Designing Ecosystem Business Models for Data-Driven Organisations Using Open Government Data

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Abstract

Open Government Data (OGD) is government information accessible to the public for viewing, reuse, and redistribution. OGD can facilitate a variety of business innovations for those that publish, utilise, and build OGD-related services. OGD efforts shift the focus of government policy from inside to outward. Good OGD benefits the economy and the community. Most nations have developed OGD initiatives from the top down, limiting information flow between the public and government. Moreover, the government possesses vast quantities of high-quality operational data, making it difficult to assess or conceptualise the benefits of publicising this data.

The study examined how government agencies develop, deliver, and capture the value of OGD over time to data users, such as Data-driven organisations (DDOs). DDOs use OGD as a cost-effective source to build a foundational layer of intrinsic value. Because the current study focuses less on business models, no thorough research on DDO business models across industries using OGD exists. This study designed ecosystem business models for a subset of DDOs that use OGD to improve their services. Ecosystem business models are developed for DDOs that use OGD to improve their services.

This study developed four research questions. First, define the value-creating roles that different participants in Open Government Data and data-driven organisations use to collaborate in the OGD initiative. Second, finding government agencies and data-driven organisations' motivations for publishing and utilising Open Government Data. Third, addressing how to design new ecosystem business models for an ecosystem that is not mature yet. Fourth, investigate how one designs ecosystem business models for Data-driven organisations using Open Government Data and unlock open data potential benefits for all actors.

To answer the research questions, this study included in-depth interviews, website searches, and documentation studies to acquire information on OGD Initiatives in New Zealand and DDO's ecosystem business models. This qualitative study used purposive sampling to locate participants with relevant expertise and background. I used semi-structured interviews to get participants' in-depth opinions of New Zealand's OGD

programme and ecosystem to get a representative sample from government agencies, DDOs, and other relevant actors.

Data were collected in two stages in New Zealand between July 2019 and January 2021 to understand the phenomenon and offer reliable findings. The first stage involved interviewing ten people from six government agencies, two DDOs, and one IT company. Second, secondary data from government and private sources were synthesised.

This study adopts a multiple case study Constructivism paradigm. The four-cycle multiple case studies provide various perspectives on individuals, actions, policies, documents, and circumstances in order to find and comprehend divergent perspectives. Three case studies are deductively and inductively coded in the first two cycles. Then, a two-cycle cross-case analysis validated the coding maps of the three case studies. In the final cycle, case study findings were triangulated with secondary data to generate several themes. Multiple case study methodologies utilise thematic analysis to generate coding clusters and maps to uncover and explain content themes or patterns. It assists me in linking thoughts and comparing redundant facts. The analysis of both primary and secondary data was conducted using QSR NVivo Version 12.

A comprehensive analysis of the multiple case study findings and the thematic maps of the three case studies relate these findings to RQ1 and RQ2 and provides the fundamental concept for creating ecosystem business models to address RQ3 and RQ4. Case studies show that government agencies and IT companies play key roles in the OGD ecosystem along the path to data availability. The OGD ecosystem encourages collaboration among all actors, especially value-creation and value-capture actors. OGD value is created through a data value chain. Thematic analysis found that government agencies and DDOs use OGD for diverse motivations. Access to large amounts of OGD has helped build new capabilities. The findings emphasise the economic value that was tapped by building services on top of open data. Implementing OGD improves transparency by providing access to government-held information. It will improve the public's understanding of government actions and government decision-making.

Furthermore, the findings suggest that publishing government data is the greatest approach to boosting OGD use. Hence the New Zealand OGD initiative proactively published data as 2022 has four times as many datasets as 2018. To match supply-

demand data, data.govt.nz allows the public to request government datasets. By integrating their data with OGD, data-driven companies can produce product/service innovations due to essential sources such as experienced humans, an online database system, and significant datasets. A data-driven organisation tried to unlock OGD's value based on its motives, objectives, and expected outcomes. Thus, data-driven organisations coupled OGD with their data to create goods or services with extra value.

