was analysed and presented using the developed model of AT constructs discussed in Chapter Three. Under the second category of co-creation, three themes emerge: the lack of uniformity in defining co-creation, practical examples of co-creation, and ways of improving co-creation. The third category 'effectiveness' is discussed under the following themes:

- Defining effectiveness;
- Measuring effectiveness;
- Investigating if the participants see OGD as effective;

- How the effective use of OGD can be improved.

The findings are drawn from 48 semi-structured interviews, participant observations of eleven events and examining two OGD portals: Dublinked and Fingal. The set of findings are presented in this chapter with graphical illustrations using NVivo diagrams, supported by informant quotes. The first section of this chapter presents an overview of the data.

5.1.1 Data overview

An overview picture of the data collected from the interviews is illustrated by using a data cloud representation (see Figure 5.2). The data cloud reflects the frequency of words in the participant transcripts.

Figure 5.2 Data cloud of this research

Figure 5.1 illustrates the most frequently used terms that emerged in the data collected from the interviews. The most frequently used words in the informant's participants are: 'open', 'demonstrating data' and 'government'. Surprisingly, the terms of 'co-creation' and 'effectiveness' do not feature in the data cloud and from this, it could be inferred that participants placed an emphasis on the topic of OGD rather than on co-creation, or it could be that the participants were not familiar with these terms.

5.2 The participants

Participants were drawn from Dublin's four LAs (the four case studies), with those from other categories including communities, academic experts, international consultants, and organisations. Each participant category is presented in detail in the following sections. Interviews were carried out with 48 individuals. Tables 5.1 to 5.5 show a breakdown of the participant numbers and roles in each affiliation.

Table 5.1 LAs participants

Dublin participants LAs	The role of the person interviewed in each LA	Coding name
Two from Fingal CoCo	An administrator	FC
	An Analyst	FC2
One from Dublin City Council (DCC)	A project Manager	DC
One from South Dublin Council	An administrator	SC
Three from Dún Laoghaire-Rathdown (DLR) County Council	An administrator	DLR1
	Team Officers	DLR2
	An analyst	DLR3

Table 5.2 Community participants

Community	Number of participants	Coding name
A civil society leader	1	CM8
A civil society leader	2	OKI1 CM2
A developer	1	DV1
Team manager	1	TM
A developer	1	DV2
A developer	1	DV3
Project manager	1	CM1
Interested communities members in OD analytics and a previous CEO	3	DA CM5 CM7
Drimnagh is a good Community leader	1	CM6

Table 5.3 International consultants

The international consultants affiliations	Number of participants	Coding name
Spain, Barcelona CoCo employees	2	BC1 BC2
Canada, organisation consultant	1	CC
USA, OD Consultant	1	USAC
UK, consultant	1	LA
Worldwide web foundation researcher	1	UKC
Netherlands, academics	2	NL1 NL2

Table 5.4 Academics experts

The academics affiliations	Number of participants	Coding name
DIT	1	AC1
TCD	1	TCDP
Maynooth University	3	AC3 AC4 AC6
UCD	1	AC2
Insight Centre for Data Analytics	2	AC5 RI

Table 5.5 Organisations

The organisations' employees	Number of participants	Coding name
Open Street Map	2	CM3 CM4
Central Statistics Office (CSO)	2	CSO1 CSO2
Institute of Public Health	2	IPH1 IPH2
Marine Institute (Galway)	1	MIG
IBM	1	IBMP
Digital Repository of Ireland (DRI)	1	DRI
Department of Public Expenditure and Reform (D)	2	PER1 PER2
Heritage Council	1	HC
St. James' Hospital (LAMP project)	1	JH

After presenting the participant breakdown, the following section explains their activities.

5.3 People's Activities

In this category, the participants' voices are presented in the light of the developed AT constructs, which are:

- Motivations/motivators that drive people to engage with OGD.
- Tools that people used to achieve their objectives.

- Barriers that people face when engaged with OGD.
- People's objectives for using OGD.
- Rules or regulations that can affect people's use of OGD.
- Community, which represents the environment in which people are working.
- Division of labour, which represents who does what - that is the work load or tasks for every member in the group.
- The level of awareness of OGD.

The pie chart in Figure 5.3, together with Table 5.6, was created to obtain an overall picture of the participant voices within the theoretical framework of the modified AT constructs.

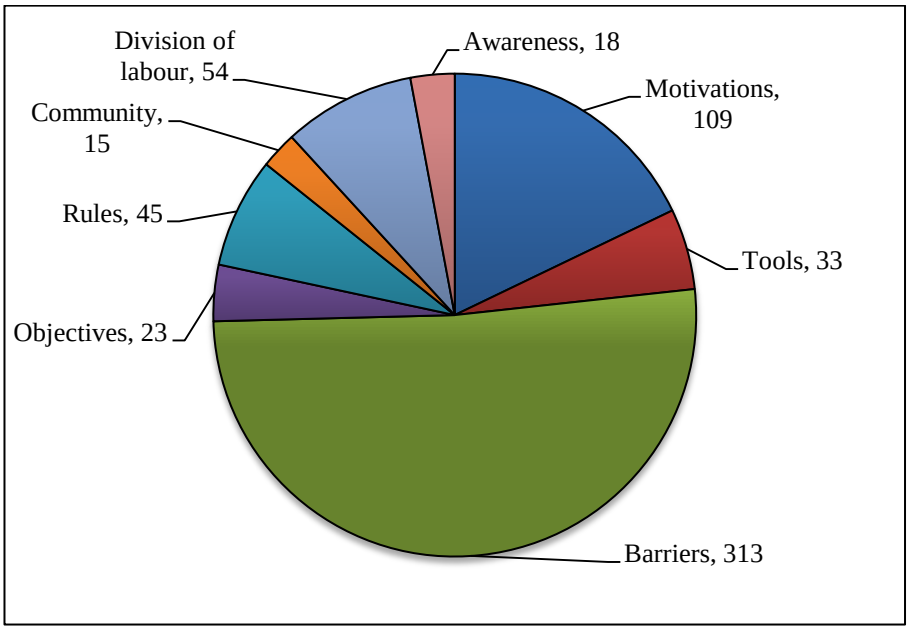


Figure 5.3 The overall findings of people's activities

The pie chart in figure 5.3 shows the frequency of codes concerning each aspect (the proportion of coded citations). For example, the number 313 next to the barriers means the number of times that this word/concept (or one of its synonyms) was mentioned in interviews. Figure 5.3 shows that the barriers are the most mentioned aspect and the data show that participants faced many barriers when they were engaged with OGD. The second mentioned aspect is of 'motivation', which explains why people were still

participating in the activity or engaging with OGD even though they face a lot of barriers. This is in itself a relevant finding.

Table 5.6 In-case and cross-case analysis for Theme 1 People's Activities

Aspect	Fingal CoCo	DLR CoCo	DCC	South CoCo	Org	Int	Acd	Comu	Total
Motivations	11	3	5	9	12	8	20	41	109
Tools	1	3	1	1	9	1	5	12	33
Barriers	15	25	7	12	28	26	87	113	313
Objectives	1	1	1	1	2	3	8	6	23
Rules	2	1	1	2	11	1	15	12	45
Community	1	1	1	1	0	0	9	2	15
Division of labour	1	1	1	1	5	4	22	19	54
Awareness	3	1	1	1	8	0	4	8	18

Table key: CoCo= County Council, DLR = Dún Laoghaire, DCC= Dublin City Council, Org=Organisations, Int= International consultant, Comu=Communities.

The numbers in Table 5.6 show in-case and cross-case analysis of the relevant codes for each perspective based on the developed AT. Each number refers to the frequency of codes for each aspect of the coded citations. For example, number 11 in the first row indicates that there are 11 sentences relevant to the motivations for Fingal CoCo using OGD and these are highlighted manually in the NVivo system. This table is the result of running a query in NVivo to see clearly all the cases and participant opinions with regard to all investigated aspects.

Table 5.6 shows that the motivations for publishing OGD are highest in the case of Fingal CoCo among other LAs. This is as expected since Fingal CoCo is the leader in the publication of OGD in the Dublin area. From the users' point of view, it can be seen that communities have the highest motivation. On the other hand, DLR CoCo has the lowest level of motivation to publish OGD due to a shortage of resources. The table also shows that communities are more concerned about motivations, barriers, and tools than other participants, while academics are more interested in the community and rules.

The findings for each local authority and participants are discussed in the following paragraphs.

5.3.1 Motivations

The origins of Fingal Open Data can be traced back to 2010 when its Head of IT approached a number of other agencies to help gather data to be used by the Council in its planning and operations. It was soon realised that these data could be shared with the public and that led to the idea of OGD. During the interview, the Head of IT stated that population growth, planning for city services, international OGD initiatives and the organisation culture of openness were the primary motivators for opening data in Dublin. He observed that one year after Fingal CoCo established its open data portal, Dublin City Council (DCC) decided to create a website called Dublinked.

Dublinked was formed as part of the collaboration between the four Dublin local authorities (DCC, Fingal, Dún Laoghaire, and South Dublin). A number of private companies gather data, making it available to individuals who are innovative and creative. The primary driver for this was the Smart City programme that was initiated by IBM which set up its Smart City research lab in Dublin as a test bed city. Fingal CoCo has its own portal and publishes its OGD on Dublinked. This is as a result of the fact that Fingal, as a public authority, cannot enter into exclusive arrangements with one company. In order to facilitate such arrangements, Dublinked was conceived as a vehicle for enabling any company to innovate within the Smart City space.

The motivation for DCC publishing OGD was inspired by the Fingal CoCo portal. The motivations that led to DLR CoCo publishing OGD are a combination of the need to meet

certain legal obligations and peer pressure from other LAs. It acknowledged that if other LAs make open data available, it must follow suit. South County Dublin CoCo gave four reasons for its engagement with OGD:

4. **The Freedom of Information (FoI) Act:** The Freedom of Information Act of 2014[23] reinforces all of the thinking around open data. When it was enacted, all local authorities felt that they must have publication schedules.

5. **Less physical attendance**: More people can access the data online, which means lower levels of physical attendance at CoCo offices and fewer phone inquiries.[24]

6. **Changes in mind-set arising from increasing use of technology:** Greater awareness of the possibilities of technology and the change in mind-set that resulted over time were influential factors in the decision to publish OGD.

7. **Government pressure**: When the national government promotes something, it is more likely to happen; for example, the *Fix Your Street* case.

An international consultant from the Worldwide Web Foundation believed that the motivations at governmental level were probably as a response to local, national and social pressures from different sources. He claimed that there appears to be a degree of copycatting among governments when it comes to publishing OGD.

From the user perspective, participants' motivations vary. The majority of community members noted that people have their own motivations to use data such as using OGD as a test bed for their own applications. Others suggested that their motivations were to start a business or a new career, or to use OGD merely for fun or as a hobby. Curiosity and findings patterns were also cited as motivators when it came to using OGD. Some

[23] The Freedom of Information Act 1997 (FOI), as amended by the Freedom of Information (Amendment) Act 2003, obliged government departments, local authorities and a range of other public bodies to publish information on their activities and make that information, including personal data, available to citizens. On 14 October 2014, the FOI Act 2014 came into effect and introduced a number of changes to widen the range of bodies to which the FOI legislation applies; it now applies to all public bodies, unless specifically exempt. It also allows for the government to prescribe (or designate) to other bodies receiving significant public funds, and thus the FOI legislation also applies to such bodies also. source: (http://www.citizensinformation.ie/en/government_in_ireland/national_government/standards_and_accountability/freedom_of_information.html)

[24] The less physical attendance is better for LAs as they are the body who expressed that. However, it could be also good for communities but they did not mention that at all the interviews.

developers mentioned the competition launched in 2012 by Fingal CoCo as a motivation for them to think about OGD. Another motivation for many participants was to use OGD to help formulate and implement evidence-based policy-making. The CSO reported that the key reason for publishing OGD is to provide citizens with the ability to view policy decisions that have been made by the government and to check whether those decisions are being made on actual data. Another member of the CSO expressed the view of OGD that "*it is a fundamental building block of democracy that this data is available"* (CSO2). According to the Department of Public Expenditure and Reform, on the other hand, publishing OGD is about its economic potential and it expects that the improved availability of OGD will have a positive economic outcome. In addition, the provision of OGD can help promote accountability and transparency by encouraging new solutions, removing inefficiencies, and improving decision-making. Easy access to public data can also encourage participation and collaboration by citizens and businesses. An informant from the Marine Institute commented that "*Our motivation is to promote the marine resource […] by publishing the marine data online so that users can see it in simple formats, access it and that's how people can take data and then add value to it*" (MIG).

The need for data for specific purposes can be the main motivator for using OGD. This was the case for many of the participants interviewed. A research student from Trinity College Dublin needed OGD for his doctoral degree. Others request OGD when they need it to solve a problem, carry out research, or simply to find something. The need to obtain more data to publish and use OGD was a strong motivator for many participants. Interestingly, the motivation for the community of Openstreetmap.org came primarily from licensing because a lot of information on Google Maps and those of Ordnance Survey Ireland is available for viewing, but cannot be re-used for other purposes due to copyright protection. For this reason, the community group created its data in Openstreetmap.org as an open data project.

5.3.2 Tools

All CoCos are using the Dublinked portal as the tool to facilitate services where data and experiences about the region can be pooled together. An analyst programmer with Fingal County Council said:

> *"I mainly use an ETL*[25] *[Extract, Transform, Load] to extract, transform, and launch to call FME [Feature Manipulation Engine]*[26] *to transform and publish it [our data] to the Fingal open data website"* (FC2).

Fingal CoCo has its own portal and tools to extract, transform, and publish its data on the main two websites: Fingal open data website and Dublinked. The backend coding for Dublinked was initially the responsibility of IBM and was later transferred to the Insight Centre for Data Analytics in NUIG.

The European project, ROUTE-TO-PA (Raising Open and User-friendly Transparency-Enabling Technologies fOr Public Administrations), is a multidisciplinary innovation project that has a Social Platform for Open Data (SPOD), enabling social interactions among citizens around open datasets coming from different sources (dataset providers). This tool aims at improving the engagement of citizens by enabling them to interact socially over open data, by forming or joining existing online communities that share a common interest and discuss common issues.

As outlined by the Department of Public Expenditure and Reform participants:

> *"The main tool is our portal, data.gov.ie, which is built using CKAN, which is an open source technology developed by Open Knowledge and maintained by Open Knowledge and the larger community as well"* (PER1, 2).

The Marine Institute stated that:

> *"to use standard tools like Google Analytics ... [and] produce monthly reports through Google Analytics on the use of our Irish Spatial Data Exchange ... [in order to] get a picture of the traffic sources on that data"* (MIG).

Both the Institute of Public Health and CSO participants emphasised that using OGD could be difficult for people and that there is, therefore, a need to provide them with adequate

[25] ETL can be described as a data warehousing tool that extracts data from a source, transforms it to fit user needs, and then loads it into a destination or data warehouse.

[26] FME was the first tool designed to be a Spatial ETL application.

tools. There is also a demand for third parties that can support them and help bridge the skills gap when using OGD.

> *"We provide tools for people to use data. Because I suppose one thing with Open Data it is a great concept but I think you need to give people tools to be able to use it. […] And then they can map it [data] and put into charts like, bar charts"* (IPH1 & CSO2).

This was elaborated on by the CSO.

> *"If we can provide JSON data, they can throw it into a visualisation tool and they can start to produce graphs. We tried a bit of that with Google, where Google provide a service for government data statistics to be populated and we were looking at it as a tool to make general use of it. We found it quite complex for people therefore […] you need third parties and skilled people in data analytics to take the information and produce it in graphical format"* (CSO1).

Here, the participant pointed out that it is not a straightforward task for non-technical skilled people to deal directly with OGD and, thus, he recommended the support of third parties to bridge the gap of using OGD.

Participants from other groups discussed tools that have broader facets. The tools used vary considerably based on background and preferences, especially in terms of needs, functions and skills.

Some people use basic tools like pen and paper to make discoveries from OGD; others use more complex tools ranging from applications to coding their own programmes. Software is also used to analyse and visualise OGD. Participants even described educational training, meetings, and infrastructure as tools to deal with OGD. A former CEO commented on this:

> *"I do believe that the toolsets vary in terms of the formats. […] if you looked at GIS Geographical Information, geospatial data, there are plenty of toolsets around that can manipulate that data and whether the data is in a different format such as PSV etcetera"* (CM7).

Others use different mobile phone apps and desktop computer applications, either directly within their browser or custom-built using their own coding skills and using a Java-based editor (JSON) as a tool. A developer from Cododojo observed that:

> *"it [the tool used] depends on the data sets. I think most of the census ones you could actually link off Spark SQS, which it's just a way of feeding it and then after that it would feed into whatever programming language. I'm an Android developer so I'm using the likes of Java and SQL Lite for that"* (DV3).

Another developer affirmed that:

> *"a lot of the tools we've used have actually been creativeness. The infrastructure is from Amazon or from Microsoft. In terms of what we've done for analysis, and pulling the information together, it's been stuff that we've coded ourselves. It's been a couple of different languages such as Java and PHP"* (DV2).

The MyQ.ie team manager described the tools by saying:

> *"For project management we use trello.com, which is just a task management tool. We use GitHub for storing the code; we use Codio, codio.com, that is an online IDE development environment for writing the front end. We use Amazon web services for the back end; we have just started using loomio.org for our decision-making tool. We use Google docs, Google drive, Google spreadsheets etc for writing stuff. We use Google hangouts or Skype for managing the team ... for catching up. There are ranges of programming languages, databases, and coding has been used as tools to deal with OGD"* (TM).

From these observations and comments it can been seen that the toolsets used by participants range from the simple and straightforward to the quite sophisticated and integrated in terms of manipulating data, merging, then visualising and displaying it. The tools vary: some are based on types of work, others on the level of user knowledge.

5.3.3 Barriers

Barriers identified by Fingal CoCo

Both the head of IT and the analyst programmer in Fingal CoCo expressed concerns about five identified barriers and impediments to publishing OGD, which are:

- ***Concerns about data protection and misuse:***

The systems analyst in Fingal CoCo expressed concerns about data protection as being one of the barriers to the release of OD. For this reason, the CoCo is trying to ensure that all the released data obeys the rules outlined in the Data Protection Act. The head of IT believes that they are the custodians of Fingal data in the public's interest and it is, therefore, important that that data are not misused. The public sector ethos is that the CoCo has a duty of care when it comes to data regarding its citizens.

- ***No formal job for OGD:***

The analyst in Fingal stated that there was no formal position to work with OGD. Working on OGD was more like a side job where there is no single person with formal responsibility for it, nor is there any employee formally assigned to OGD production or management.

- ***Multiple websites for the OD:***

One of the problems with OGD in Ireland is that there are multiple portals for OGD (Fingal OD, Dublinked, and data.localgov.ie), and this creates confusion as to where to put the data.

- ***Data format:***

The head of IT in Fingal noted that there was a challenge with spatial data relating to the KML [Keyhole Mark-up Language] format in particular because it is not really suitable for large data sets. A solution must be found for this.

- ***Misinterpretation:***

The head of IT in Fingal CoCo expressed deep concerns about another problem, namely misinterpretation. This is a real problem for the CoCo, and mentioned that situations have arisen where data has been released and ended up becoming a press story.

Barriers identified by Dublin City Council

With regard to DCC experience with barriers, the Dublinked manager identified six barriers and impediments to publishing OGD. These are as follows:

- ***Shortage of time and resources:***

As in Fingal CoCo, there is a shortage of resources in DCC and no time is allocated to work specifically on OGD projects. The Dublinked manager noted that by stating:

> *"[It's] just a matter of finding more time and resources. To date most people working on Dublinked are putting in their time on a 'best effort' basis although we are looking to increase our resources so we can drive the project forward".*

- ***Misinterpreting and misusing:***

The Dublinked manager shared the concerns of Fingal CoCo about the risks of misinterpretation and misuse of data.