I construct an enhanced logic model based on the model used to summarise the New Zealand Open Government Data initiative's ecosystem. The model allows the government to analyse if its data gathering and opening operations match OGD's goals to establish commercial models for an immature ecosystem. The logic model develops hypotheses on ecosystem-driven business model development. It helps detect gaps, organises new portions of each component, and communicates the strategy to actors and other stakeholders.

Furthermore, I designed an Ecosystem Business Model Canvas (EBMC) as an extended version of the BMC template by Osterwalder, with three extra elements: networks and relationships, customer motivation, and customer requests and feedback. The EBMC helps New Zealand OGD actors examine their ecosystems, growth potential, and customer/client impact. Based on the EBMC, four types of DDOs' ecosystem business models and value-stream diagrams were developed to enable sustainable collaboration and partnership in the OGD initiative ecosystem.

Preface and Acknowledgments

I do not earn the PhD on my own. This study program is designed to be rigorous and to bring forth my best qualities. I could not have accomplished this without the support of Allah - God Almighty and numerous people, especially since half of my study period was in the COVID-19 pandemic, which impacted my study completion.

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I say, in the Indonesian way, "Terima kasih banyak!" or "Thank you very much! "

Novy
Auckland, October 2022

Attestation of Authorship

I hereby declare that this submission is my own work and that to the best of my knowledge and belief, it contains no material previously published or written by another person except where explicitly indicated and acknowledged, nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning.

Signed by:

Date : October 13, 2022

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Abbreviations and Acronyms

Abbreviation/Acronym	Definition
ACM	Association for Computing Machinery
AIS	Association for Information Systems
API	Application Programming Interface
AUT	Auckland University of Technology
AUTEC	Auckland University of Technology Ethics Committee
BM	Business Model
BMC	Business Model Canvas
CC BY	Creative Commons Attribution license
CFO	Chief Financial Officers
CKAN	Comprehensive Knowledge Archive Network
CMS	Content Management System
CONF-IRM	Conference on Information Resources Management
CSV	Comma Separated Values
DDO	Data-driven organisation
DH	Department of Health
DSR	Design Science Research
DSS	Decision Support Systems
GPS	Global Positioning System
HSCIC	Health & Service Care Information Centre
HTML	HyperText Markup Language
ICT	Information and Communications Technology
IEEE	Institute of Electrical and Electronics Engineers
IT	Information Technology
JSON	JavaScript Object Notation
MP4	Motion Picture 4
NGO	Non-Government Organisations
NHS	National Health Service
NIB	National Information Board
NZ	New Zealand
OD	Open Data
ODBM	Open Data Business Model
ODI	Open Data Institute
OECD	Organisation for Economic Cooperation and Development
OGD	Open Government Data
OKF	Open Knowledge Foundation
PDF	Portable Document Format
QDAS	Qualitative Data Analysis Software

Abbreviation/Acronym	Definition
RQ	Research question
RTI	Right to Information
TOE	Technology-Organisation-Environment
UK	United Kingdom
US	United States
USA	United States of America

Research outputs

Papers presented at conferences & published in the proceedings:

Mokobombang, NNRA; Gutierrez, J. & Petrova, K. (2020). '*Value-creating Roles Played by the Actors in Open Government Data: A Systematic Literature Review*'.

- Paper presented at the 2020 Australasian Conference on Information Systems (ACIS2020), 3rd December 2020 – at the hybrid conference hosted by Victoria University Wellington, New Zealand.
- Paper published in ACIS 2020 Proceedings, March 2021, https://aisel.aisnet.org/acis2020/14/

Mokobombang, NNRA; Gutierrez, J. & Petrova, K. (2020). '*Open Government Data initiatives: Open by Default or Publishing with Purpose*'

- Paper presented at the Conference on Information Systems Resources 2020 (Conf-IRM2020), 29th May 2020, at the virtual conference hosted by the Florida International University, Miami US.
- Paper published in CONF-IRM 2020 Proceedings, September 2020, https://aisel.aisnet.org/confirm2020/8/

Mokobombang, NNRA; Gutierrez, J. & Petrova, K. (2019). '*The benefits of Open Government Data use: A cross-country comparison'*.