- ***Cultural and mistrust:***

The Dublinked manager revealed that it was difficult to make organisational cultural changes, which requires more openness in the public sector. Organisational cultural changes require time and patience, particularly with a backdrop of resource cuts and the public mistrust of institutions. This point also brings to light another issue: the mistrust between data providers and data users.

- ***Technical challenges:***

There also exist technical challenges, particularly with opening up large complex and dynamic data streams. These include creating visualisations and providing tools to convert dataset formats. Some DCC employees do not have the technical skills to face the needs of citizens and therefore avoid their engagement with OGD work.

- ***Licensing:***

There are licensing issues around proprietary city systems and in relation to outsourced services. People are afraid of publishing or using OGD when they are not sure about the

licensing terms and conditions, especially because not everybody understands all of the terminologies used in the licensing documentation.

- ***Data protection concerns:***

As in the Fingal CoCo case, concerns in DCC are related to data protection. The Dublinked manager commented:

> *"Personal security and data protection are primary concerns and we always on the side of caution when publishing public data so that it cannot be reverse engineered to identify any personal customer information"* (DC).

Barriers identified by DLR CoCo

Focusing on the Dún Laoghaire Rathdown County Council (DLR CoCo), many challenges were identified. Among the four LAs, DLR CoCo faced the greatest number of challenges and barriers with OGD as follows:

- ***Insufficient resources:***

As for the cases of Fingal and DCC, Dún Laoghaire-Rathdown CoCo faces a shortage of financial resources which in turn leads to a shortage in human resources.

> *"If you have money you can do anything. in reality we don't have new staff especially after the recession. We lost staff. We need new staff, because new staff bring fresh thinking, for seven years we don't have graduates. Availability of resources is the barrier for us to move because we lack the money, fresh thinking/youth/new staff with new ideas, and creativity"* (DLR2 & 3).

- ***Lack of knowledge:***

Among some of the participants, there was an acknowledgment that there was a lack of knowledge about the composition of open data and how to explore it. One of the informants candidly admitted that:

> *"There is an idea of making the data open but how open is it?"*

One employee in DLR CoCo agreed that the data ought to be made available for general usage, but acknowledged that he did not fully understand what open data meant. Some felt that the OGD phenomenon was still in the developing phase.

- ***Data quality concerns:***

DLR CoCo acknowledged that it tended to respond to OGD rather than driving it forward. This was justified by stating that it had neither a clear definition nor easily identifiable attributes for open data. The CoCo also appeared to be overly concerned about even simple things like spelling mistakes that could make the body vulnerable to criticism. Concerns were expressed about the quality of data, and not necessarily its availability, as being a barrier as it was felt that a high quality of data could be guaranteed to fulfil different needs, and there was therefore an unwillingness to release it.

- ***Cultural issues:***

In DLR CoCo, there appears to be a belief held by some staff that they are in essence "*giving away intellectual property*" even though it has been argued that OGD is meant for the public good because it is paid for by taxpayer money. There were officials who were unsure if providing open data was necessarily a good initiative, especially if other entrepreneurs make money out of it. Appropriate data management is one of the main causes of concern among public service organisations.

- ***No formal job for OGD:***

Similar to Fingal CoCo, DLR CoCo felt that an internal barrier for OGD was that engaging in such work was voluntary and not officially part of anybody's job description.

- ***Lack of agreement on the OD policy:***

DLR CoCo employees had an issue when people utilised the OGD app for financial gain despite this being enabled by OGD. Among their aspirations was for the Irish government and its people to agree on an open data policy.

Initially, each of the four LAs cited exactly six barriers although the six were not the same for each body. However, while collecting data for this research it emerged that DLR identified additional barriers. There were signs of discontentment from employees who appeared to have emerged from a lack of knowledge to a position that added to their resistance to publish more data. One interesting observation was that a: "*... huge number of people are not aware of open data. Even here in Dún Laoghaire-Rathdown County Council maybe 75% don't know what it is*" (DLR2 & 3). This response suggests that the lack of knowledge is one of the main barriers for OGD progress.

Barriers identified by South Dublin CoCo

The IS manager raised several issues, rather than obstacles, that impede cooperation with OGD. These include:

- ***Different authorities:***

One of the problems that is caused by the intersection of different authorities relates to data about traffic. He gave a pertinent example:

> *"If you look at something like the M50. It starts in Fingal [and] comes around into ourselves and down into Dún Laoghaire. And for instance the National Roads Authority, they would have connected up the information sources around those areas. The (Local Authorities) LAs move at different speeds, which means that it can be a little bit frustrating in terms of connecting the broader picture in terms of open data than if you can get the same detail level access to information from all of the counties saying respective traffic data"* (SC).

He cited another example of a third party wishing to do business with OGD. In his view, using OGD would be a problem for this third party because it would probably need to request data from four different authorities. This can deter individuals from setting up businesses using Dublin OGD. In this case, each LA responds to the local need and has different socio-economic bases with different employment and economic activity, making this one of the greatest general challenges for OGD in Dublin.

- ***Lack of standardisation and consistency:***

As a result of having different authorities, standardisation problems and lack of consistency were prevalent. Each CoCo has different standards, different datasets and each uses those datasets in different ways. A lack of consistency is the result of every council having its own open approach; some councils will respond better and quicker than others.

- ***OD were not created in an open format:***

The IS manager stated that although taxpayers paid for the data, the problem was that the data were not originally created in an OD format. Consequently, open data brings with it shortcomings such as concerns over privacy. One example is with housing data. When individuals apply to the CoCo for housing, there are significant privacy issues around how much of this data can be released.

- ***No focused initiative:***

The IS manager contended that without a focused initiative or resourcing within the area of OGD, it would be quite a task to work with it using unclear strategic plans within an OGD budget.

- ***Sustainability, resources shortage and commitment:***

Making OGD sustainable is a big challenge. The IS manager commented that producing OGD is not difficult, but felt that customer demand was unlikely to be greater than their data production level.

Barriers identified by other participants

On the usage of OGD, the community category faces barriers and challenges that are different from the other barriers and challenges mentioned above. These include the following:

- ***Lack of understanding:***

Many participants expressed their feelings about the lack of understanding of OGD, believing that there was a distinct lack of understanding within government about the nature of open data, and what constituted being open and not. In the view of the Canadian

consultant, the main obstacle surrounding OGD was "*defining what open data means*" (CC). This reflects an underlying problem that exists in understanding this phenomenon.

- ***Inconvenient meeting times:***

Participants did not feel it was fair to conduct OGD meetings in Dublin only during work hours. Some expressed their frustration at having to come to meetings at awkward times.

- ***Unfair resource distribution:***

An academic participant from DIT felt that government should distribute resources and allocate funding - currently given to one company like Insight Centre for Data Analytics (NUIG) or Inkex - more broadly and allow others the opportunity to work with open data.

- ***Availability of OGD:***

Some participants from the group of academics and developers complained about the lack of availability of many datasets.

- ***Quality problem:***

Many participants complained that the available OGD was often out of date and that there was no regular data maintenance. This made them frustrated about the whole situation as they had to chase up different local authorities for more, and more current, data. Many stated that OGD were not updated frequently and that there was a lack of real time access to the updates. Under the question of data quality, participants were not happy about inconvenient data formats and a lack of metadata.

- ***Bureaucratic approach:***

Many participants mentioned the problem of 'bureaucratic red tape' and said that people in charge often supported the concept in theory, but not always in practice. A community member noted that:

> *" ... the red tape is desperate, it's a kind of public sector culture here in Ireland, I am trying not to be negative about it [...] I find dealing with the public sector is negative"* (CM6).

Unsurprisingly, participants calling for removing formal rules when dealing with public sector that are considered redundant and hinders their OGD use.

- ***Cultural problems:***

Irish culture is different from that of America, a fact explicitly mentioned by three participants (an Irish developer, Irish project manager, and American consultant). In Ireland people tend to be cautious in their approach, while in America there is a tendency to be more adventurous when it comes to exploring new ideas. One participant from IBM suggested that changing the culture and mentality was a challenge when working with OGD. The evidence suggested that Irish cultural attitudes could slow down the progress of OGD and should be considered a barrier.

- ***Lack of skills and expertise:***

Some participants noted that there were barriers from a skills perspective because not many people understood what skills were needed. Users in the community who wished to have access to OGD did not know how to deal with it. In addition, employees within the LAs also lacked the expertise and skills to work with OGD. For example, one participant commented on this, stating that:

> *"the local authorities are very motivated to get this information published, but they don't have anybody on staff that knows how to do this, they just don't have the technical expertise"* (DA).

An American consultant summarised this further, giving an example of An Garda Síochána:

> *" ... they have a national database, which they do not share with anybody [...] I think the national government is getting very bad advice because it's acting by itself. So, I don't think it's an issue of willingness. I think it's an issue of having the right technical skills and the right programme and project management skills, along with having somebody with experience comes in and says, 'Hey let's develop a work pool for releasing the data or develop a process to validate and curate the data'. None of these things happen, there's just a 'SECAM portal' that somebody threw up overnight and threw up a couple of data sets and called [OGD]. That's*

not open data that is checking a box and claiming transparency, which is very dangerous" (USAC).

- ***Legal and technical barriers:***

Many respondents were concerned with OGD licensing. Licensing seems to be one of the most perplexing issues within the OGD field. The interviews showed that none of the participants was a legal expert on OGD licensing, with the exception of the CSO employees who seemed to have a better grasp of it than the other participants in this study. One of the participants from Openstreetmap.org community outlined how knowledge of this issue is critically important.

> *"I need to be very careful because in my work, my day job, I'm dealing with sensitive data that's expensively licensed and I can't mix the two. I need to be quite careful; there has to be a wall built between the ODBL licensed data. I can't mix that with our own internal datasets because I know I have to share my own internal data sets back out again you know, strictly speaking"* (CM4).

This quote reflects how licensing is confusing to people because they are afraid of mixing different data sets that have different licensing rules and conditions. Another problem with licensing is that some participants considered OGD as 'not open data' because the licence is not sufficiently open. One interviewee stated:

> *"I have looked at both of Fingal open data Hub and Dublinked [and] a lot of the data [Geodata] have been either derived from using Google maps as a base layer or using Ordnance Survey Ireland map as a base layer, which means from an open street map perspective because of licensing we cannot touch that data. See, Fingal serve data with an open licence but the data has been derived from a source that does not open. So there is a bit of confusion over it. If you look at the licensing conditions in Google maps you cannot derived data from it which means open street map cannot use the information that Fingal have created because they have been derived from a source that isn't open. So even though Fingal said their data is open, they have been derived from something that isn't open"* (CM3).

What emerges from this participant's response is that the illegal use of data exists, albeit unconsciously or accidentally.

- ***No fund/financial problem:***

Some communities stated that lack of funds was a barrier to working with OGD. For example, one developer commented: "*I had to bring in a team of people together and try to convince a team of people of a vision without having any money is difficult in my experience so, it's blind faith*" (DV2). Another community member said: "*there has to be a budget associated with it*" (CM8). This latter participant felt reluctant to consume his time working with unguaranteed data (in terms of availability and quality) when he could work with the private sector where there are clear financial returns.

- ***Difficult online communication:***

Even though there are meetings about working on OGD between LAs employees and interested communities, many community members expressed their frustration about the difficulties in communicating with the LAs by other means such as email or by phone. Participants are unhappy because there are no clear contacts within the OGD portals and they do not know who is responsible for what; this could be to avoid embarrassment and they may be reluctant to put their name forward because they could open themselves up to blame.

- ***Trust:***

Most developers had trust issues when engaging with OGD. They asked how, if they create their projects based on OGD, its availability and sustainability can be guaranteed. Some community members questioned the LAs commitment to OGD. For example, a MyQ.ie manager said:

> *"if I went and developed an App based on OD there's a huge risk in it for me. I spent a year doing it; blood sweat and tears, weekends, nights and spent all the money buying the domains and hosting it and all that kind of stuff and really poured my soul into it and launched it and then Dublinked said, 'Oh, that's immoral, sorry you can't do that anymore'"* (TM).

Another community member expressed a similar opinion:

"I don't feel a commitment all round. I even see it with the government when they're talking about the open data portal; they're still looking for answers why they should do this" (CM8).

- ***Uninformed interoperability challenge:***

LAs are different authorities with different situations that affect the consistency of the datasets being published in different formats. This can cause users to face difficulties in utilising OGD. For example, one programmer commented: "*It's just so fragmented […] and it's really broken here and that's really needs to change*" (DV2). A participant from the Marine Institute commented further, saying:

"Another challenge to open data is that different organisations collect data and manage data in different ways. So, obviously they're using different technologies to handle their data. So, there's a challenge to publish data in inter-operable formats means formats that can be exchanged between one organisation and another" (MIG).

It is clear from this comment that the Marine Institute participant recognised the existence of the interoperability challenge he was facing when publishing data.

5.3.4 Objectives

The Fingal Open Data website follows objectives that are similar to those outlined on the opengovernmentdata.org website which are listed as follows:[27]

- **Transparency**: where citizens can access and use government data for making decisions.
- **Citizen participation**: where citizens can use the data to analyse issues and propose new ideas.
- **Collaboration:** where both citizens and businesses are encouraged to make suggestions about what applications or services could be built using the OD.

[27] http://data.fingal.ie/About/

- **Economic Development:** where both citizens and businesses are encouraged to use the published data to create apps and websites to support the decision-making process.

The head of IT at Fingal CoCo said that their objective of opening the data was to help people enhance the quality of their lives. He insisted that it was about the culture of helping people and commented as follows:

> *"there's a tradition in Ireland, it's called the Meitheal, and the Meitheal is the idea where local communities come together to help each other, so there would have been a thing of the Meitheal bringing in the harvest, so if a farmer had to bring in the harvest, the whole community would help the harvest and they'd help each other to bring in the harvest. So I think that's in us, in the Irish psyche to do that, I think it's a cultural thing, and I think that's part of why I think we can tap into it with this as well, and you know bring that Meitheal concept into the digital age".*

The culture of helping people stems from the *Meitheal* concept. Meitheal is an Irish tradition, particularly in rural communities and OGD can be seen as an extension of this tradition. Interestingly, the culture aspect in Ireland has two sides, one to help and encourage people to use OGD and the other about fear of data protection and misinterpretation. The aim of Dublinked[28]:

> *"Is to drive innovation and collaboration in the development of new urban solutions, using open data and with the city region as a test bed; [and their vision of Dublinked] is to form a smart open city; open access to public data, open to new technology, open to new ways of working and new collaborations. Smart Dublin is a collaboration framework for Dublin that enables the co-creation of solutions to prioritize city region challenges".*

The DLR CoCo objectives of publishing OGD are to help informed decision-making, to create more opportunity for business, improve service and engagement levels.

[28] http://dublinked.ie/about-us/ accessed on 31/05/16

The objectives of South Dublin CoCo are to fulfil evidence-based decisions, benefit its communities, and facilitate improved involvement. The IS manager said that: *"[W]ith OGD the ultimate outcome of any activity in the local authority is far better and it's based on evidence rather than hearsay"* (SC). He also commented that it was expected that OGD should improve communities because communities should be able to see and stand up for themselves. He added that:

> *"we would like an awful lot more engagement in that space [OGD] because it would yield for better communities and better environments for those communities within the broader society"* (SC).

The IS manager felt that thinking about improving communities requires opening the data up for them and it is the responsibility of CoCo to serve every need and enable people to become more informed.

On the other hand, there are different objectives to using OGD. The objectives are as follows:

- ***Finding out patterns and using visualisation:***

It is worth mentioning here that it was difficult for the participants to use distinctive 'objectives' without using 'motivations' interchangeably. In other words, participants were mixing objectives and motivations all the time when they were asked about what are their objectives and motivations to utilise OGD. Some community members said that their objective in using OGD was about discovering patterns and using visualisation to understand what was going on. For example, the Dublin Dashboard[29] community presents the OGD in attractive visuals such as interactive maps. The Dublin Dashboard (based at Maynooth University) provides interactive maps to aid everyday decision-making and fosters evidence-informed analysis.

- ***For business, commercial or career purposes:***

Some participants expressed their desire to start their own business and create a good network that could help them either in terms of business opportunities or in their career.

[29] http://www.dublindashboard.ie/pages/index

Using OGD for business purposes was a sensitive topic for some due to licensing issues such as terms and conditions, while others expressed their willingness to start up their own business. A participant from IBM said:

> *"The goal of any company is to build products that they can sell. So, from a research lab, we can't just do research for the sake of research, we still have to have a target or a goal in mind to come up with systems that will help us understand the world better or build a product that will then be able to run analytics and give insight back to a customer at the end of the day"* (IBMP).

It now becomes clear that participants do not have a clear cut distinction to differentiate between the meaning of 'objectives' and that of 'motivation'. In the comment above, the participant from IBM used both 'objectives' and 'motivations' to answer the question about objectives.

- ***For health services:***

In St. James' hospital, the LAMP (The Local Asset Mapping Project) represents a new vision for health, one that focuses on the society's own priorities and assets with the aim of improving society and individual health.

- ***Raising awareness:***

Within the Heritage Council, datasets have been created to raise awareness of the facilities represented within each dataset, with the aim of promoting their cultural heritage. Raising awareness is a means to an end and is seen as an effective means to achieve objectives.

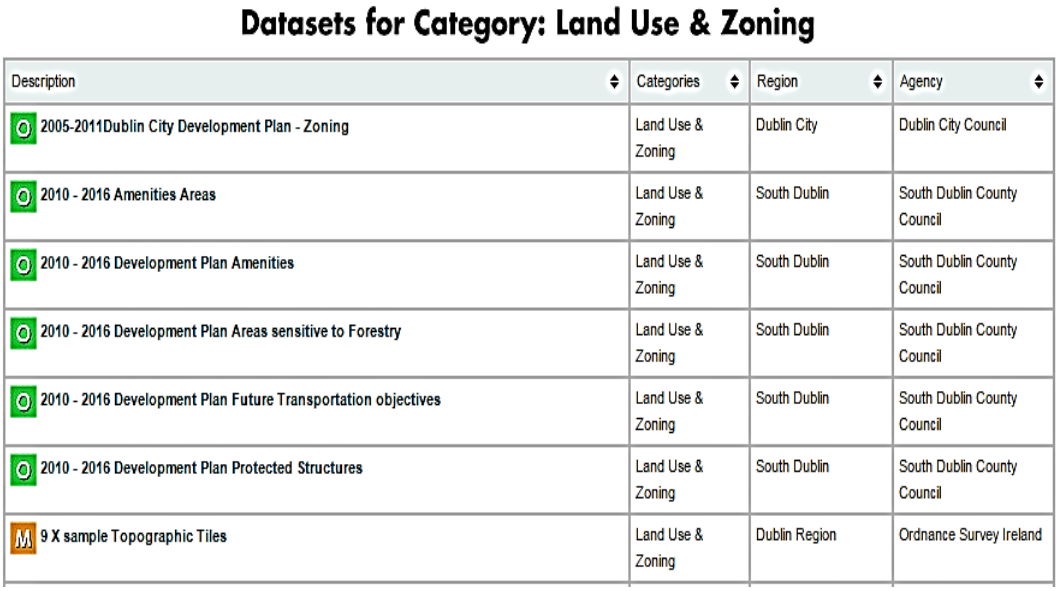
- ***Leading to policy development:***

The Department of Public Expenditure and Reform (DPER) leads policy development, implementation, reform activities, and creates a good environment for the economic, social and democratic benefits of OD. DPER helps to create the OGD portal (http://www.per.gov.ie) with the aim of creating an environment by opening up government data for new research opportunities, innovation, transparency, and efficient engagement.

5.3.5 Rules

Many participants referred to licensing, citing the rules in the OGD field such as the Public Sector Information (PSI) and Creative Common (CC) licenses. It is important for those who have a license to know the various rights and obligations, especially for commercial purposes. However, most of the participants require the licence to be as open as possible. The Fingal CoCo system analyst noted that the licence was an unrestricted open data one (including commercial use). Consequently, it is possible for entrepreneurs to use open data and develop apps to provide services. From examining the Dublinked website, restrictions exist to access some of the datasets in Dublinked. For example, 'O' signifies that the dataset is open, while 'M' signifies that the user must be a member to access this dataset (see Figure 5.4). This means that Dublinked is not OGD, according to the definition of OGD used in this research.

On the Dublinked website, when public users click on 'M' datasets they receive a page like that depicted in Figure 5.5 which informs them: "*Limited access, data available to members only*".



Datasets for Category: Land Use & Zoning

Description	Categories	Region	Agency
O 2005-2011Dublin City Development Plan - Zoning	Land Use & Zoning	Dublin City	Dublin City Council
O 2010 - 2016 Amenities Areas	Land Use & Zoning	South Dublin	South Dublin County Council
O 2010 - 2016 Development Plan Amenities	Land Use & Zoning	South Dublin	South Dublin County Council
O 2010 - 2016 Development Plan Areas sensitive to Forestry	Land Use & Zoning	South Dublin	South Dublin County Council
O 2010 - 2016 Development Plan Future Transportation objectives	Land Use & Zoning	South Dublin	South Dublin County Council
O 2010 - 2016 Development Plan Protected Structures	Land Use & Zoning	South Dublin	South Dublin County Council
M 9 X sample Topographic Tiles	Land Use & Zoning	Dublin Region	Ordnance Survey Ireland

Figure 5.4 Dublinked datasets example

Source: Dublinked[30]

[30] http://dublinked.com/datastore/by-category/land-use-zoning.php

Access Permissions	Limited access, data available to members only
Licence or Use Constraints	Osi T&Cs

Figure 5.5 Restrictions on the dataset

The Dublinked manager mentioned that the reason for having some data under the membership rule was because Dublinked was not only for publishing OGD, but also for publishing data from a number of public and private organisations in the Dublin region. People may think that Dublinked is an OGD portal; however, it is a platform for Dublin Smart City to pitch ideas and solutions, and for third parties to get involved in the Smart City initiative.

However, in South Dublin CoCo, the IS manager mentioned both PSI and creative commons licences and claimed that anything that appears on the CoCo website is licensed under the PSI license.

5.3.6 Community

In Ireland, the first community publishing OGD came into existence in 2010 when Fingal CoCo became the first public sector body in Ireland to publish OGD. The CoCo has had a significant effect on the community in encouraging the OGD phenomenon. It is now focusing on the *Code for Ireland* community with the aim of making the publication of data sustainable within the organisation and finding opportunities for local authorities to work with local communities in enabling access to that data.

The Dublinked community, as part of the DCC, is considered a cooperative activity because it is run by multiple parties. IBM is responsible for the infrastructure, while the National University of Ireland (NUI) Maynooth is responsible for coordination between the four LAs. Other public and private organisations in the Dublin region are publishing data on Dublinked which are: Dublin City Council, South Dublin County Council, Fingal

County Council, Dún Laoghaire–Rathdown County Council and finally Maynooth university is providing the coordination service between them (see Figure 5.6).

Figure 5.6 Principle collaborators in Dublinked[31]

DLR CoCo participants mentioned the impact of the European Union on OGD as the community/environment is driving all European countries to open up their data. The IS manager in South Dublin CoCo commented about the government as an influential factor. From this scenario, it appears that the community/environment is strongly influenced by the OGD movement.

There are several influencing factors in Irish society that can affect communities interested in engaging with OGD. For example, Open Knowledge Ireland (OKI) aims to be a central hub for the open data movement and there is sponsorship from Amazon to the interested communities to encourage them. Amazon sometimes provides the communities a space for their buildings, as well as food and drink products. Google also gives communities a space to meet. Mypp.ie group provides all sorts of sponsorship in terms of arranging for the hosting of websites. Facebook also provides a space and free food. Encouragement does not always take the form of money, but a lot of bodies provide a good environment in which individuals can work on OGD in Dublin. These bodies/entities are positively influencing interested communities to continue working on OGD because they see its potential value.

5.3.7 Division of labour:

Based on participant opinions in Fingal CoCo, labour is divided between the Manager (the head of IT) and data analysts (to extract, transform, launch and publish OGD). Other than

[31] http://dublinked.ie/about-us/

that, there is no clear picture about who does what exactly work in the OGD because it is performed by volunteers.

According to the Dublinked website:

> *"Dublinked has received initial funding from the National University of Ireland Maynooth and Dublin City Council. The four local authorities (Dublin City Council, Dún Laoghaire Rathdown County Council, Fingal County Council and South Dublin CoCo) are investing significant effort to extract and prepare the data for release. To enable the start-up phase of this project, IBM Research is providing, on a non-exclusive basis, a platform of open collaboration technologies and research tools".*[32]

This suggests that OGD is seen as an ecosystem rather than a formal division of labour. However, to extract roles, they distributed between the social roles (connecting people), technical roles (providing the platform) and financial roles (funding the project).

The manager of Dublinked said that she had been working on connecting people to information and developing the necessary tools to become involved in the planning of their own communities. Her role is to engage both internally (employees) and externally (communities) with OGD to facilitate innovation within the DCC and across the city. Other roles are not clear (who does what) regarding OGD in Dublin CoCo, which is the same as the Fingal case. In DLR CoCo, the geographical information system (GIS) team is the group interested in engaging with OGD and the administrative economic officer is responsible for examining initiatives for economic development. The head of the IS department in the South Dublin CoCo has responsibility across the entire organisation for any technology-related initiatives. Other than that, the structure remains unclear.

Reflecting on the division of labour in the area of OGD, participant observations and interviews show that there is no obvious structure and all participants confirmed that they did not have formal positions when they were working with OGD. All work is carried out on a voluntary basis. In all cases, there was one leader who inspired others and that role was apparent.

[32] http://www.dublinked.com/?q=aboutus

5.3.8 Level of awareness

Level of awareness can affect the level of engaging in publishing and using OGD. The evidence showed that the level of awareness was relatively acceptable, only within the geospatial communities because they were struggling with expensively licensed data. As expected, people who were interested in engaging with OGD, such as the community of Code for Ireland, were aware of it. However, when interviewed, most stated that the majority of people in their general community do not know what OGD means, nor do they know about the available portals and datasets. The members noted that the level of awareness about OGD was limited to those working in the IS or IT department of the LAs and developers (tech community) who are connected to the LAs. Beyond that, they felt that most members of the general public would not even know what OD meant even if they had previously heard the term. Interestingly, some people may use open data in the form of a product (e.g. in app) and still do not know that it is open data because they just know about the app (e.g. open street map).

OGD is a new phenomenon requiring greater dissemination channels in order that the public becomes familiar with it. Ways of increasing the level of awareness suggested by the participants include:

- Using social networks, such as Twitter and Facebook, would be a strong way of reusing visualisations;
- Using TV and radio;
- Running competitions to showcase new applications using OGD could be a very effective method to encourage people to learn about OGD,
- Using middleware: The manager of Dublinked stated that the public needs middleware to enable interactions, and to understanding and find the story in the data.

Having discussed the findings and emphasising the AT constructs, it is now obvious that the useful and most relevant construct relates to ‘barriers’, while the least useful construct in the context of OGD is the ‘division of labour’ because the work is done on a voluntary basis. The second main category in the findings is co-creation which is discussed in the next section.

5.4 Co-creation

The second main phenomenon examined in this research is the concept of co-creation within the OGD context. Three themes emerged from this analysis which resulted in the formulation of a co-creation model. The co-creation model is presented in the next chapter.

5.4.1 Definitions - A Lack of Uniformity

In starting out on this research, a question posed to interview participants was:

"If I define co-creation as **"the joint creation of products such as applications by local authorities who publish OGD and their local communities",** do you agree with this definition? Or, if you do not, how would you define co-creation within the context of using OGD?"

Participants responded in different ways which reflected a clear lack of agreement among the interviewee cohort when it came to defining the term. The IT manager in Fingal CoCo who commented on the definition asserted that:

> *"there is that relationship between the two [the public sector and citizens] that is not simply 'I am consuming', but also I have a responsibility as a citizen. But by carrying a responsibility as a citizen and as a local authority their responsibility will be to facilitate, engage and help citizens to fulfil their needs and enhance all the services"* (FC).

One academic argued that: *"creating an open data ecosystem environment is certainly a co-creation between data consumers and data producers"* (AC5). This participant perceived that co-creation exists when there is more than one party involved in producing and consuming. This is a different perception from that of the Fingal IT manager who believed that there was a real opportunity for citizen engagement with OGD. Thus, he encouraged the co-founding of the Code for Ireland project because he believed that this project could be the ideal mechanism for creating further engagement between local government and citizens, as well as being a step towards co-creation in the sense of involving them in the process of creating value from OGD. Based on the IT manager's opinion, the term "*relationship with responsibilities*" for all concerned parties is an

important aspect of the definition of co-creation where there is no one party that is consuming and not contributing. On the other hand, the Dublinked manager defined co-creation as the "*inclusion*" of users, citizens, communities and other stakeholders to improve public services. She stated that co-creation exists in the sense of creating communities of interested people through Dublinked's Innovation Network activities, which include regular thematic events and informal 'dubmeets'. This environment provides a forum for engaging and the exchange of ideas between entrepreneurs, developers, the public sector and researchers. This environment also helps to co-create ideas, experiences, apps and services. According to the Dublinked manager, co-creation exists as part of an inclusion process through regular meetings without stressing specific responsibilities. DLR CoCo participants indicated that co-creation began after the emergence of technologies resulted in fewer boundaries between citizens and local government. In their view, co-creation existed primarily in a virtual environment because of their emphasis on technology. DLR CoCo agreed to some extent with the definition and with the removal of local authorities from it because they were, as they put it, "*very small in this field; we are a baby, But it's between individuals, businesses and communities*". Unlike the Dublinked manager, the Administrative Officer of Economic Development in DLR CoCo commented on the regular monthly meetings at which there is collaboration with Dublinked, viewing these as an example of the learning environment rather than of co-creation. The view of the Dublinked manager considered the 'meetings' as an example of a co-creation environment. The definition offered by the IS manager in South Dublin CoCo as being a kind of "*crowd sourcing*" reflects the case of Fixyourstreet.ie where individuals contribute to the website (Fixyourstreet.ie). His knowledge of co-creation is limited to Fixyourstreet.ie in which citizens do not create apps using datasets as per the example among many others. It is clear that the variety of views of the participants about co-creation highlighted the lack of uniformity in defining the term. Comparing the views of the four LAs regarding the co-creation definition shows that there is no agreement between them on what co-creation means.

Participants other than the four LAs also revealed that they were not sure what could be considered a suitable definition for "co-creation". One developer highlighted the ambiguity surrounding the term, stating: "*There is cooperation whether there is co-creation … it's a grey area*". The developer did not know how to differentiate between cooperation and co-creation.

Another developer from the openstreetmap.org.org community agreed with the given definition about co-creation, but added that the definition did not take into account licensing and formats which he believed to be the major issues with open data. In his view, parties needed to agree on standards in order to have co-creation without restricting the use of OGD. This means that licensing is the essence of co-creation, which means giving the right to use the data as openly as possible (CM3). Co-creation, according to one of the international consultants, could be defined at different levels (NL2). In other words, the co-creation of *services* would be different from that of *policies*. Within each level of co-creation, there are sublevels. For example, within the co-creation of policy agenda are sublevels, such as the co-creation of policy *decisions*, the co-creation of policy *implementation*, and the co-creation of policy *evaluation*. Furthermore, he contended that the given definition of co-creation would fit within the third type of co-creation, policy implementation and then, more specifically, within the implementation of government services. In his opinion, this would be a specific example of co-creation that entails the joint creation of government policies for the implementation of government services.

Illustrating further the diversity of views and understanding of co-creation, one participant from the Marine Institute stated that "*co-creation in open data does not need active collaboration in the creation of products like apps*". In other words, collaborative creation could be explained as a pro-open data policy where the individual public body releases the open data.

Based on the above responses and comments, co-creation may be interpreted differently from different viewpoints such as relationships, meetings, a process of crowdsourcing, levels, and approaches. This results in considering co-creation more broadly than just the creation of products.

5.4.2 Examples of Co-Creation

One example of co-creation is *Dublinked* where the four LAs, Maynooth University, and other bodies (such as IBM, the Insight Centre for Data Analytics - NUIG, Intel, the European Research Lab) collaborated together and co-created Dublinked as a smart platform for Smart Dublin.

The Mypp.ie owner states the second example of the process of co-creation. He referred to the work of one individual who approached Fingal CoCo and then other LAs to request planning datasets for a project (application) called 'Mypp.ie'. Mypp.ie shows detailed planning applications on an interactive map and won the Enterprise category and a prize of €2,500 in 2012 in the competition of Apps4Fingal. Mypp.ie started off with planning applications published by Dublin authorities that enabled the application owner to create the application. Next, the application owner was able to request more data from local authorities all around the country, resulting in the majority of local authorities submitting planning application data to him. The Mypp.ie owner commenced as a small start-up company employing a number of staff. His business has made considerable progress, even securing contracts internationally in the United States with the application owner now selling the application to states such as California. The Mypp.ie project was jointly funded by the local authorities in Ireland. The essence of co-creation was not based on the application being built jointly. Rather, it was a commercial solution implemented between the community and the local authority. One member of staff in Fingal CoCo, for example, played a significant role in project-managing the Mypp.ie application, which led to its overall success.

The owner of the Mypp.ie application is now a partner for the Code for Ireland project. Code for Ireland is another notable example of co-creation. According to its website:

> *"Code for Ireland follows in the footsteps of Code for America, which was founded in 2009. Like it, Code for Ireland has attracted technologists to get involved in developing solutions in and with the Irish government and its communities".*

The co-creation within Code for Ireland is between civic-minded individuals, businesses and public sector organisations. There are monthly meetings for Code for Ireland with several applications and services in progress. The following is a sample of some of the applications available as of October 2016:

- **Dublin Collaboration Dashboard** - sharing information about community groups and projects in Dublin.
- **What's in my water?** - providing open data on water quality in an accessible format.

- **Wedding red tape** - making government information on marriage easier to access.
- **Falls & Fracture prevention** - making an online tool to help people assess their risk level for falls and fractures
- **Rothar** - prototyping an idea to reduce bike theft. Open source code is available to develop further.
- **Save a Selfie** - mapping defibrillators so they can be found in an emergency. The public's help is needed to develop this Android app. According to the saveaselfie.org website: "*The Save a Selfie app has been designed and developed to help members of the public pinpoint the location of emergency equipment in their local community*".

The CEO of Mypp.ie views co-creation as fundamental in creating the standard for open data. He observed that co-creation exists:

> *"… where we created a standard, we share that with councils and then what we found was, we get really good people from the CoCos, who can improve on that and say, We can make this better […] We're not partnering with these [local] governments, there's no commercial agreement, it's just asking them 'can you release your data in an open format'? That's all that's happening. So, there's no financial transaction, it's just access to public information"* (CM8).

Code for Ireland is distinguishable from hackathons in that the latter are one-off coding events. Code for Ireland members gather monthly which suggests that the levels of sustainability and continuity among its members appears to be more effective than hackathons.

On the other hand, there is another type of co-creation in Fixyourstreet.ie where the local government is the receiver rather than producer or publisher. The website allows citizens to report issues to local government and receive a response within two working days. Fixyourstreet.ie is a service launched in 2011 by South Dublin County Council, operating on behalf of all local authorities in Ireland.

The collaboration between Ireland and *Lesotho* in Africa is one of the significant examples of co-creation, although it is outside Ireland. This involved some employees in Fingal CoCo visiting Lesotho to help authorities map their territories. A participant commented

on this, saying that: "*this is a commitment from the local authority itself to aid the project on a global basis*" (CM4). Irish people have even travelled to help and co-create maps for Lesotho citizens, as confirmed by the Fingal IT manager.

A PI (principal investigator) on the Programmable City project asserted that the Digital Repository of Ireland (DRI), the All-Island Research Observatory (AIRO), and Dublin dashboard.ie are examples of co-creation because they all involve different organisations and a variety of people trying to leverage the data into something more significant/beneficial.

A final example of co-creation is the Social Platform for Open Data (SPOD)[33] which enables social interactions among citizens around open datasets coming from different sources (dataset providers). SPOD can be used to co-create, with others, solutions for common problems. The information about SPOD was gained from the last participant observation in October 2016, at the Smart Dublin showcase.

Analysing the co-creation examples of Mypp.ie, Code for Ireland, Dublinked, Fixyourstreet.ie, working with Lesotho and all other tools such as DRI, AIRO, Dublin dashboard.ie, and SPOD shows that co-creation can exist at different levels of engagement and in a variety of approaches which, to some extent, reflect the different views of defining co-creation as outlined in the previous section.

5.4.3 Improving Co-Creation

Having discussed successful manifestations of co-creation, the participants were asked to suggest ways to improve the co-creating process. A number of themes emerged. The first concerned the various roles of the County Councils. The second area is related to identifying and overcoming existing challenges of current co-creation practice.

Some Councils see their role as enablers and partners when formulating events for innovative networks and for the co-creation process. The Fingal IT manager contended that LAs have a particular role to play in the co-creation process because they are the part of the government that is closest to local communities. He also added that it was important for

[33] http://dublin-spod.routetopa.eu/

LAs not to seek solutions; rather LAs are playing the roles of enablers and partners in the process of co-creation. In this way, OGD could be utilised in enabling communities to grow, develop services, and solve community problems. The Dublinked manager from DCC stated that its role was to create events and innovation networks to connect people and co-create ideas, products and services together. On the other hand, communities believed that the main role of LAs was to facilitate accessibility to datasets. Moreover, it was clear that there was a demand for a flexible relationship between data publishers and users (DV2). Consequently, it appears that there is a certain perception of LAs in that they do not need to provide solutions to citizens, but instead facilitate the accessibility and availability of OGD and connect interested parties in innovation networks.

With regard to these issues of co-creation, participants mentioned three challenges using the OGD as follows:

- ***Unstructured Involvement***

Within the co-creation process there is sometimes a lack of structured involvement between the parties collaborating together. One developer highlighted this point, saying that: "*there wasn't really a plan. Like we couldn't go tell them how we did it. Like it was through relationships and there is no formal team in the co-created projects*" (DV2). This issue clearly needs to be resolved because without a structured agreement between parties, conflicts are inevitable. Agreement is needed at least on licensing and format(s), as recommended by one participant (CM3). Another community member believed that the "*[C]o-creation of information by multiple organisations has to start with an agreed format or a standard that they're going to stick with when making that information available*" (DA). In light of the need for such a co-creation agreement, a member from a Canadian organisation emphasised the need to have a governance agreement:

> *"It [co-creation] is a social activity. There need to be agreements. General social agreements, to make sure you follow certain rules so that you're respecting the various people that are around the table. There needs to be some rules that keep you from getting angry at each other in a negative way, it's a human collaboration activity, in my view"* (CC).

This participant highlighted the importance of having a general social agreement that is comprised of rules to manage human collaboration and avoid clashes that may stem from different opinions.

- ***Necessity for Feedback Channels***

Many participants stressed the importance of having feedback channels to know what people think about the available data and whether they are considered to be useful. It is important also to undertake proper user ability studies on the provided websites.

- ***Lack of Metadata***

For users, the provision of metadata can be vital to understanding the information. The metadata must include the contacts for queries and feedback. It should be a two-way process, otherwise, it may lead to a dead-end road where it is not possible to progress and develop co-creation activities.

5.5 OGD Effectiveness

Investigating the participants' perspectives on the effectiveness of OGD in this research includes: definitions of effectiveness, how to measure effectiveness and some ways in which the process can be improved.

5.5.1 Difficulty/Challenge in Defining Effectiveness

Considering that OGD is still in its early stages in Ireland, all participants found it difficult to assess its effectiveness For example, one candidly admitted that:

> *"I am not sure what you mean by effectiveness and I would always apply a much more differentiated view than simply describing it as one word, simply being effective"* (AC5).