- Paper presented at the Conference on Information Systems Resources 2019 (Conf-IRM2019), 29 May 2019, at AUT, Auckland New Zealand.
- Paper published at CONF-IRM 2019 Proceedings, August 2019, https://aisel.aisnet.org/confirm2019/21/

Papers presented at Symposium:

Paper presented at NZISDC 2021 (New Zealand Information Systems Doctoral Consortium), 3 July 2021, Massey University, Auckland. '*Designing ecosystem business models for data-driven organisations using Open Government Data'.* Mentor: Professor Michael Myer (University of Auckland) & A/Prof Gohar Khan (University of Waikato)

Paper presented at NZISDC2018 (New Zealand Information Systems Doctoral Consortium), 13 July 2018, Auckland University of Technology, Auckland. '*Ecosystem business models for Open Government Data'.* Mentor: Dr Antonio Diaz Andrade (Auckland University of Technology)

Paper presented at the Auckland University of Technology Postgraduate Research Symposium, Auckland, 17 August 2018. '*Open Government Data benefits: insight from existing research*'.

In progress:

Mokobombang, NNRA; Gutierrez, J.; Petrova, K. Paper "*Open Government Data value creation for data-driven organisations in a Smart City context",* will be submitted to Transforming Government: People, Process and Policy Journal
This article was approved as a chapter for the Monograph about Smart Governance and Emerging Technologies, a project by Edward Elgar publishing. However, the project was cancelled in June 2022.

Mokobombang, NNRA; Gutierrez, J.; Petrova, K. Paper "*Ecosystem business models for data-driven organisations in exploiting Open Government Data value",* will be submitted to Electronic Markets-The International Journal on Networked Business

Mokobombang, NNRA; Gutierrez, J.; Petrova, K. Paper "*Value creation and value capture by key actors: A collaboration model for the Open Government Data Ecosystem",* will be submitted to Electronic Government Journal

Chapter 1 Introduction

The research presented in this thesis studies Open Government Data (OGD) initiatives in order to investigate how government agencies create, deliver and capture the sustainable value of OGD (Kalampokis, Tambouris, & Tarabanis, 2011; Teece, 2010). Ecosystem business models are designed for selected Data-driven organisations (DDO) that use OGD to improve the benefits and the value of their services. The findings are based on an extensive literature review and multiple case studies of OGD and DDO in New Zealand.

This chapter briefly introduces the rationale and significance of the study and research motivation. The study objectives are defined, and the research contributions are developed. The last section of the chapter describes the thesis organisation and summarises its content.

1.1 Background

Over the past 25 years since the term OGD was firstly introduced, there has been a noticeable increase in data being open as a means of transferring the concepts of strategic analysis from the public sector to the private sector (M. H. Moore, 1995). The idea emerged as a result of the comparison of the goals of public and private organisations. In Moore's view, rather than being committed to creating economic value (Maaike Kaasenbrood, Anneke Zuiderwijk, Marijn Janssen, Martin de Jong, & Nitesh Bharosa, 2015), government agencies were committed to creating social value (United Nations. Dept. of, 2017). With open data, the creation of benefits relies on the ability to share data, to make them available to other parties, rather than on mere volume like big data (Janssen, Charalabidis, & Zuiderwijk, 2012) . Openness is a basic concept to open source, open government and open data. De Chiara (2018) identified a correlation between the development of community programmes, private initiatives, and the creation of public policies related to the release of open data.

Today's open data systems form a highly interconnected network of government agencies, private companies, universities, and citizens as the actors. The concept of mutual networking among these actors of open data is needed to build a rapidly changing environment in which actors will be able to interact with each other symbiotically.