Other views varied according to their objectives and perspectives. One international expert from the Netherlands explained that effectiveness depends on what goal is sought and achieved. He asserted that different goals could be distinguished and that there is a distinction between transparency, participation, collaboration, and economic growth within

the OGD field. With regard to transparency, OGD can be effective in his view if "effective" transparency is created that enables citizens or other stakeholders to monitor government activity. He added that it can achieve more when it facilitates new forms of government participation in policy-making or in the co-production of government services. In terms of collaboration, OGD can be valuable where it helps to facilitate collaboration between different groups in finding solutions to problems, such as traffic jams, sustainability, and safety. Lastly, OGD can be effective when it facilitates economic growth and helps citizens. While other participants identified the link between effectiveness and their objectives at a broader level, their responses lacked significant detail into the kind of objectives discussed by the Dutch participant.

Based on the responses of the participants in this study, it would appear that there is lack of a clear vision on what OGD effectiveness actually means to them.

5.5.2 Measuring OGD Effectiveness

Measuring OGD effectiveness is a complex one as there are no specific tools to conduct this task. If effective OGD is defined in terms of its impact on society, then measuring effectiveness is not straightforward due to its intangible nature. None of the LAs, as dataset providers, measured the value of OGD processes or datasets. However, an American consultant, an academic participant, and the manager of Dublinked in the DCC suggested the following methods to measure the effectiveness of OGD:

- Checking the reuse of datasets (tracking the usage) by installing Google analytics on the backend to see click traffic (USAC);
- Comparing the number and quality of datasets with previous datasets and checking if there is any improvement (AC2);
- Analysis of website hits (AC2);
- Qualitatively, conducting interviews with potential users or disseminating surveys (AC2);
- Investigate funding and ascertain if it is being maintained for a particular project (AC2);
- Analyse usage and the kind of products that are being created, either to be used for free

or sold (AC2);

- Effectiveness can also be measured by measuring impact (output) on cost savings, efficiencies, improved services, or increased economic activity (DC).

Only three participants from the 48 interviewed suggested ways to measure the effectiveness of OGD. However, several of the suggested ways measure usage of OGD rather than effectiveness. This implies the absence of detailed knowledge among participants when it came to understanding what the term "effective" means in the OGD context.

5.5.3 Do participants see OGD as effective, and why?

Some respondents considered OGD in Dublin as it is effective. Effectiveness is perceived in how OGD stimulates projects. For example, Fingal CoCo stated this implicitly by pointing out that OGD had enabled some communities to start their own projects based on OGD; reflecting on the kinds of effect of OGD on communities. Only two participants, from the Insight Centre, believed that OGD in Ireland was effective, one of whom contended that Irish OGD was useful because it had continually existed since its establishment in 2010 when Fingal and Dublinked were set up. In her view, investment in this field suggests significant efforts being exerted to improve the effectiveness of OGD. She highlighted the availability of datasets as the criterion of being effective, regardless of quality. Another academic from the Insight Centre offered the opinion that the Irish OGD is effective because:

> *"There are a lot of very enthusiastic people in the government who put a lot of work and effort and dedication into making it work. They're the champions in their organisations and they are then trickling down and creating a real world impact. So, in that sense, it is certainly effective"* (AC5).

Another participant affirmed that there was progress being made in Ireland, commenting that:

> *"Ireland is certainly on its way at this point of time. Other countries are a bit further along. The UK has already, for quite a number of years, an open data policy and data sets, but now Ireland is well on its way as well"* (AC5).

One of the noteworthy findings in this research is that the standard DCAT, now a recommendation by the European Commission for representing metadata on OD portals for all European member states, was based on the research study of a student from the Insight Centre. This is evidence of the contribution being made by the Insight Centre toward OGD and linked data. The Insight Centre has been giving individuals the opportunity to work on the OGD project. As a consequence, research funding is allocated in order to progress their work towards achieving this objective. Some academic experts and participants from the LAs believe that OGD is effective. This is in contrast to other participants, such as developers from different communities who expressed the view that OGD is not effective as a result of their experience with unavailable and non-updated datasets, as well as their dissatisfaction with the lack of adequate communication. However, not all datasets released are ineffective. One academic commented on this by saying:

> *"the real-time data is actually not bad, it is pretty good compared with almost any city on the planet actually […] but in general OGD in Dublin are at the stage of just thinking about what data do we have and could we make it open?"* (AC6).

Even though the participant complimented the real time data, he reflected the view that the general status of Dublin OGD is still premature. The majority of interviewees did feel that OGD was not effective as it was still at the embryonic stage of development.

5.5.4 Suggestions to improve the effectiveness of OGD

How can the effective use of OGD be improved? Many participants provided suggestions to improve OGD effectiveness, including the following:

Publishing additional datasets by LAs and other agencies

The IT manager in Fingal CoCo felt that there was a necessity for other agencies to publish datasets such as education data, social protection data, employment data, data about social services, and health data. These services are provided by national agencies that publish different datasets and are not published by the LAs. In a similar vein, one of the academic participants (AC3) called for more datasets such as housing data, homelessness data,

average rents data, and vacancy rates data to be made available. Some participants called for additional datasets that could enrich OGD in addition to some of those available from the website of the Central Statistics Office. Some interviewees expressed a preference for all datasets to be in a single repository for all OGD in order to avoid possible confusion.

The need for government understanding of OGD's potentials

Many participants held the view that to have effective OGD, the government must understand the potentials of OGD in order to utilise it effectively and efficiently. Participants across all categories (LAs, academics, international experts, communities, and organisations) agreed on the fact that civil servants lack understanding of OGD. They insisted that many still doubted the benefits and potentials of OGD and feared the associated financial burden associated.

Provision of equal opportunities

Some participants complained that they did not have the opportunity to attend OGD meetings or did not have an adequate budget to work with OGD. One academic summarised this point by stating that:

> *"Everyone should have the opportunity to take part in OGD process. Last year the public consultation happened, where only 50 people were from civil society. You should do advertisements on television, in newspapers to get everyone involved. They are making things more difficult to participate. Everyone can have ideas. You know better than others what you need in your area"* (AC1).

Moreover, he identified the need to hear all voices in society, as is the case in other European countries. He added that:

> *"[I]n Germany for example, people working for children, they want to know what children need, so they will go actually to meet and ask children what they want, not just asking parents what children want. There are opportunities to say what they really need because adults do not know"* (AC1).

Increasing awareness through social media

Another way to make OGD more effective is to link it with social media. A participant from the CSO suggested using social media in this context to reach out to people more frequently. He commented on his experience in the CSO and noted that: "*relating social media to OGD means opening it up to a wider group of people to make it more effective*" (CSO1). The participant suggested the use of social media, such as Twitter, as a means to increases awareness levels within the wider group of people.

Provide Metadata - New forms of adaptation and application

Most of the participants highlighted the importance of metadata for having effective OGD. For example, the IT manager in Fingal said that *"metadata should state factually and boldly this is what the data is for"*. Furthermore, the IS manager in South Dublin CoCo also stressed the importance of having metadata. He added that it should be not only *"available but also consistent at least at national level by using the same naming schema"*. A participant from the Digital Repository of Ireland referred to the 'Dublin Core'[34] which is one of the most basic metadata schemas and includes elements expressed in the form of questions such as: Who created this? When was it created? What's it called? What's in it? What are the rights over it? Where was it published? She asserted that DCAT was based on the Dublin Core and the purpose of DCAT was "*just to give a really simple way to describe things in the datasets*". The international consultant from the USA suggested that one of the global problems with the open data movement is there is no standard on metadata. He commented further, saying that "*there are metadata standards like DCAT, but I would say the adoption of those metadata standards is somewhat spotty*". He provided an example of the type of labels used to describe data in the USA: in the city of Raleigh a particular dataset is called 'Police incident data' while in the next city similar data, it is known as 'crime data'. This can create a problem due to the lack of standardised names. He provided a solution that has been created by the Open Data Institute (ODI) which released a 'data certificate' on its website at odi.org that contains metadata templates. There is one for each country, and it allows for the use of the same terminology

[34] This refers to Dublin, Ohio.

to talk about metadata. A participant from the Public Health Institute (PHI) also confirmed the importance of standard metadata, pointing out that "*[I]t is also important to have [metadata] standardised. If everybody was collecting their metadata in a different format or a different way, it gets messy*" (PHI1 & 2).

Applying standardisation to OGD is important and is also supported by the participants from the Barcelona CoCo. They felt that standardisation is the key for OGD effectiveness because if they publish one file or one dataset in a standard format with the same field, this dataset can be used in different cities. They said:

> *"… we share a multi-council strategy with other city councils around Barcelona to establish this standard … this is difficult work because it is difficult to do inside only the Barcelona city council but you can imagine how difficult it would be if you want to work with others. This is an objective to [sic] European level"* (BC).

Further, both the CSO participants and one academic emphasised the importance of having a methodological guide with OGD. The academic participant differentiated between the metadata and methodology

> *"Metadata is what you use to discover the data; it's usually how the data are described. However, a methodological guide is more than metadata; a methodological guide tells you how those data were collected, when those data were collected, why those data were collected, and the statistical significance of those particular kinds of datasets. You cannot get that just from metadata. Certainly not the metadata on most open data portals, it is too minimal"* (AC3).

Consult international OD organisations

The US international consultant believed that if the Irish government consulted outside organisations like the Open Data Institute (ODI), its OGD could be better due to the fact that ODI connects, equips and inspires people around the world to innovate with data. ODI, founded by Sir Tim Berners-Lee and Sir Nigel Shadbolt, is an independent, non-profit, non-partisan company limited by guarantee.[35] One of the academic participants highlighted the importance of organising data appropriately rather than just throwing

[35] http://theodi.org/about-us

everything up on a website. He recommended that the: "*[OGD portal] has to be properly built, and it has to have a proper set of policies and strategies in place to make sure it is around in ten, fifteen, twenty years' time*" (AC6). In order for OGD to be effective for the long term, organisations must look beyond mere publishing, rather they ought to consider building proper datasets with long term policies and involving strategic management.

5.6 Summary

The findings of the research showed that the four LAs and other participants hold different perspectives about all the developed AT constructs. Additionally, the findings revealed that participants lacked any uniformity in their views of the concept of co-creation. Different participants understood co-creation differently. Effectiveness concept was just as problematic when it came to the questions of definition and measurement within the OGD context. Although some felt that effectiveness depends upon the purpose or objectives of publishing OGD, it was argued that it could have been understood as an impact or effect on society. In general, most responses indicated a negative perception towards the current effectiveness of OGD. If the recommendations and suggestions outlined previously were taken into consideration, this could go a long way to improve the effective use of OGD in the long term.

Chapter 6

DISCUSSION

6.1 Introduction

This chapter embeds the co-creation concept within the OGD context and AT constructs. The chapter discusses the main findings of this research. It presents co-creation as an ecosystem and discusses the application of the developed AT. Further, it explains the effectiveness of using OGD for co-creation and presents the vibrant co-creation model. Finally, the chapter concludes by answering the research questions.

6.1.1 Co-creation as an Ecosystem

As noted in section 2.5 of Chapter Two, co-creation takes many forms. The literature of co-creation envisages it as having two central dimensions: openness and ownership. Based on these, Pater (2009) proposed four types of co-creation: the club of experts, crowd of people, coalition of parties, and community of kindred spirits. However, the form of co-creation that emerges in this research can be best described as a type of ecosystem in which various elements or stakeholders interact and inter-depend in various ways, with co-creation overlapping more than one of the four mentioned types. Ding *et al*. (2011) also proposed a similar conceptualisation but for Linked Open Government Data(LOGD) as an ecosystem, albeit in a much narrower way. In this system, OGD acts as the food supply; it is the raw material from which products, services and information are either generated within or created by the ecosystem. For an ecosystem to survive and thrive, it is necessary that all of its elements share at least some common interests. Furthermore, to enable it to thrive, it is necessary that there is sufficient commonality in the objectives of different members of the system (survival being the most obvious one), and sufficient compatibility between the objectives of different members (or, in AT parlance, subjects). Co-creation systems are innovative; they create new things. The question of interest here is how to support and enable both the ecosystem in meeting its various objectives and creating new things, i.e. in creating a vibrant co-creation community.

6.1.2 Applying AT

Within a co-creation system, by definition of 'co' which involves more than one party, there will be multiple **subjects**. The subjects observed in this research can be divided into four groups: data providers, communities, businesses (corporate entities) and academic and other experts. The consideration of multiple subjects enriched the findings through the understanding of different perspectives which led to the discovery of more factors that are necessary in order to be considered in the co-creation model.

The core common **objective** of all these groups is the creation of value in some form. All subjects stressed that an important objective of the co-creation system is creating public value, although businesses had a wider value creation agenda (e.g. including career purposes and financial benefits). As noted by Ofe and Tinnsten (2014), both economic growth and transparency are commonly identified as objectives and were found in this research, although each was much more in the forefront of thought for some subjects than others. Transparency is an objective that might not be uniformly viewed by different subjects, since one person's transparency can be another's breach of privacy (Bannister & Connolly, 2011). Interestingly, in all four case studies, transparency was considered to be an objective by all subjects, albeit with different degrees of emphasis on its importance. Other objectives emerged and were stressed by particular subjects. For citizens and communities, participation was an important aim. Communities wanted OGD to help with the analysis of local issues in order to assist in proposing new ideas regarding both policy and services. All parties shared the objectives of driving innovation in the development of new solutions to urban problems, informed decision-making and improving quality of life through the provision of better services. Some communities' objectives included searching for patterns relating to the visualisation of information and business, and even personal career purposes.

The **rules** component in AT manifested itself, particularly with users, as being primarily about licensing. A small number of authors have examined this question such as (Larsson, 2013; Khayyat & Bannister, 2015). On close inspection, these authors have argued, licensing turns out to be quite a complicated topic with many nuances which are not always well understood. This lack of understanding was verified by this research when respondents were asked what they understood by "rules" in the co-creation process with

OGD, the dominant response related to the licensing of OGD (and, to a much lesser extent, licensing of the products created). Most respondents admitted to being confused about this topic and felt uncomfortable speaking about it. A common response included words to the effect that "*I am not a legal expert/lawyer*". Several respondents confirmed that they found it difficult to understand the so-called 'fine print' in the terms and conditions, and that the terms sometimes seemed to be ambiguous.

In the examination of the **environment/community** component of OGD, Ding *et al*. (2011) also use the concept of an ecosystem although they do not discuss or explain the impact of its components on the publishing of OGD. This research suggests that several factors are of significance. The obvious one, in the context of Irish local government, is the presence of a champion or leader. The development of OGD in Fingal can be viewed as a type of Skunk Works[36] project wherein an individual, supported by a small number of like-minded colleagues, took the initiative to create an OGD portal. In DCC, the project was more formal. However, even an enthusiastic champion needs support. In the case of Fingal CoCo, this came from a number of internal staff members as well as external data providers. One key player for all four LAs has been Maynooth University which provides coordination that, together with a number of other bodies, has enabled the LAs to address the coordination challenges described by Zuiderwijk *et al*. (2012). IBM (a commercial organisation) and the Insight Institute (a data analytics research consortium) helped in providing the infrastructure. The Insight Institute assisted in creating standards for OGD which are vital components of the OGD environment. The support of the three-strong entities, one commercial and the other two academic, contributed to the early success of the Fingal/DCC co-creation initiatives and are expected to encourage more SDCC and DLR in the future.

The **division of labour** component turned out to be the least useful component of AT in analysing the four cases and other participants. This is largely because of the fluidity and informality of the activities within the system. Even though there are defined roles and responsibilities within the LAs, because of the "extracurricular" nature of the work on OGD, traditional roles and lines of command are not relevant. Communities also tend to

[36] A Skunk Works project is a term used to describe an 'unofficial' or non-sanctioned piece of research and/or development carried out within an organisation. The term comes from the Lockheed Corporation Skunk Works plant in California.

have a fluid structure with people coming in and out of the process and contributing according to their skills and availability. Within communities, it was found that there were no particular biases or patterns when it came to age or gender, nevertheless most of those involved were over 30 years old. Skills to use OGD were varied. Interestingly, the division of labour has a total of 54 relevant interview transcript codes displayed in Table 5.6; however, this number represents the positions and roles of participants in their formal job rather than within their OGD projects. Division of labour was clearer at macro level where the work with OGD portals was divided between LAs and other agencies. Working with OGD involved publishing, using, programming, hosting, analysing, visualising, coordinating and providing standards and metadata. However, the division of labour was not structured clearly at micro level (task breakdown) for LAs employees and community members. The work with OGD was more like a random engagement. Since much of this work was on a voluntary basis, the division of labour element did not yield much by way of insight into the nature of the co-creation system.

Tools, by contrast, provided a powerful lens for looking at the system. Tool-sets varied with subjects. For publishers/providers, tools included front end portals (Davies, 2012a; Lee, 2012), although these were backed up by a large number of other tools, including the following: Extract Transform and Load (ETL) systems; Feature Manipulation Engine (FME) to transform and publish the data; CKAN (Comprehensive Knowledge Archive Network) - a powerful data management system that makes data accessible by providing tools to streamline publishing, sharing, finding, and using data; and JSON (JavaScript Object Notation) which is a lightweight data-interchange format. JSON is easy to read and write. It provides a standardised data exchange format.

Users also employed a large tool-kit, including ROUTE-TO-PA (Raising Open and User-friendly Transparency-Enabling Technologies fOr Public Administrations), which comprises a Social Platform for Open Data (SPOD) that enables social interactions among citizens around open datasets coming from different sources (dataset providers). Other tools and techniques adopted by users included Google Analytics, educational training, meetings, and Spark SQS (Simple Queue Service - a GitHub[37] project for feeding the data

[37] GitHub is a web-based Git repository hosting service. It offers all the distributed version control and source code management (SCM) functionality of Git as well as adding its own features.

into any programming language), in addition to a wide range of other programming, data management and visualisation websites (including loomio.org), several Google products (Docs, Drive, Spreadsheets, Hangouts), and video chat (Skype). Users employed infrastructures such as Amazon Web Services and Microsoft Cloud to save files. Some users accessed GitHub to store the code; others used codio.com, an online integrated development environment (IDE) for writing the front end of applications. Most of these tools were chosen because they were free. The range of tools in use is extensive.

The evolved AT model incorporates four additional components, as shown in Chapter Three, all of which were investigated as follows:

One of the most striking findings from the thematic analysis was the enormous emphasis placed by several parties on **barriers** to co-creation. The barriers sub-theme was the most mentioned based on the results in Table 5.6 (313 NVivo codes). This confirms the importance of adding this component to the augmented AT model. The research revealed that communities faced far more barriers than other participant groups. Understanding the barriers for both publishers and users was seen by all parties as vital to solving and overcoming those barriers for better OGD utilisation. The literature is rich with much research concerning OGD barriers (Janssen *et al*., 2012; Martin *et al*., 2013; Van Veenstra & Van Den Broek, 2013; Barry & Bannister, 2014; Conradie & Choenni, 2014; Martin, 2014; Khayyat & Bannister, 2015). This research is consistent with previous research papers and has confirmed the existence of many barriers for both publishers and users of OGD. There continue to be numerous challenges and impediments. This research has revealed that many open datasets were of poor quality and lacked the appropriate meta-data required for providing the necessary historical and use-case context. There were also limited ranges of data formats such as, for example, data in .pdf format which did not fulfil the needs of different users. Many users complained about unclear licensing which confused them and made them concerned about the legal consequences of reusing OGD. Finally, the timeliness and latency of data made users reluctant to reuse outdated data.

Sustainability, standardisation and psychological reluctance

Three barriers not (as far as could be ascertained) reported in the literature were found in this research. These are sustainability, standardisation from the provision point of view, and psychological reluctance from the usage-perspective.

Unfortunately, OGD publishers did not have any guarantee that the data would be sustainable because they had neither formal jobs for OGD nor a separate budget. Moreover, the lack of standardisation among the same dataset from different LAs (such as the traffic dataset where the M50 crosses different borders with different data rules) caused difficulties in using OGD. For example, third parties wishing to undertake business using OGD would face a problem due to the difficulty of dealing with different data formats from the four different LAs. This can be a deterrent to setting up a business using the Dublin OGD. This problem can be remedied if standards are applied by all LAs for consistency.

With the sustainability and standardisation problems, a further factor that should be considered is the reluctance to use OGD. Since data providers do not ensure sustainability nor address standardisation of OGD, some respondents reported that they became reluctant to use OGD. People are unwilling to invest in developing products such as creating applications that depend on the continuing availability of data in the longer term without some assurance of continuity of data supply. This concern is heightened by the informal nature of the current OGD provision which, as noted, depends upon champions and people working on OGD projects in their spare time. A key contribution to the success of co-creation that emerged from this research is the necessity for LAs to put their OGD on a formal, and eventually statutory, footing with increased insights on standards. Other barriers identified by respondents related to the timeliness and latency of data. There can be long delays in data release, making users more reluctant to rely on outdated data.

The psychological reluctance barrier is the most difficult to solve because when people lose their trust in using OGD, it is difficult to regain it. Some participants preferred to pay the private sector to build applications on sustainable data that are more secure regarding availability, quality, and updates. It was easier for some to communicate with the private sector than chase LAs for data that required updating or to be published in the desired formats. This research suggested that other barriers such as the financial and technological

are easier to overcome than psychological reluctance because the latter is the consequence of a number of accumulated barriers. For example, it can be easier to overcome the barrier of resource shortage by obtaining money or other resources from a sponsor. The three new barriers, along with the long list highlighted in the literature, bring with them more concerns about the situation of OGD that need to be addressed.

The **motivations** component is the most mentioned sub-theme after barriers (see Table 5.6). While it is important to know the objectives of engaging with OGD, it is also of interest to examine motivations. While motivations and objectives are linked, they are distinct. The motivation component has been added in this research to the augmented AT model; however, it was later found that the motivation component had already been added to the second generation model as noted by Allen *et al*. (2011); Allen *et al*. (2013), but is not used in other research as part of the AT model. Understand why people are interested in using OGD can help in promoting, encouraging, and fostering their motivators to use OGD and consequently ensure its continuous use. For example, knowing that one of the motivators was the organising of competitions increases the need for more competitions to be held.

Motivations varied from the commercial to civic mindedness (non-commercial), the latter relating to civic responsibility and engagement in helping communities. Unlike civic mindedness, motivations for commercial benefits aim at taking action to develop and progress business. As might be expected, each subject has its own mix of motivations and these are diverse as they differ from one particular community to another. Some users are politically-motivated (e.g. transparency, policy analysis, and participation), some are community-oriented (better or new services or new constructs). Others found that they were motivated by more personal/emotional factors (such as enjoying working with others, and the pleasure of creating new products or new challenges). The findings of this research are consistent with previous studies (Lakhani & Panetta, 2007; Fitzpatrick, 2012; Yang & Kankanhalli, 2013; Foulonneau *et al*., 2014) that found that people were motivated to co-create for many purposes: economics, community, self-interest through the enhancement of professional careers in public or private sectors. For many, the following were identified: the role of economic motivations, notions of enjoyment, transparency, creating or enjoying new services, having fun and the social benefits of community. Lastly, some users were financially-motivated (e.g. building businesses and careers).

These orientations (commercial, personal, and community/civic mindedness) show that an individual who is interested in co-creation or innovation has, as one might expect, at least one motivating factor to take action and contribute in the co-creation process, but that some people have several motivations. This research discovered another motivation that had not been evident in previous research, namely the Meitheal concept as shown in the case of the Fingal IT manager who reported co-creating with others due to the culture of working together (Meitheal). This idea of the Irish culture working together is one of the motivations that must be protected and passed on to new generations for future co-creation with OGD. This finding concerning the Meitheal concept provoked a brief search of the literature of Irish folk traditions. For example, O'Dowd (1981) conducted a study of co-operative labour in rural Ireland, defining Meitheal as "*the term which accrues most frequently in connection with the co-operative work team*" (p.57). In the study, which covered thirty two counties in Ireland, the term Meitheal was recorded from twenty-two counties as comprising a team of more than three workers. According to Stokes (1868, cited in O'Dowd (1981), Meitheal is meaning to reap and can generally refer to any team of people. Meitheal culture is more recognised in rural counties than cities, but many city dwellers have rural backgrounds and would be aware of the concept.

Level of awareness turned out to be an important factor in investigating participant activities with OGD. Level of awareness is a construct that has not been extensively examined in the OGD literature, although it is mentioned by Foulonneau *et al*. (2014) who recommended raising awareness of the reuse of open datasets as an important step to be taken. Clearly, those already engaged in using OGD for co-creation have a reasonable level of awareness of OGD's potential (which ranges from moderate to high). However, informants from the LAs would like to see a higher level of awareness within their communities. To this end, several initiatives have been launched including open days, hackathons, competitions, the support of emergent groups wherever possible, and so on. The consensus is that even in Dublin (which is probably ahead of much of Ireland in this respect), awareness of OGD and its potential in co-creation remains low. Informants suggested several ways to increase the level of awareness, including:

- Use of TV, radio, and social networks such as Twitter and Facebook to announce OGD tools and visualisations.
- Running competitions to showcase new applications using OGD.

- Providing middleware bodies to raise citizens' awareness and enable the public to interact, understand, and find the story in the data.

These can be utilised to make people aware about OGD as much as possible.

The final component examined was **effectiveness**. While there were many varied views, however, there was broad agreement that measuring effectiveness was problematic for many reasons, including the lack of a clear and agreed definition, lack of suitable metrics, and paucity of reliable data. Many of the comments on effectiveness by informants were anecdotal. In Dublin, local government remains an element within the approach (initiated by the publishers) of "casting bread on the waters" to see what happens. It may be that at this relatively early stage in the development of OGD-based co-creation in Ireland, the measurement of effectiveness was premature. This is largely voluntary work and is characterised by the attitude of "*let's see what happens if we try this*", instead of setting targets. This is not to say that nothing tangible is happening. There are, as noted above, several new products and services now available and new ideas are continually being explored. This research, in order to examine effectiveness, presented the outcomes of co-creation using OGD (see Table 6.1 which includes projects judged by respondents as effective). The outcomes of the co-creation projects reflect the positive effect of OGD on the Irish society.

Table 6.1 Examples of effective use of OGD

Projects	Outcomes
www.Myplan.ie www.Mypp.ie	Improving housing planning
Parking application in Dublin (ParkYa)	Improving the performance of services
www.fixyourstreet.ie Code for Ireland and trial workspaces like My Space, Agora and Co-Creation.	Encouraging civic engagement and improving performance of services.
Dublin Dashboard Fingal Traffic View Fingal Day Tripper 'Fingal Deals' App	For visualisations and better decision-making
IsDublinBusy.com	To solve city problems. This website allows people to, at a glance, check parking availability, traffic flows, public transport tweets, and help them decide the best time to visit town.
http://localauthorityfinances.com	Transparency: to know the budget breakdown for each local authority, how it compares with the national average and other councils.

Some other ongoing projects are:

- Save a Selfie - mapping defibrillators;
- Dublin Collaboration Dashboard - information about community groups;
- Rothar - prototyping an idea to reduce bike theft;
- Dearest Ireland – a place for letters to the future Ireland;
- Falls & Fracture prevention - online tool;
- What's in my water? - open data on water quality;
- Wedding red tape - government information on marriage;

- MyQ – reducing queuing for public services;
- Organising a Hackathon.

Based on the outcomes and on-going projects, OGD influences and has a positive impact on society. OGD in Dublin can be reasonably effective to some extent for better decision-making, enhancing services, and attracting more civic engagement. However, there are many recommendations that must be considered and applied; these are presented in the co-creation model (see figure 6.2). Note that all of the co-created projects show a feature of continuity. Co-created projects[38] implied the term "bricoler" in French which means "*construction or creation from a diverse range of available things*"[39].

6.2 Supporting co-creation with OGD

In the literature of co-creation, many studies have been carried out in the area of co-creation from a market perspective (Payne *et al*., 2008; Grönroos, 2011; Kohler *et al*., 2011; Chen *et al*., 2012; Ind & Coates, 2013; Ind *et al*., 2013; Vernette & Hamdi-Kidar, 2013; Lorenzo-Romero *et al*., 2014; Terblanche, 2014). Other research papers have discussed different themes and phenomena, including the co-creation experience (Prahalad & Ramaswamy, 2004; Füller *et al*., 2011; Kohler *et al*., 2011; Majdoub, 2014), and co-creation of product, service development, and value co-creation (Prahalad & Ramaswamy, 2004; Chen *et al*., 2012; Grönroos, 2012; Grönroos & Voima, 2013; Majdoub, 2014; Terblanche, 2014). Most of the current co-created projects remain in progress because OGD is still developing. The findings showed that skilled individuals meet face to face with others who need to be more active co-creators of knowledge and service values. Other examples were mainly found in the monthly meetings for mutual interaction between LA employees and interested communities at which they shared ideas and showcased different projects using OGD. The missing element is online communication because communities tend to have the problem of who to contact; this will be addressed in the proposed co-creation model (see section 6.2.1).

[38] The bricoler concept appeared in co-creation projects based on the observations.

[39] https://en.oxforddictionaries.com/definition/bricolage

OGD implies in the literature that governments publish public data as OGD. However, in this research, by analysing the process of co-creation in the case of fixyourstreet.ie (where citizens are feeding data to the website to report, view, or discuss local problems and share these with the government), the community role is to enter the data, rather than use existing data (see Figure 6.1). One interesting finding in this research is that we can argue that this is a shift in the meaning of OGD to something more like open government citizen data (OGCD).

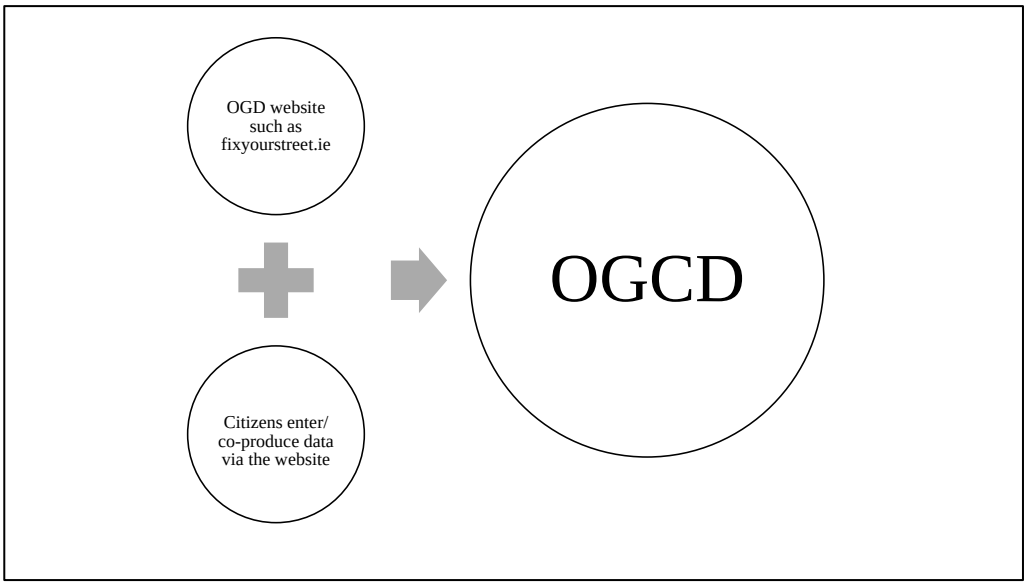


Figure 6.1 Open data from both Government and citizens (open government citizens' data)

Figure 6.1 shows that both governments and citizens create data. However, the accuracy, completeness, and integrity of data entered or uploaded by citizens/communities must be checked. This is a case of "Caveat emptor", meaning that the government must be aware of what citizens are contributing to the OGD area.

The key objective of the research was to identify ways in which co-creation can be better facilitated and encouraged. The developed co-creation model was presented in a poster to obtain feedback from stakeholders and interested communities. As a result, the model was modified in a number of ways which are discussed in the next section.

6.2.1 Co-creation model

Very little was found in the literature on co-creation models. Only one theoretical model for co-creating IT value through the collaboration of organisations presented by Flak *et al*.

(2015) was identified in the literature search. This model is designed to co-create IT value which is not clear enough because it does not elaborate or add further details for each element of the Flak *et al.* co-creation model. This makes it less efficient as a way of designing a co-creation model for this research. The findings helped to fill this gap by creating a model that can be used to understand what factors should be applied in order to achieve co-creation between government, citizens and corporates.

From the AT and thematic analysis of the interviews, 24 actions/proposals for the encouragement and enablement of co-creation emerged. These are illustrated in the proposed model in Figure 6.2. Some apply to more than one player, but one is identified as the primary member of the system in full charge for each action or set of actions.

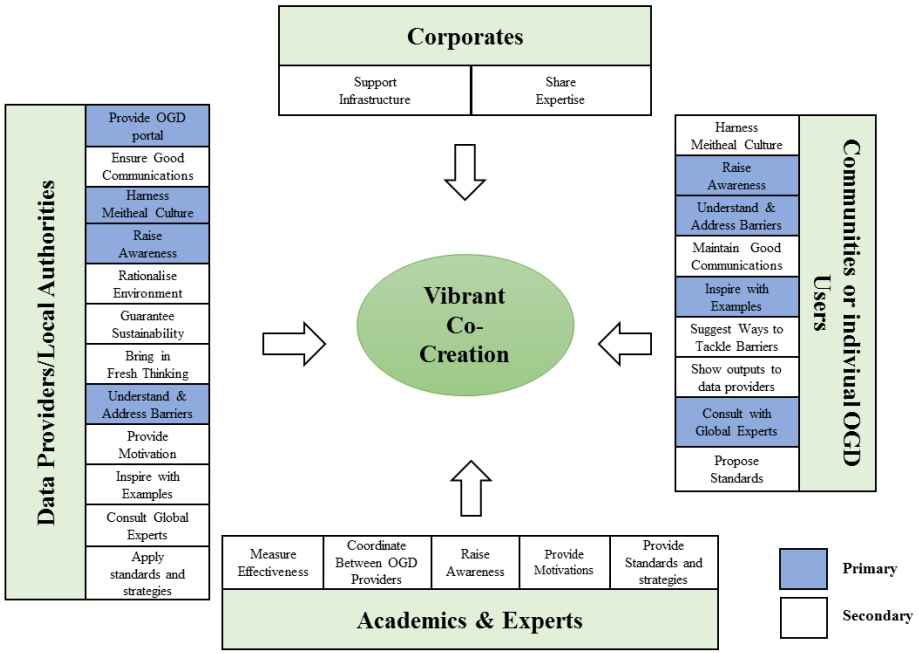


Figure 6.2 Model of support structures and activities for promoting emergent co-creation.

Provide OGD portal by data providers. This action is the core and primary dynamic action in this technological era to co-create with OGD. Data should be available online for public access. Having the data on portals is vital to facilitate access for wider usage. The crucial role of portals for OGD was emphasised by both the literature and informants.

Ensure and maintain good communications. Data providers must ensure they have contact details for users. Users should maintain good communication with data providers

by contacting and informing them of their needs. Informants emphasised the crucial role of having good communication channels. Two-way channels help both sides (publishers and users) to exchange feedback, and for publishers to be aware of which datasets are required by users and in what formats. Some informants suggested that contacts for specific datasets could be included as part of each dataset's metadata.

Harness the Meitheal culture. Data providers and communities should take advantage of, or seek to create, a Meitheal culture to promote co-creation. The Meitheal is an Irish traditional strategy for working together for a better future. For example, in rural areas, individuals cooperate and work in a team to achieve a competitive advantage at harvest time. This traditional strategy is still strong in many Irish communities. Several respondents commented that steps should be taken to encourage this culture and provide structures that might support it, such as mechanisms for distributing skills knowledge or expertise in communities.

Raise awareness. Lack of awareness about the possibilities for co-creation using OGD (or even around its availability) was a common theme. This lack of awareness is one of the main contributors to the wider lack of interaction with OGD. Informants suggested that using diverse approaches to raise awareness will increase the probability of getting more citizens to interact with it and co-create value by providing feedback, ideas, creating applications and web services, and all of the other benefits that can come from people's creativity and innovation. Raising awareness can be achieved by academics, communities and LAs. Recommendations for raising awareness included the use of mainstream and social media, competitions, hackathons, training, viral marketing, and local liaison.

Rationalise the datasets environment by data providers. Rationalisation of data refers to standardising definitions. This includes formats, licensing, metadata and communication channels. A commonly-expressed requirement was for clear licensing and metadata standards. Informants realise that that they must maintain data in different formats (such as .txt, csv, etc.) to accommodate the differing needs of various user groups. Having data available in multiple formats leads to more engagement and greater value creation, although it was acknowledged that this comes with an overhead for both creation and maintenance, thus, a balance should be struck. Informants repeatedly emphasised the importance of metadata, i.e. that which explains what the base data are, where they came from, when they were collected, why they were collected, and so on. Informants reported

that good metadata helps users to better understand the base data and make more effective use of it. A problem noted by a number of respondents was that when metadata is absent, base data may be effectively useless as it is not possibly unreliable or even lacking in meaning.

Guarantee sustainability by data providers. This requires putting the provision of data on a formal and properly resourced basis. It was noted above in Chapter Five, section 5.3.3, that one of the main barriers to co-creation using OGD is uncertainty about the continuity of data availability. Data publishers complain that one of the main headwinds faced in the open data arena is that they do not have full-time employees who can work officially on developing OGD, and that they rely on other bodies to provide some datasets. An informant from the SDCC highlighted the importance of having properly budgeted and resourced initiatives, including full-time employees to focus on OGD-creation and the provision and support of part of the organisation's normal functions. An informant in one of the LAs spoke about a long-term vision to make OGD sustainable and viable, but feared that unless it features within formal organisational budgets it will not happen.

Bring in fresh thinking. This comment was made by a number of informants, particularly amongst the publishers. One of the LAs complained about lacking new staff with fresh thinking. Suggestions included encouraging school and university students to become engaged by making OGD part of their projects and assignments. This is already under trial by the Central Statistics Office (CSO) which has run open competitions such as *Apps4gaps*, specifically targeted at students and designed to motivate them to be creative using OGD. LAs can learn from the CSO experience and contact academic experts to gain new ideas and fresh thinking for government.

Understanding, addressing, suggesting ways to tackle barriers by data providers and communities. This is a vital step for co-creation to overcome these barriers that hinder engagement with OGD. This research is in line with Martin's (2013) belief that "*the topic of barriers (although may be not as 'glamorous' as other areas of open data) was and remains an import area to explore*".

For data providers, it is imperative to understand and address the barriers that can deter individuals from utilising OGD. For example, one such barrier identified by this research is the lack of standardisation among the four Dublin LAs, particularly in relation to traffic

data where some share the same M50 but with different data formats. In addition, other datasets can be shared by more than one LA. For example, in the water supply system, the main rivers - the Liffey, Dodder and Tolka - cross more than one LA. However, neither Dublinked nor Fingal OD include datasets about these shared rivers. On the one hand, this barrier should be addressed to facilitate the use of data. On the other, understanding and addressing barriers is a secondary action for communities/users because while they may have solutions to address such obstacles, they have less authority than the LAs with regard to budgets and decision-making. Community members can also suggest ways to tackle barriers because theirs is the category that faces the most OGD barriers.

Provide motivations by data providers and academics. Both the literature and informants confirmed the importance of being motivated to utilise OGD. Providing motivations such as running competitions and distributing assignments in schools and universities by using OGD can draw attention to it and boost its usage. Highlighting and promoting success stories can also motivate others to get involved.