1.2 Research Motivation, Aim and Objectives

The largest disruptive DDO are developing rapidly using open data for reasons related to cost-effectiveness. Therefore, the business of DDO depends on the quality of OGD (Eriksson & Kovalainen, 2016). The critical step in how government agencies can create, deliver and capture sustainable value for data-driven organisations is developing what the business models will be.

However, less attention is paid to the crucial issue of business models in current research. This may be because the studies primarily follow focus-firm business models and that there are no detailed business models developed for data-driven companies in various industries using OGD. The research aims to bridge this gap by designing ecosystem business models for selected DDO that use OGD to improve the benefits and the value of their services. The research addresses this problem by investigating how selected organisations use OGD to improve the benefits and the value of services in their organisations.

The research aims: First, to consolidate reported ecosystem business models in both academic and practice literature. Second, to identify and explore the roles of each actor, the required services and significant roles that must be defined and implemented. Three, to develop ecosystem business models on how DDO can successfully translate OGD as the potential source of impact.

More specifically, this research investigates four Research Questions as follows:

(RQ1) What are the value-creating roles played by different actors in Open Government Data and data-driven organisations?

(RQ2) What is the motivation of government agencies and data-driven organisations to publish and use Open Government Data?

(RQ3) How does one design new ecosystem business models for an ecosystem that is not mature yet?

(RQ4) How does one design ecosystem business models for data-driven organisations using Open Government Data and unlock open data potential benefits for all actors?

1.3 Rationale and Significance of the study

In an executive order issued by the USA President in 2013 (White House, 2013), it was postulated that the highest benefit of open data is providing information resources freely available, easily found and accessible. In contrast, open data have high value if they are shared, little or no value if they are locked (Janssen, 2012). Furthermore, the value enhancement of open data based on their level of detail, accuracy and compatibility creates better decision making, better product and service offerings, and greater accountability (McKinsey, 2014). This research began with a consideration that open data should have an ecosystem where all actors compete and collaborate symbiotically.

Moreover, while open data can come from many sources—including social media, private sector companies, and scientific research—the most extensively used open data comes from government agencies (G. Magalhaes, Roseira, & Manley, 2014). As a result, the large disruptive DDO rapidly evolve by using open data from governments, big data and internal data to create new markets and value networks with a wide range of business models. The United Nations has defined Open Government Data terms as "*government data that is proactively disclosed and made available online for everyone's access, reuse and redistribution without restriction* " (United Nations. Dept. of, 2017). DDO often use OGD as a cost-effective source for them to build a fundamental layer of inherent value on top of which they layer other datasets. Technopedia defines Data-driven organisations as organisations where the data dictate all decisions and processes[1]. That notwithstanding, being a DDO is not just about having and processing a massive quantity of data from all of the sources; it is about making business decisions based on those data.

Each actor in the open data ecosystem has its role in the flow processes and relationships between each other (Teece, 2010; Ubaldi, 2013). An ecosystem will build a value chain to allow each actor to engage in this network. A valuable ecosystem will

[1] https://www.techopedia.com/definition/18687/data-driven the latest access in June 2021

be developed by maintaining the quality and permanency of providing open data, such as an agreement to data process for opening, delivering, combining and boosting useful data (Kitsios, Papachristos, & Kamariotou, 2017). Building on the analysis of the extensive literature review and case studies of the DDO that use OGD across various sectors in New Zealand, this research will contribute in several ways. Theoretically, the study is expected to develop an advanced business model design framework in the context of a new ecosystem for OGD and DDO. The research will provide practical insight into OGD and DDO to evaluate their ecosystem. Moreover, the research will fill the gap where no current studies designed comprehensive ecosystem business models for DDO using OGD.

The critical step in how government agencies can create, deliver and capture sustainable value for DDO is developing what the business model will be. Data do nothing on their own; they require innovation on the part of the government and organisations. However, the crucial question of the business models has received insufficient attention in current research. This could be attributed to the fact that most studies predominantly adopt firm-focal perspective business models; no comprehensive research on business models designed for DDO in different sectors using OGD exists. The research aims to bridge this gap by designing ecosystem business models for selected DDO that use OGD to improve the benefits and the value of their services.

1.4 Research contributions, Limitations, and Future research

The study makes a theoretical contribution by demonstrating that the technological and operational benefits of OGD illustrate the fact that users need government agencies to maintain high-quality data to maximise their value, as the OGD provider does. Facilitating networking among actors through the creation of an ecosystem will provide a direct economic gain for governments, private companies, and citizens. OGD initiatives can also generate additional significant value by offering a model of how top levels of government (in their position as policymakers) communicate with government agencies dealing with OGD.

There are some drawbacks to the study. First, the context heterogeneity, the maturity of OGD adoption, top-level policies, and the OGD ecosystems restrict the reliability of the research. Another limitation is the fact that the surveyed studies addressed two different types of OGD adoption, i.e., OGD use experiences in leading OGD countries vs experiences of early-stage OGD adopters; this may have led to a somewhat fragmented

picture. This research, however, attempts to minimise the limitations by applying the same steps for all cases and using a simple one-level-coding scheme to categorise the benefits.

Future work is expected to explore further OGD programmes in other countries, applying a thematic approach to analysis and creation of code with complex variables.

1.5 Outline of the thesis

This thesis is organised into eight chapters, as shown in Figure 1.1. This chapter (Chapter 1) introduced this study, and set out the aims and objectives of this research, explained the rationale and significance and described the structure of the thesis.

Chapter 2 briefly describes OGD, including its definition and benefits, before explaining the concepts of business models, ecosystems and DDO.