Coordinate between OGD providers by academics. This action proved its importance in the case of Maynooth University at which there is a team coordinating the four Dublin LAs. Coordination was mentioned in the literature as being a challenge, thus having a specific body to oversee it is a powerful solution within the context of OGD. For example, one of the challenges concerns the unclear boundaries of responsibilities among OGD stakeholders. The solution suggested was to have a third party to coordinate between OGD stakeholders, set up a plan, enable modular interconnected processes, and deep coordination-related knowledge.

Inspire with examples and show outputs. Providing easy-to-replicate examples on hubs and portals is seen as valuable. A variety of approaches were suggested (some of which are already in use) including demonstration videos and e-demo videos. These could show not only what datasets are available, but how they are, or could be, used. The objective would be to inspire people to be creative. Communities also should show their outputs to the LAs in order to gain more attention and support.

Consult with global experts. Although this is a relatively new field, there is a growing base of expertise, including international knowledge. Interestingly, it was suggested by several informants that the use of OGD could be much more effective if the Irish

government engaged in international consultation concerning the development of OGD in Ireland. Current views tend to be insular, not just in national terms, but also regarding the focus on benefits to the government *per se* rather than to the wider community. Many informants sensed that government tends to regard co-creation initiatives as something that should benefit only governments. This in itself is not wholly unsurprising, but ignoring the benefits or factors likely to motivate the community is not desirable for obvious reasons. Dublin and Galway are the two most active cities for developing OGD in Ireland, but according to informants it is necessary to change mind-sets elsewhere in order to create more openness in line with international OGD policies. This can be achieved by consulting experts in countries that are leading users of OGD, such as the USA, as well as consulting national agencies such as the CSO and experts from the Programmable City project, the Digital Repository of Ireland, the All-Island Research Observatory, and the Dublin Dashboard. One initiative along these lines that is working well in Ireland is the use of international consultants in Code for Ireland which uses Code for America as its model.

Propose, provide and apply standards and strategies by data providers, academics and experts. When there is more than one party working together, it is important to provide and apply some standards to facilitate the work. It is also important to establish strategies to ensure the long-term work. This action can be undertaken by academics (providing) and data providers (applying), as the case in Dublin where the Insight Institute provided standards but LAs must still apply them to the datasets. Communities can also propose standards; this has already occurred with the Mypp.ie community which proposed standards for OGD to LAs. This action of identifying standards can solve the problem of having different datasets from different sources with different formats (which makes the use of data more difficult). Standards that have already been created include DCAT by the Insight Institute and strategies by The Programmable City and PER. Applying both standards and strategies is the challenge that can make OGD actively and reasonably effective, at least in facilitating the co-creation process.

Measure effectiveness. Academic experts can help in measuring the effectiveness of using OGD in their research. This can develop the OGD situation and discover new aspects for continuing improvement. Further, it can enhance the understanding of OGD and draw attention to it within the academic field.

Measuring effectiveness can, as noted above, be challenging. At this early formative stage of co-creation in Dublin, it is premature to place too much emphasis on effectiveness, especially when real effectiveness may only become noticeable over the longer term.

Support infrastructure and sharing expertise. Lastly, organisations can undertake two actions: support infrastructure and share expertise. For example, in the case of OGD in Dublin, corporates such as IBM have supported Dublinked with infrastructure such as servers. Another corporate like CSO had shared Dublinked with expertise.

After explaining all actions within the model, it is important to acknowledge the impact of the Leadership factor which is not mentioned in the model. This is because even if the participant has less control and consequently does not exercise leadership, he or she can be inspired by an individual, such as the Fingal IT manager. It is only a slight exaggeration to say that much of what has happened to date in the field of OGD in Ireland is thanks to the vision of one person (Fingal IT manager).

6.3 Answering the research questions

Returning to the research problem of the ambiguity of the co-creation phenomenon within the context of OGD leads to the consideration of research questions relating to how and to what extent different communities in Dublin are making use of Open Government Data (OGD)? And how effective are OGD in facilitating that co-creation? Taking into consideration the analyses, it is evident that different communities have used OGD for different purposes. This is discussed as follows:

OGD used to facilitate its usage for both LAs and communities:

LAs preferred to use OGD proactively instead of going through the internal process of requesting the required data. One example of how the LAs used the OGD was apparent in the monitoring of traffic data wherein each LA could monitor traffic flow to check how fast traffic was moving in particular areas in order to manage the volume of traffic.

Creating datasets:

Some communities created datasets, such as users of the Fixyourstreet.ie and openstreetmap.org communities. Fixyourstreet.ie users were interested in solving city

problems by reporting them to the LAs. The Openstreetmap.org community was interested in creating its own data instead of using that from Google maps due to the licensing issue.

Run analysis to find patterns:

Some communities, such as Code for Ireland, were using OGD to run analysis to identify patterns that could help them understand what was going on and then propose projects. This aimed to improve society and the lives of people in Ireland while using technology.

Make evidence-based decisions:

All participants displayed a common interest in using OGD to make evidence-based decisions. For example, some communities said that they needed to first check OGD before proposing any suggestion to local government, starting a business, or even before buying/renting a home or enrolling their kids in schools.

For test bed and research purposes:

Many research units like IBM, the Smart Cities groups, and Intel and the European Research Lab were accessing the data to examine new things. For example, the IBM research team was interested in using OGD to monitor the data and use them as a test bed for their research to design products. Another example was Intel with the City Sense Project in which it implemented sensors within cities to collect data to be made available through Dublinked. Next, IBM accessed all the data in Dublinked and examined how that could enhance Smart Cities. Other researchers were engaged in comparing the OGD (as real data) with standards, such as a Ph.D. student in TCD who compared energy consumption with what was identified by consumption standards.

Creating standards:

Both the Insight Institute and start-up community, Mypp.ie, were more engaged in creating standards such as DCAT by Insight and planning data standards by the Mypp.ie team. Mypp.ie team has also a commercial purpose to engage with OGD.

Creating visualisations:

A community such as Dashboard was more involved in using OGD to create visualisations. Developers created apps and web services.

For health services:

In St. James' hospital, the LAMP (Local Asset Mapping Project) represented a new paradigm for health, one that focused on the community's own priorities and assets, with the aim of improving community and individual health.

For raising awareness:

The Heritage Council - in which datasets were created to raise awareness of the facilities represented within each dataset, with the aim of promoting cultural and natural constructed heritage.

For policy development, implementations, reform activities and creating an environment where the economic, social, and democratic benefits:

As in the case of the Department of Public Expenditure and Reform (PER), which leads policy development and implementation activities under the Open Data Initiative across the wider Public Service.

The summarised answers to the research questions reflect that this research has shown that OGD has been used to facilitate usage for both LAs and communities: some communities prefer to create their own datasets; others run analysis to find patterns, make evidence-based decisions, or use it for test bed and research purposes; some were interested in creating OGD standards (such as that undertaken by the MyPP.ie community); and others were creating visualisations (the Dashboard community). In addition, the concept of OGD was used for health services such as the LAMP project in St. James' hospital, while others used OGD to raise awareness such as that achieved by the Heritage Council through the creation of datasets to raise awareness of its facilities. OGD was also used in policy development, implementation, reform activities, and in the creation of an environment where the economic, social, and democratic benefits (such as that achieved by DPER under the Open Data Initiative) were available across the wider Public Service.

With regard to the second part of the research question which was concerned with how effective OGD were in facilitating co-creation and considering the outcomes (see Table 6.2) and ongoing projects, OGD in Dublin can be considered as being *effective to some extent* in decision-making, enhancing services, and attracting civic engagement. It has

positively affected a closer relationship between LAs and communities. It is expected that if the co-creation model actions applied, then the positive effect of OGD and the outcome would be much improved.

6.4 Summary

This chapter proposed a model of the players and factors necessary for a vibrant co-creation ecosystem. Four principal players/groups were identified: data providers, corporates, communities, and academics/experts. These groups engage in a variety of different ways to create products and ideas. The model provides a framework and series of actions and activities to better exploit the availability of OGD in Ireland in the form of 24 actions/proposals for the encouragement and enablement of co-creation. The contribution of this research has been to help in conceptualising and developing a wider understanding of OGD and co-creation by using the AT as a theoretical framework.

Chapter 7

CONCLUSION

7.1 Introduction

This chapter presents the contributions, implications for practice, and limitations of this research. It also provides suggestions for future research. Finally, the concluding remarks of the whole study are given.

7.2 The research contributions

This research makes three main contributions to the body of IS knowledge. The first lies in advancing knowledge about the relationship between OGD and co-creation. The second contribution refers to developing an existing theory (Activity Theory) to the augmented model of AT. The third concerns designing and creating the vibrant co-creation model within the OGD field, which includes 24 actions. The following paragraphs summarise these three contributions.

7.2.1 Advancing the knowledge of the two emergent phenomena: OGD and co-creation

This exploratory research helped to advance the knowledge and understanding of the two emergent phenomena: OGD and co-creation, and the relationship between them. This research study sought to make a contribution to the IS research field and the international research network of OGD by explaining how co-creation processes can and do use OGD. The novelty of this research lies more in widening the co-creation research spectrum to be between four bodies: data providers (local authorities or LAs), corporations, academic experts and citizens (grouped in different communities), rather than considering it as if it were only between customers and firms, as in market research. This research provides a wider understanding of the co-creation phenomenon from an IS perspective rather than

solely from a commercial/marketing perspective. Furthermore, in this research the effectiveness of using OGD for co-creation is investigated by examining the outcomes and their effects on society, which reflects a positive impact on the Irish context.

7.2.2 Enriched and evolved Activity Theory (AT)

This research found that using AT was beneficial in the data collection and analysis stages. This is because the AT's six components helped in formulating the interview questions and categorising the themes in the analysis phase. However, the existing version of AT had a number of shortcomings as shown in Chapter Three, section 3.1.3. The AT model has, therefore, been reshaped and four more components added. This is to address the previous AT generations' problems. This research found that there are benefits to the additional components (barriers, motivations, level of awareness and effectiveness) as follows:

- **Barriers:** Barriers was the most mentioned sub-theme and is a construct that has been extensively examined in the OGD literature. This confirmed the importance of adding this component to the augmented AT model.

- **Motivations:** The motivations component is the second most mentioned sub-theme after barriers. While it is important to know the objectives, it is also of interest to examine motivations to understand what motivates people to use OGD, as this can help in promoting, encouraging and fostering their motivators. The motivations component has been added to the augmented AT model in this research; however, later, it was found that the motivations component was already added to the second generation model by Allen *et al*. (2011); Allen *et al*. (2013), but not used in other research as part of the AT model.

- **Level of awareness:** The level of awareness turned out to be an indispensable factor in investigating people's activities with OGD. It is a construct that has not been extensively examined in the OGD literature, although it is mentioned by Foulonneau *et al*. (2014) who recommended raising awareness of the reuse of open datasets as an important step to be taken. This research suggested ways to increase the level of awareness mentioned in Chapter Six, section 6.1.2.

- **Effectiveness:** The final examined component was effectiveness. There were many varied views; however, there was broad agreement that measuring effectiveness was problematic for many reasons including the lack of suitable definition, suitable metrics, and the paucity of reliable data. Many of the comments on effectiveness by informants were anecdotal.

7.2.3 Designing and creating the co-creation model within the OGD field

The significance of this study is that it addresses the gap in understanding how co-creation can be facilitated between government and communities, while considering at the same time two more bodies - corporates and academic experts. Considering the roles of the four bodies gave a much-detailed picture of the co-creation process. This can help Irish society to utilise OGD in a more effective way.

7.3 Implications for practice

A wide range of OGD stakeholders have a role to play in enhancing co-creation activities using OGD, including government bodies, communities, corporates, academic experts and organisations. The findings, including the developed co-creation model, have important implications for co-creation activities and for taking advantage of the increasing number of government datasets becoming available. This research can also help in understanding how different bodies perceive co-creation using OGD and, further, this study provides lines of enquiry for further in-depth research into the behaviour of different stakeholder groups.

One of the implications of this study is to facilitate the collaboration and co-creation between many parties by identifying different tasks, roles and actions for each. In particular, this study sought to make a contribution to Irish bodies including OGD publishers (such as the four Dublin LAs), academic experts (including members from DIT, TCD, Maynooth University, UCD, Insight Centre for Data Analytics), communities (such as Open Knowledge Ireland, openstreetmap.org, Code for All Ireland), and corporates/agencies - either governmental or commercial (including CSO, IBM, The Marine Institute, The Heritage Council, Institute of Public Health, Digital Repository of Ireland, PER, Heritage Council, St. James' Hospital). Furthermore, this research presents a

number of ideas or ways in which other individuals, such as developers, take advantage of OGD.

Universities and even schools can apply the recommendations of raising awareness of students concerning OGD, which can make an impact by drawing their attention to make use of the available data in their projects/assignments.

In practice, many barriers surround the publishing and use of OGD which could cause its abandonment, thus, rendering it pointless. However, by applying the co-creation model the barriers can be diminished. It is expected that through its application, the right environment for increased participation and collaboration using OGD will be facilitated. Applying the co-creation model can also lead to the following actions which will help to raise the level of co-creation activity. Participants can:

- seek increased infrastructure support from corporates, as in the case of IBM supporting Dublinked;
- seek greater knowledge from experts. For example, learning from the CSO experience concerning datasets management;
- create clear communication channels with data providers to facilitate communication and feedback from others;
- encourage and develop pride in the Meitheal culture and draw the attention to it where it is unknown among city dwellers;
- provide a good OGD environment by providing different formats, updating data in a timely manner, and considering the consistency by applying strategies and standards to the available datasets;
- ensure the sustainability (availability and quality) of datasets as part of the meta-data. This can be achieved by assigning a specific budget for OGD initiatives and employing full-time staff who can work officially on developing OGD.
- seek agreement with other bodies that are responsible for providing local government with some datasets.

It is good to remember that increased use of the OGD data has the potential to lead to more engagement, more innovation, and greater creativity in the open government data field, which are some of the desired implications of this research.

7.4 Research Limitations

The results, as is always the scenario in case study research of this nature, of this research based on a single city (Dublin) will reflect local contextual factors (financial, legal, social, cultural, and so on). While extensive efforts have been made in this research to obtain the view of international experts and use available international evidence in order to generalise as much as possible the findings of this research, further research should be undertaken to investigate the viability of applying the developed co-creation model in different countries and find the local variant 'Meitheal' concept. This is to examine the possibility of applying this model in different contexts and settings.

Using the AT was helpful as a lens to investigate co-creation activities using OGD; however, other researchers could examine co-creation within OGD, using other theories such as the Actor Network Theory (ANT) because it also considers certain social and technical aspects of phenomena which AT does not.

This research used only qualitative techniques for data collection because the aim of this study is to gain an understanding of and insight into the perspectives of participants in co-creation projects. A quantitative approach is not appropriate because understanding of a phenomenon from the participants' point of view is difficult, if not impossible, using purely numerical methods; however, other researchers may use quantitative or mixed methods to conduct their investigations.

7.5 Future Research

First, there is scope to repeat this work in other cities and at regional or national level. Although this study showed how different bodies (including OGD publishers, various communities, academics, international experts, volunteers, as well as many government agencies and commercial organisations) perceived co-creation using OGD, further research

can focus on one body to investigate their experience of co-creation by using OGD in-depth.

In this research, interpretive epistemology is used; however, other researchers may apply a critical realism epistemology to examine the structures of activities. Furthermore, a qualitative method is utilised, although other scholars may use quantitative or mixed methods to investigate existing co-creation within OGD.

Assessing the effectiveness of using the augmented AT model in IS or other disciplines can be achieved in future research.

This study can be considered multi-dimensional, using the ten constructs of the developed AT to examine co-creation within the OGD field. The reason for considering all ten constructs of the developed AT on multiple case studies (four LAs) is to obtain a wide picture of the OGD situation and obtain a range of different opinions, rather than studying each case in depth, something which might be undertaken in future research. Each construct can be investigated in-depth in future studies, such as investigating only the motivations to engage with OGD and how these can be promoted.

Further research can test the effectiveness of applying the developed co-creation model on the co-creation process using OGD. Testing the model can be at city or national level.

The developed co-creation model contains 24 actions. Future research might focus on each individual action. One important example is research into the effectiveness of OGD use in co-creation and what strategies might help achieve this.

Barriers remain a problem within both OGD and co-creation. Several questions remain unanswered at present with regard to how to overcome the barriers and problems of OGD, such as the problem of having different OGD for different LAs with different institutional managements and standards. There is abundant room for further progress in determining a strategic plan for the LAs to manage their OGD. A further study with greater focus on managing more than one publisher (which is the case of having many data sources from different bodies) with different levels of resources is also suggested.

7.6 Overall conclusion

It was noted at the start of this dissertation that both OGD and co-creation are relatively new and emergent phenomena. Studying these in their early stages presents both challenges and opportunities. Challenges include examining the literature reviewing both phenomena, collecting data in a foreign country where the network has not been previously established, and analysing and interpreting data in a second language.

The approach taken in this research has been that of an open-minded view of co-creation using OGD and seeking comments, ideas, suggestions, and views from a broad range of experts, publishers and users. The developed co-creation model provided in this research a wide range of mechanisms which fostered a vibrant and productive co-creation. There is no single guaranteed and absolute solution that will do this. It is anticipated that through the application of the insights and ideas in the developed co-creation model, more community groups and individuals will be encouraged and inspired to take advantage of the increasing number of government datasets available and that this in turn will lead to more engagement, increased innovation, and greater creativity.

A 24 dimensional co-creation model has been developed as a potential framework for better exploiting the availability of OGD in Ireland. The contribution of this research has been to help in conceptualising and developing a wider understanding of OGD and co-creation, and to provide a wider understanding as the foundation for further research.

At the end of this research, the importance of considering all the aspects of the co-creation model are emphasised to ensure that the Irish OGD will continue to attract and engage more communities in an effective and sustainable manner. Otherwise, OGD risks abandonment where its availability makes no sense within Irish society. Albert Einstein will conclude this research:

"*The world is not dangerous because of those who do harm but because of those who look at it without doing anything*"

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Appendices

Appendix A: Website Analysis

Examining the two portals, Dublinked and Fingal OD, includes checking the dataset's formats, and licensing types. For example, for Dublinked and Fingal OD the dataset categories were examined with regard to the formats and licensing. Dublinked includes over 14 different datasets formats: .csv, .xml and others (see Figure 1). Fingal OD includes only datasets formats: CSV, XML, .RDF , KML and APP (see Figure 2).

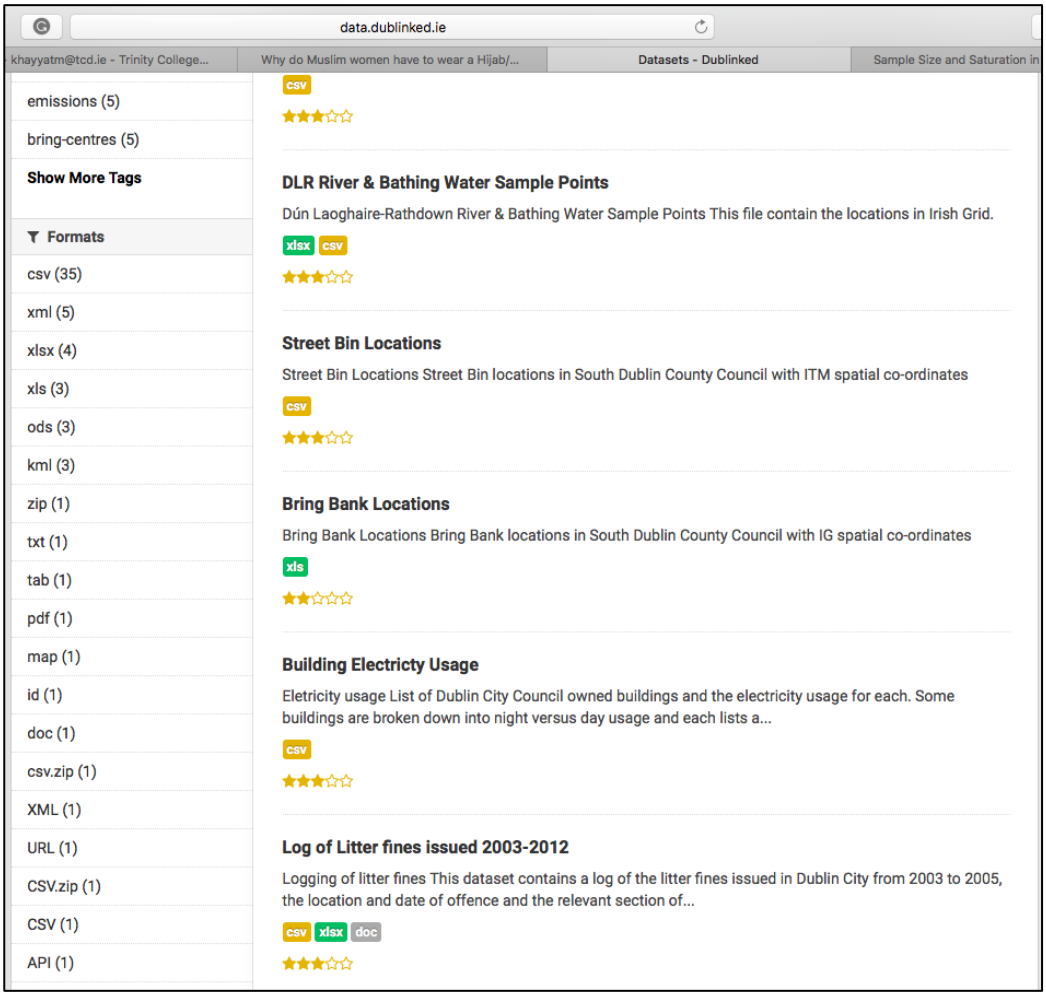


Figure 1. Dublinked datasets formats

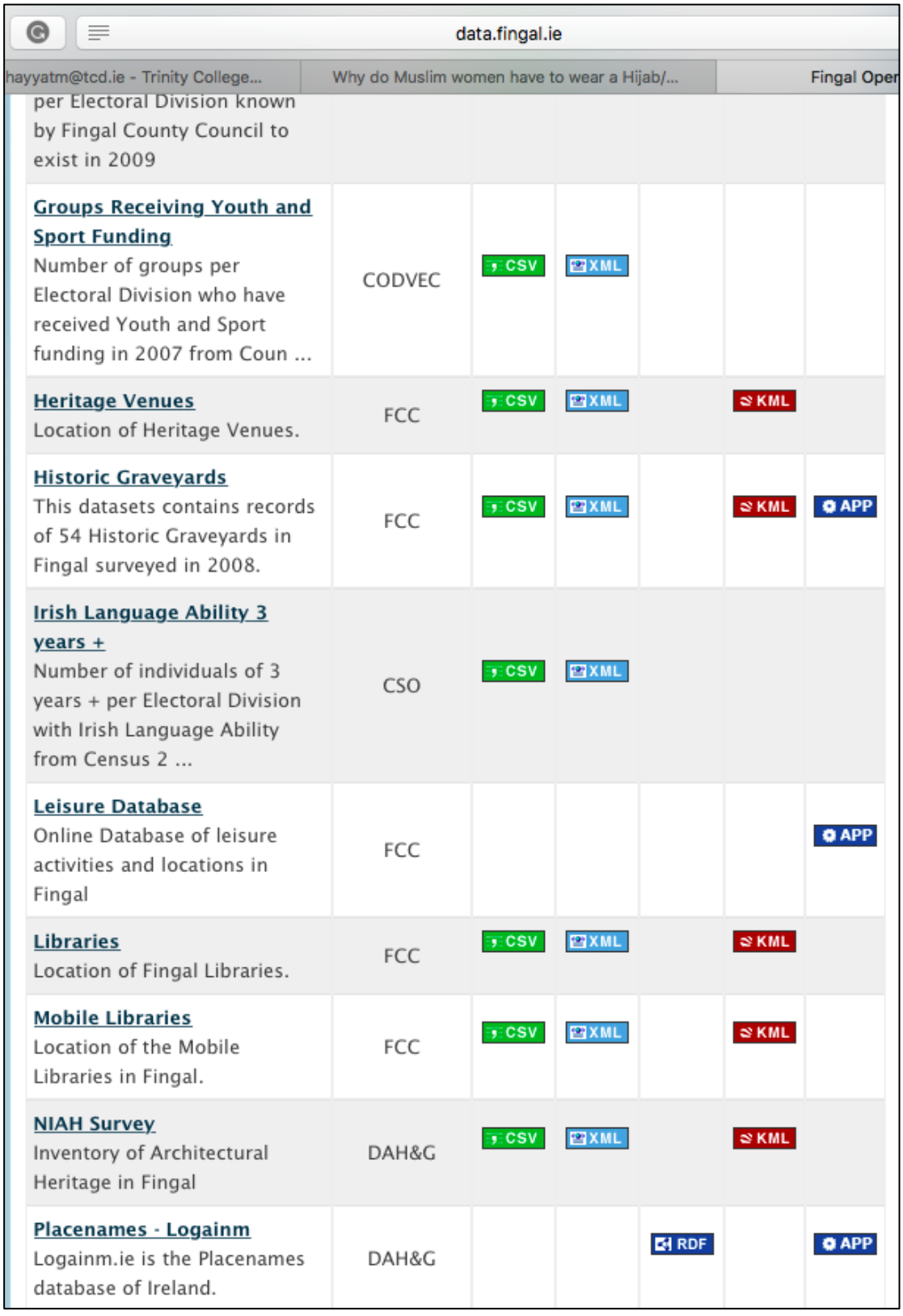


Figure 2. Fingal datasets formats

With regard to the licensing types, in Fingal all datasets provided on this site are accessible, free of charge, and licensed under Creative Commons Attribution (version 4.0 CC BY) (for details about CC BY 4.0 see Figure 3).

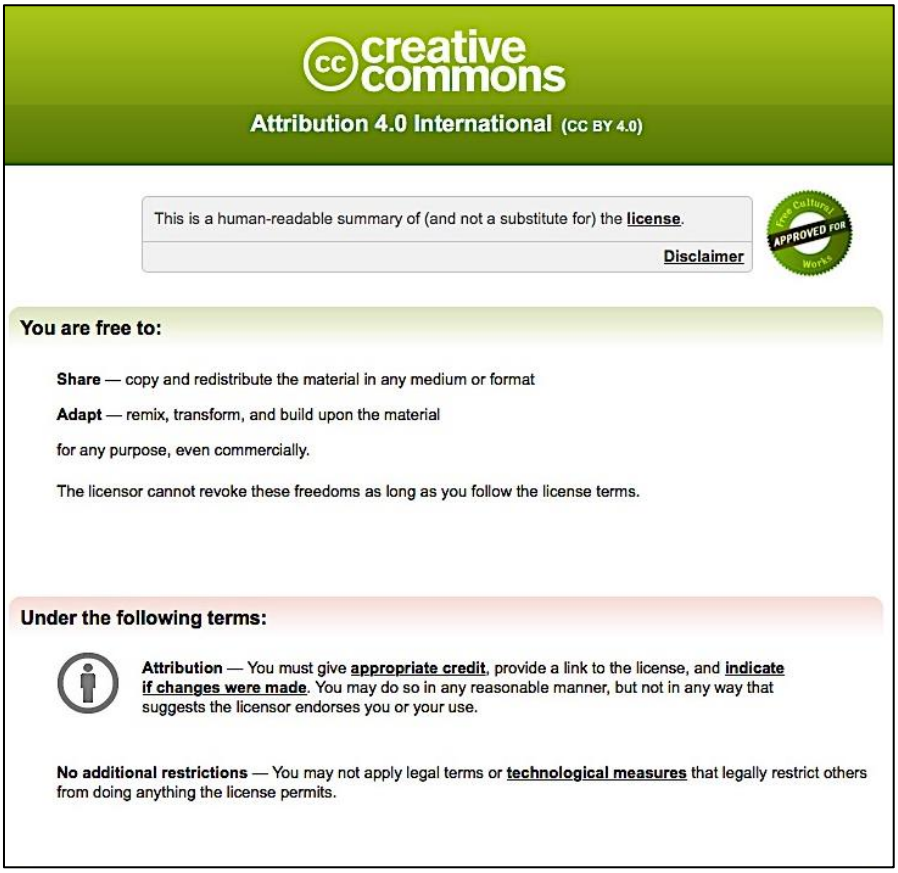


Figure 3. Licence CC BY 4.0

Source: https://creativecommons.org/licenses/by/4.0/

The Dublinked[40] portal provides more information about the licensing because it presents two types of licensing: PSI and CC BY 4.0. Most of the datasets on Dublinked are licensed under PSI. The PSI Ireland license identifies re-use requirements for developers using government data. Some Dublinked users have reported that the PSI license is constraining commercial reuse. However, a small number of licensed or sensitive datasets are available to Dublinked members for research purposes upon signing a data confidentiality agreement. For example, to have access to the OSI (Ordnance Survey Ireland) datasets users first need to take membership. The other type of licensing in Dublinked is the CC BY

[40] http://dublinked.ie/open-data-licence-change-creative-commons-licence-recommended-for-public-sector-open-data/#_ftn1

4.0 license. This license permits others to build upon data, distribute, remix, and, even use the data commercially, as long as they acknowledge the original source of data. In addition, the results and output of co-creation by different communities that are active in creating value from OGD have been studied by analysing their blogs, applications, and created services. For example, the code for Ireland community was found in the blog of Fingal open data, as shown in Figure 4.

Figure 4. Blog of Fingal open data

Also many co-creation communities were found in the Apps4Fingal 2012 web page as shown in Figure 5.

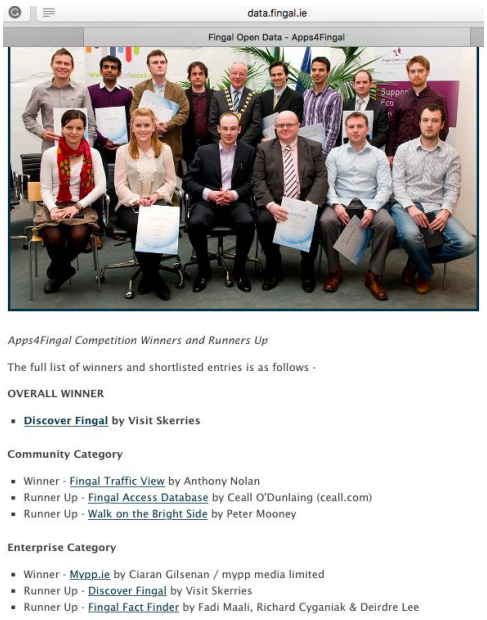


Figure 5. Apps4Fingal

Appendix B: Interview Protocol

1. Opening

A. (Establish Rapport) Hello, my name is Mashael Khayyat and as a PhD student in TCD I am conducting research about OGD and communities co-creation, it would be great to interview you, so that I can get better understanding of this area.

B. (Purpose) I would like to ask you some questions about your experience with Open Government Data (OGD).

C. (Motivation) I hope to use this information to help the Irish government and communities make better use of OGD.

D. (Time Line) The interview should take about 30-45 minutes. Are you available to respond to some questions at this time?

(Transition: Let me begin by asking you some questions about how you define OGD)

2. Body: Interview Questions

Questions for CoCos	**Communities, organisations, academics and international experts**
Dublinked & Fingal (OGD Local authority publishers) **Get started:** Can you please tell me some information about your background and role in OGD? What sort of OGD initiatives do you provide? **Compose co-creation definition:** If I define Co-creation as it refers to the joint creation of products (for public good such as applications) by local authorities who published OGD and their local communities. Do you agree with this definition or how would you define co-creation within the context of using OGD for co-creation in the public sphere? Talk to me about co-creation if you see that it exist within communities or individuals who use OGD? Have you any cooperative projects with such communities where LA staff are working alongside communities to develop product or service or to help or discuss policy issues? **For snow ball sampiling purpose an sustainability** If you know any communities or individuals who are using OGD could you please describe them and how do they use OGD? What communities/ individuals outcomes have already launched? Are they sustainable? Are they effective?	**Get started:** Can you please tell me some information about your background and role (as individual or community member) in using OGD. What sort of activity are you interested in using OGD/how do you use OGD ? Have you any ideas about using OGD in future? If I define **Co-creation as it refers to the joint creation of products by local authorities who published OGD and their local communities**. Do you agree with this definition or how would you define co-creation within the contact of using OGD in the public sphere? Talk to me about co-creation if you see that it exist within your community by using OGD? Have you any cooperative projects with LA staff if they are working alongside with your community s to develop product or service or to help or discuss policy issues? **Understand and categorise the factoers that lead to succesful OGD use and successufl co-creation:** do these questions relate to OGD use or cocreation? Why is this activity taking place? What motivates/ drives the use of OGD? What benefits do you get or anticipate from this activity? Have you any stories illustrating successful OGD initiatives? Do you face **any barriers / challenges** / obstacles or concerns in using OGD? (e.g. data formats, licensing

OGD Effectiveness

Talk to me about the effectiveness of the current datasets, and how do you measure their effectiveness?

Motivations and incentives to investigate co-creation drivers

Do you provide any incentives for users (communities/individuals) to use open data for co-creation? And how do you do it? If you do not do it why not? How might you go about it?

What do you think motivates/stimulates communities or individual to create value from OGD?

Barriers/ challenges / obstacles or concerns (publish and usage)

Have you experienced any barriers/ challenges / obstacles or concerns either in publishing data or that users face using these data?

How were they (or might they be) solved?

OGD awareness

Do you think Irish citizens (generally) are well informed about OGD? How can people's awareness about the potential uses of OGD be improved?

Ending/ closing the interview

Would you like to add opinions, ideas, thoughts or reflection that could add to this field of research of the active usage of OGD?

South CC & Dún Laoghaire CC

Get started:

Can you please tell me some information about your background and role in the county council.
What do you know about OGD? Or What do you think OGD means?
Talk to me about the effectiveness of the current datasets, and how do you measure their effectiveness?
Do you think Irish citizens are well informed about OGD? How can people awareness about using OGD be improved?

Establish the reasons for delay launching

What plans are there to have OGD websites for (South Dublin County Council or Dún Laoghaire–Rathdown County Council)? What stage are these plans at?
Do you know any communities in your LA area who are using OGD and how do they use OGD?

Compose co-creation definition:

If I define **Co-creation as it refers to the joint creation of products by local authorities who published OGD** terms). How might they be solved?

What are the desired outcomes from carrying out this activity of using OGD? Do you measure your achivments.

Sampling and finding new potenial intervwees

Who is involved in carrying out this activity?

By what means (technical tools) are you performing this activity? How do you find these tools to work with? Do you find them diffecult or easy to use?what other tools would you like access to?Do you have access to technical resources such as skilled people?

Are there any control, rules , regulations, licensing governing the performance of using OGD?

Do you need metadata (data about data)for using OGD? Why? Give me an example please about metadat.

Which websites and data sets do you use? How easy to use are they?Do they contain the data you need?what data are missing would you like access to? Have you discussed this with the LA in question? Do you mash that data with other non-government data, if yes , do you face difficulties with open data licensing?

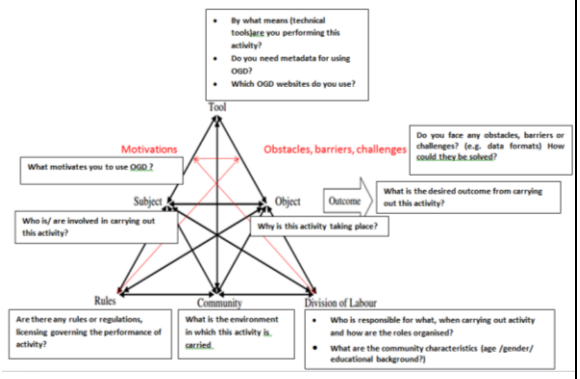
Who is responsible for what, when carrying out activity; how are the roles organised; what are the characteristics of each member (age /gender/ educational background)?

Asking about the role of leadership and other stakeholders in co-creation

How is the group organized (check if they are loose and informal or if they have sort of structure)? Do you have a leader for the community, if yes what is his/her role.
Who are the stakeholders (anybody internaly or externaly who is involved in creating prducts or services by using OGD)(with major or minor effects on this activity)?

Ending/ closing the interview

Any other comments about OGD and co-creation.
Would you like to add opinions, ideas, thoughts or reflection that could add to this field of research of the active usage of OGD?
Do you think Irish citizens are well informed about OGD? How can people awareness about using OGD be improved?

and their local communities. Do you agree with this definition or how would you define co-creation within the context of using OGD in the public sphere? Talk to me about co-creation if you see that it exists within communities or individuals who use OGD? Have you any cooperative projects with such communities where LA staff are working alongside communities to develop product or service or to help or discuss policy issues? **<u>Motivations and barriers</u>** What do you think motivates/stimulates communities or individuals to create value from OGD? What do you think the barriers / challenges / obstacles or concerns would be, either in publishing data or challenges that could users face using these data? How they could be solved? What about the motivations and barriers to the LA to have OGD? **<u>Ending/ closing the interview</u>** Any other comments about OGD and co-creation. uld you like to add opinions, ideas, thoughts or reflection could add to this field of research of the active usage of D?	

(Transition: Well, it has been a pleasure finding out more about OGD and co-creation. Let me briefly summarize the information that I have recorded during our interview.)

3. Closing

A. (Summarize) ….

B (Maintain Rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know so that I can successfully introduce the mechanism of co-creation from OGD?

C. (Action to be taken) I should have all the information I need. Would it be alright to email you if I have any more questions? Thanks again.

Appendix C: Interviews Methods

Category	# interviews	# interviewees	Type
County Councils (CoCo) seven members have been interviewed			
Dublin City CoCo	1	1	email
Fingal CoCo	2	2	F2F and Phone
South Dublin CoCo	1	1	F2F
DLR CoCo.	2	3	F2F
Organisations - 11 members have been interviewed			
Central Statistics Office	2	2	F2F
Institute of Public Health	1	2	F2F
Marine Institute (Galway)	1	1	video
IBM	1	1	F2F
Digital Repository of Ireland	1	1	F2F
Department of Public Expender and Reform	1	2	email
Heritage Council	1	1	phone
St. James Hospital (LAMP project)	1	1	phone
Academics/Researchers - eight members have been interviewed			
DIT	1	1	F2F
TCD	1	1	F2F
Maynooth University	3	3	F2F
UCD	1	1	F2F
Insight Centre for Data Analytics	2	2	F2F and Video
International experts - seven members have been interviewed			
Spain (Barcelona COCO)	1	2	video
Canadian organisation (Casrai)	1	1	video
USA, OD Consultant	1	1	phone
UK, Future Cities Catapult	1	1	phone
Worldwide web foundation	1	1	video
Netherlands, Academics	2	2	Video
Communities – 14 members have been interviewed			
Open Knowledge Ireland	2	2	F2F
Open Street Map	2	2	F2F and Phone
Code for Ireland	1	1	phone
Parking developer	1	1	F2F
MyQ.ie developer	1	1	F2F
ParkYa developer	1	1	F2F
Apps4Gaps.IE and Cododojo	1	1	phone
Risc project manager	1	1	F2F
Interested community in OD analytics	3	3	F2F and Email
Drimnagh is good community	1	1	F2F
Total	44	48	

Appendix D: The Use of NVivo to Analyse Data

A total of 44 documents of transcripts of interviews that had been transcribed were imported into NVivo. Figure 6 illustrates the informant transcripts stored in NVivo as internal sources of data.

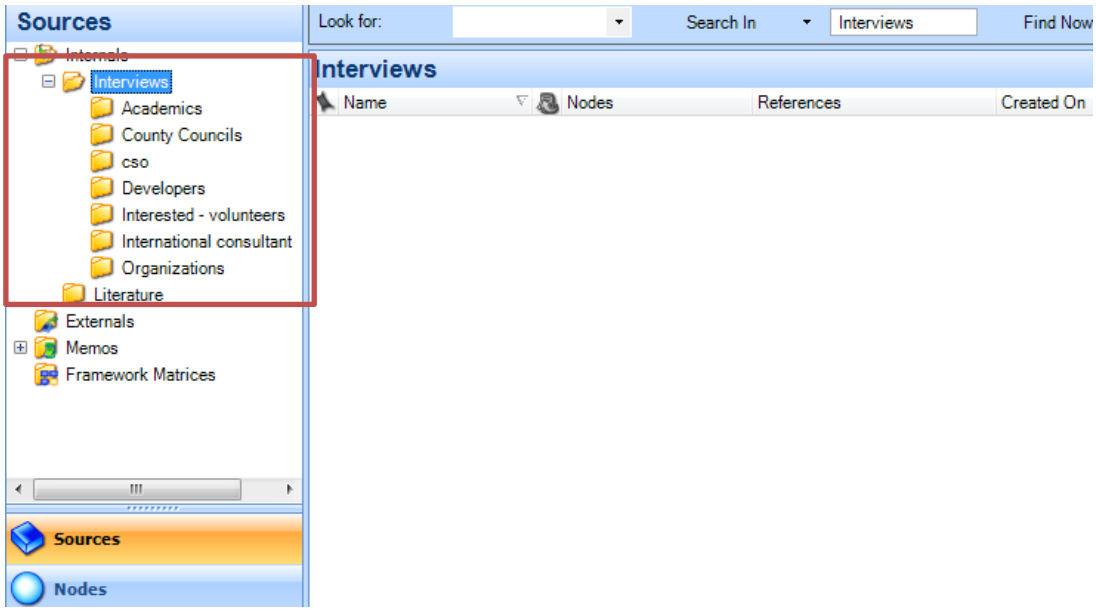


Figure 6. Informants imported into NVivo as sources.

Data were initially coded based on the proposed the augmented AT labels. Next the open coding phase helped to evolve more labels based on the participants' points of view. Donald (2013) states that "*[T]he identification of nodes in NVivo is a relatively simple activity in terms of labelling, yet a difficult task in terms of identification*" (p.172) and this was time-consuming in the analysis phase. Having previously identified some of the codes through AT aspects, coding was a relatively straightforward exercise but time-consuming as the volume of data was large. Each item of information relevant to the AT aspects and other emerging aspects was identified and highlighted before they were finally named (as codes) as illustrated in figure 7.

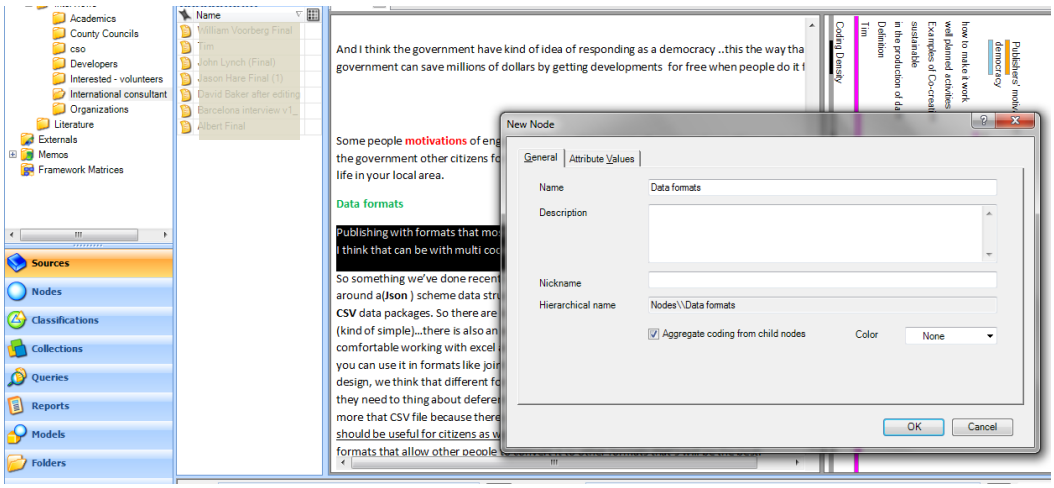


Figure 7. Illustration of first Participant's answer to question one

An example of the data from informants used to identify the nodes is illustrated in Figure 8.

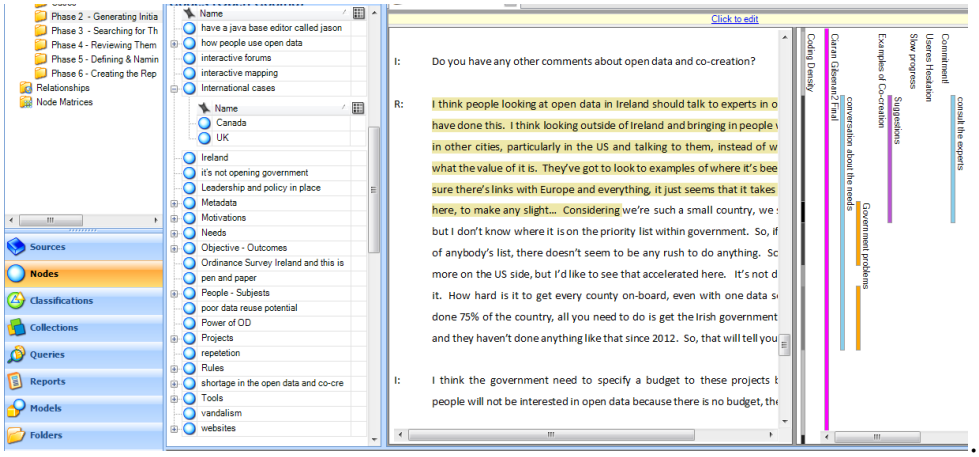


Figure 8. Coding of a piece of text

More codes were then developed, bringing the total number of codes to 630. These codes were then refined and reduced to fit three themes.

Then, queries were developed to extract the data in useful formats to support the findings. Queries at the analysis stage were the most valuable function of NVivo, as these facilitate the creation of graphical models to show the pattern of the findings. Finally, the Endnote software tool has been used for managing bibliographies, citations, and references in this research.

Appendix E: Ethical approval

School of Computer Science & Statistics
Research Ethics Application

CHECKLIST

The following documents are required with each application:

1.	SCSS Ethical **Application Form**	✓
2.	**Participant's Information Sheet** must include the following: Declarations from Part A of the application form; Details provided to participants about how they were selected to participate; Declaration of all conflicts of interest.	✓
3.	**Participant's Consent Form** must include the following: Declarations from Part A of the application form; Researchers contact details provided for counter-signature (your participant will keep one copy of the signed consent form and return a copy to you).	✓
4.	**Research Project Proposal** must include the following: *You must inform the Ethics Committee who your intended participants are* i.e. are they your work colleagues, class mates etc. How will you recruit the participants i.e. **how** do you intend asking people to take part in your research? For example, will you stand on Pearse Street asking passers-by? If your participants are under the age of 18, you must seek both parental/guardian AND child consent.	✓
5.	Intended **questionnaire**/survey/interview protocol/screen shots/representative materials (as appropriate)	✓
6.	**URL** to intended on-line survey (as appropriate)	Null

Notes on Conflict of Interest

1. If your intended participants are work colleagues, you must declare a potential conflict of interest: you are taking advantage of your existing relationships in order to make progress in your research. It is best to acknowledge this in your invitation to participants.
2. If your research is also intended to direct commercial or other exploitation, this must be declared. For example, *"Please be advised that this research is being conducted by an employee of the company that supplies the product or service which form an object of study within the research."*

Notes for questionnaires and interviews

1. If your questionnaire is **paper based**, you must have the following **opt-out** clause on the top of each page of the questionnaire: *"Each question is optional. Feel free to omit a response to any question; however the researcher would be grateful if all questions are responded to."*
2. If you questionnaire is **on-line**, the first page of your questionnaire must repeat the content of the information sheet. This must be followed by the consent form. If the participant does not agree to the consent, they must automatically be exited from the questionnaire.
3. Each question must be **optional**.
4. The participant must have the option to '**not submit, exit without submitting'** at the final ***submission point on your questionnaire.***

5. If you have open-ended questions on your questionnaire you must warn the participant against naming **third parties**: "*Please do not name third parties in any open text field of the questionnaire. Any such replies will be anonymised."*

6. You must inform your participants regarding **illicit activity**: "*In the extremely unlikely event that illicit activity is reported I will be obliged to report it to appropriate authorities."*

School of Computer Science and Statistics
Research Ethical Application Form

Part A

Project Title: **A study of Open Government Data (OGD) and co-creation communities in Dublin**

Name of Lead Researcher (student in case of project work): **Mashael Khayyat**

Name of Supervisor **Dr. Frank Edward Bannister**

TCD E-mail: khayyatm@tcd.ie Contact Tel No: **08 9968 0435**

Course Name and Code (if applicable): **Doctor in Philosophy, Computer Science (Full-Time)**

Estimated start date of survey/research: **20 November 2014**

I confirm that I will (where relevant):

- Familiarize myself with the Data Protection Act and the College Good Research Practice guidelines http://www.tcd.ie/info_compliance/dp/legislation.php;
- Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)
- Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures (a copy of the information sheet must be included with this application)
- Obtain informed consent for participation (a copy of the informed consent form must be included with this application)
- Should the research be observational, ask participants for their consent to be observed
- Tell participants that their participation is voluntary
- Tell participants that they may withdraw at any time and for any reason without penalty
- Give participants the option of omitting questions they do not wish to answer if a questionnaire is used
- Tell participants that their data will be treated with full confidentiality and that, if published, it will not be identified as theirs
- On request, debrief participants at the end of their participation (i.e. give them a brief explanation of the study)
- Verify that participants are 18 years or older and competent to supply consent.
- If the study involves participants viewing video displays then I will verify that they understand that if they or anyone in their family has a history of epilepsy then the participant is proceeding at their own risk
- Declare any potential conflict of interest to participants.
- Inform participants that in the extremely unlikely event that illicit activity is reported to me during the study I will be obliged to report it to appropriate authorities.
- Act in accordance with the information provided (i.e. if I tell participants I will not do something, then I will not do it).

Signed: MASHAEL KHAYYAT Date: 29/10/2014
Lead Researcher/student in case of project work

Part B

Please answer the following questions.		*Yes/No*
Has this research application or any application of a similar nature connected to this research project been refused ethical approval by another review committee of the College (or at the institutions of any collaborators)?		No
Will your project involve photographing participants or electronic audio or video recordings?		Yes (audio rec)
Will your project deliberately involve misleading participants in any way?		No
Does this study contain commercially sensitive material?		No
Is there a risk of participants experiencing either physical or psychological distress or discomfort? If yes, give details on a separate sheet and state what you will tell them to do if they should experience any such		No
Does your study involve any of the following?	Children (under 18 years of age)	No
	People with intellectual or communication difficulties	No
	Patients	No

School of Computer Science and Statistics
Research Ethical Application Form

Details of the Research Project Proposal must be submitted as a separate document to include the following information:

1. Title of project
2. Purpose of project including academic rationale
3. Brief description of methods and measurements to be used
4. Participants - recruitment methods, number, age, gender, exclusion/inclusion criteria, including statistical justification for numbers of participants
5. Debriefing arrangements
6. A clear concise statement of the ethical considerations raised by the project and how you intend to deal with them
7. Cite any relevant legislation relevant to the project with the method of compliance e.g. Data Protection Act etc.

Part C

I confirm that the materials I have submitted provided a complete and accurate account of the research I propose to conduct in this context, including my assessment of the ethical ramifications.

Signed: MASHAEL KHAYYAT Date: 29/10/2014
Lead Researcher/student in case of project work

There is an obligation on the lead researcher to bring to the attention of the SCSS Research Ethics Committee any issues with ethical implications not clearly covered above.

Part D

If external or other TCD Ethics Committee approval has been received, please complete below.

External/TCD ethical approval has been received and no further ethical approval is required from the School's Research Ethical Committee. I have attached a copy of the external ethical approval for the School's Research Unit.

Signed: ..... Date: .....
Lead Researcher/student in case of project work

Part E

If the research is proposed by an undergraduate or postgraduate student, please have the below section completed.

I confirm, as an academic supervisor of this proposed research that the documents at hand are complete (i.e. each item on the submission checklist is accounted for) and are in a form that is suitable for review by the SCSS Research Ethics Committ

Signed: **FRANK BANNISTER** Date: 31/10/2014.
Supervisor

Completed application forms together with supporting documentation should be submitted electronically to research-ethics@scss.tcd.ie Please use TCD e-mail addresses only. When your application has been reviewed and approved by the Ethics committee hardcopies with original signatures should be submitted to the School of Computer Science & Statistics, Room F37, O'Reilly Institute, Trinity College, Dublin 2.

TRINITY COLLEGE DUBLIN

INFORMED CONSENT FORM

LEAD RESEARCHER: Mashael Khayyat, PhD student in the School of Computer Science and Statistics

BACKGROUND OF RESEARCH:
This research investigates the process(es) whereby different communities exploit Open Government Data (OGD). The study will involve interviews. The interview will take around an hour and will be taped using a digital voice recorder if that is acceptable to you. Otherwise hand written notes will be taken. If a voice recorder is in use, you may ask at any time for this to be temporarily or permanently switched off.

Please take your time to read the following declaration and sign it please.

DECLARATION:

- I am 18 years or older and am competent to provide consent.
- I have read, or had read to me, a document providing information about this research and this consent form. I have had the opportunity to ask questions and all my questions have been answered to my satisfaction and understand the description of the research that is being provided to me.
- I agree that my data is used for scientific purposes and I have no objection that my data is published in scientific publications in a way that does not reveal my identity.
- I understand that if I make illicit activities known, these will be reported to appropriate authorities.
- I understand that I may stop electronic recordings at any time, and that I may at any time, even subsequent to my participation have such recordings destroyed (except in situations such as above).
- I understand that, subject to the constraints above, no recordings will be replayed in any public forum or made available to any audience other than the current researchers/research team.
- I freely and voluntarily agree to be part of this research study, though without prejudice to my legal and ethical rights.
- I understand that I may refuse to answer any question and that I may withdraw at any time without penalty.
- I understand that my participation is fully anonymous and that no personal details about me will be recorded.
- I have received a copy of this agreement.

PARTICIPANT'S NAME: Date:

PARTICIPANT'S SIGNATURE:

Statement of investigator's responsibility: I have explained the nature and purpose of this research study, the procedures to be undertaken and any risks that may be involved. I have offered to answer any questions and fully answered such questions. I believe that the participant understands my explanation and has freely given informed consent.

RESEARCHERS CONTACT DETAILS: khayyatm@tcd.ie , 0899680435

INVESTIGATOR'S SIGNATURE: **MASHAEL KHAYYAT** **Date:**

INFORMATIONSHEETFORPROSPECTIVEPARTICIPANTS

My name is Mashael Khayyat. I am a PhD student in the School of Computer Science and Statistics in Trinity College Dublin. You are being invited to take part in a research study investigating the co-creation process of how different communities exploit and make better use of open government data (OGD). Please take your time to read the following information.

I am asking about 40 people to take part in an interview to investigate their views on the publication and use open government data.

Your participation in this study is voluntary and you can withdraw from the study at any time.

If you decide that you would like to take part, I will hold the interview in your workplace at a time that suits you. The interview will last about an hour. You will not have to do anything special to prepare for this interview.

You may or may not benefit directly from participating in this research, but you will be helping to advance knowledge and understanding of making better use of OGD. However the results of the research will be available to you on request.

Conflict of interest
This research should not conflict with any participants' interest. That because it is just for understanding the process of co-creation by using open government data that is already open for users and there is no sensitivity in this area of research. There are no ethical considerations in this project other than the normal one of respecting the confidentiality of your comments. There are no sensitive social, political, medical or sexual issues involved in this research.

Privacy and confidentiality
With your permission, I will record the interview on a digital voice recorder to make sure that I remember what we talked about. I will turn off the recorder at any time if you are not comfortable with it.
The results of this project may appear in papers, books chapters, journal articles and in presentations at conferences, but you will not be identified or identifiable in any of these reports unless you wish to be so identified. No audio or video recordings will be made available to anyone other than the researcher, nor will any such recordings be replayed in any public forum or presentation of the research. The audio will be stored in the researcher computer under password, and it will be destroyed after the research is completed. Individual results may be aggregated anonymously, and research reported on aggregate results.

Further information
If you have any questions about this research you can ask now or at any point during the study.

Mashael Khayyat 0899680435 Khayyatm@tcd.ie

Research Project Proposal

1. **Title of project**
   Open Government Data (OGD) and Co-creation Communities in Dublin.
   Investigating the co-creation process and how different communities exploit and make use of OGD.

2. **Purpose of this project including academic rationale**
   The overall aim of this research is to gain an in depth understanding of the co-creation phenomenon within the OGD context. This includes investigating the process(es) whereby different communities exploit and make use of OGD including the factors that facilitate or hinder such activities. An understand of this can help in conceptualizing and developing wider understanding about co-creation between government and citizen groups who are presented in this research as communities.

3. **Brief description of methods and measurements to be used**
   This study involves qualitative, multiple case studies. The primary data gathering approach will be one to one semi-structured interviews. Other data acquisition methods will include websites analysis, reflective notes from participant observation(some of this has already been done by attending "meetup" meetings with the open data publishers and communities interested in using open data to turn it to public good via websites and applications). The data analysis in this research will be done through transcribing the interviews texts to be analyzed in terms of categories/themes based on the co-creation communities' activities. The qualitative data analysis software (NVivo) will be used for the data analysis.

4. **Participants - recruitment methods, number, age, gender, exclusion/inclusion criteria, including statistical justification for numbers of participants**

   Target interviewees fall into two categories.

   Approximately 10-15 will be drawn from open data publishers and stakeholders from Dublin four local authorities will be interviewed.

   Approximately 30-40 will be drawn from communities of open data users (co-creation communities) including academics, not for profit organizations' members and individuals who already involved in using open data to create public good/goods. Some of the communities' members are listed in open Fingal data websites as winners of competitions designed to encourage community use of open data (http://data.fingal.ie/Apps4Fingal/).

5. **Debriefing arrangements**

   I have already met the OGD publishers from Dublin City Council and Fingal County council who will be interviewed. I have already asked them if they are interested in participating in this research and they have agreed to do so. The remainder of my informants will be identified using snowball and purposeful sampling and from names listed in the OGD websites as competition winners. Summaries of interviews will be checked with informants to ensure their accuracy.

6. **A clear concise statement of the ethical considerations raised by the project and how you intend to deal with them**

There are no ethical considerations in this project other than the normal one of respecting the confidentiality of the interviewees' comments. There are no sensitive social, political, medical or sexual issues involved in this research. All interviewees will be adults.

I confirm that I will abide by the School of Computer Science and Statistics Ethical Guidelines and I will inform the Committee if there is any ethically relevant variation to the project as described in this application.

Signature of Applicant **MASHAEL KHAYYAT 29/10/2014**

Email to Informants

Dear …,

My name is Mashael Khayyat. I am currently doing a full time PhD at Trinity College Dublin. My area of interest is the use of open government data by different communities in Dublin.

The objectives of my research are to establish what OGD websites are currently available in Dublin and to understand how different citizen communities are using these data. By studying this I hope to obtain deep insights into how citizens from different backgrounds and with different interests/agendas exploit the phenomenon of open data and how such developments contribute to their communities and to the wider public good. This research will also examine what motivate people to engage in such activities and the barriers that they face when dealing with OGD websites.

I am contacting you because [here the reason for the approach will be entered, e.g. you are involved with the development of a particular app] and would like to request an interview. The interview should only take around 30 minutes and all information gathered will be secured and remain confidential.

If you are willing to be interviewed to participate in this study, please contact me by return via email or feel free to call me on 0899680435.

Kind Regards

Mashael Khayyat