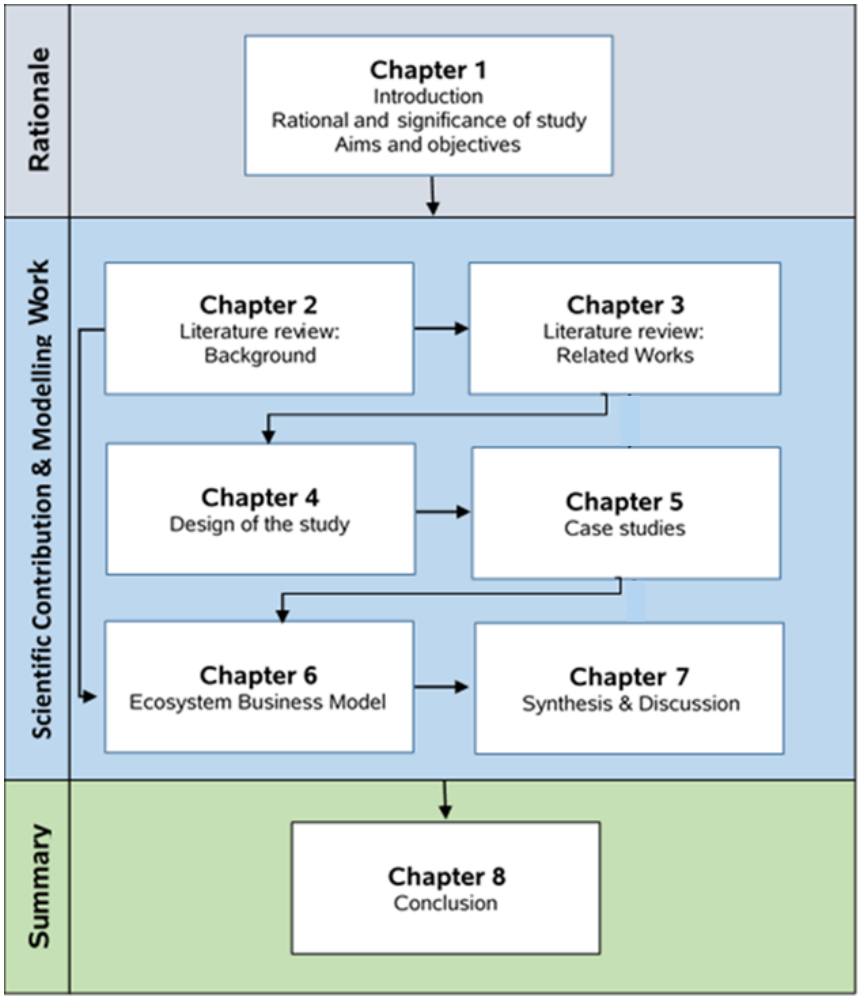

Figure 1-1 Overview of the thesis structure

Chapter 3 reviews prior literature on OGD initiatives, and e-government adoption from the perspective of actors. It outlines the New Zealand OGD programme used for analysing the OGD initiatives in New Zealand. This is followed by practical cases of OGD implementation in other countries on how the public as users could gain social and economic benefits from open data.

The design of the study is presented in Chapter 4. It has been defined in a systematic attempt to find answers to research questions. This chapter covers the research philosophies, paradigm, data collection methods and data analysis techniques that are used in the research and how to treat the validity.

Chapter 5 expounds on the qualitative data obtained from each case study. There are three case studies to show the findings on New Zealand government agencies, DDO as the users and IT companies that supported the New Zealand Government. The steps and the conduct of the qualitative multiple case studies process are elaborated to present supply and demand perspectives on actors, activities, policies, documents and issues for identifying, then interpreting, the different views of every case.

Based on the findings in Chapter 5 and the design principles made in Chapter 4, designing and evaluation of ecosystem business models for DDO using OGD are commenced in Chapter 6. Several categories satisfy the defined criteria and requirements.

Chapter 7 draws upon the entire thesis, binding up and synthesising the various analytical, theoretical and ecosystem business model designs. This chapter also includes a discussion of those aspects of OGD adoption by the New Zealand Government and usage by DDO and the reasons behind any contradictory findings.

Finally, Chapter 8 summarises the work, suggests detailed contributions and implications and makes a recommendation for further studies.

1.6 Summary of Chapter 1

This chapter defined key terms and concepts and formulated research questions, purpose, and objectives. It summarised the study's methodology, the contribution of the thesis and limitations of the study, and explains the outline of the thesis. The next chapter discusses the literature review.

Chapter 2 Open Data, Open Government Data and Business models: Concepts and Definitions

This chapter begins by discussing the historical background and definitions of several key terms and concepts such as Open data, OGD, DDO and Business models. The review of literature is divided into five major sections. The first section, 2.1, discusses the literature on Open data. Section 2.2 reviews the available literature on OGD, while Section 2.4 discusses the constraints and challenges associated with ecosystems and OGD. Section 2.5 concludes by delving into the concept of business model. The last section elaborates on data-driven organisations.

2.1 Open Data

While this study is focused on OGD, it is essential to briefly talk about the larger concept of open data (OD) at this point. There are numerous domains where open data may be anticipated to be valuable and where instances of its use already exist. Additionally, numerous individuals and private and public organisations, can get benefits from the availability of open data. Simultaneously, it is hard to foresee precisely how and where value will be created. The nature of the creation frequently occurs in unexpected places.

2.1.1. Open data principles

The Open Definition[2] was published by the Open Knowledge Foundation[3] in 2005 with the objective of clarifying what "open" means in phrases such as "open data", "open

[2] http://opendefinition.org/ last accessed November 2021

[3] https://okfn.org/about/ last accessed November 2021

content" and "open knowledge". Since then, various modifications have been made to the Open Definition, with the most recent version V2.1 released in 2015[4].

The Open Data principle (O. K. Foundation, 2009) states:

> "*Open means that anyone can freely access, use, modify, and share data for any purpose (subject, at most, to requirements that preserve provenance and openness)."*

The key concepts that arise in each attempt to describe openness is: "*anything can be* ***freely used****,* ***modified****, and* ***shared*** *by* ***anybody*** *for* ***any purposes*****"**[5]. According to (O. K. Foundation, 2009), an "open work" is a piece of information that satisfies the following three distribution parameters:

1. The work must be publicly accessible over the Internet and made completely available for a reasonable price in an open format. Any extra information necessary to ensure compliance with the licence must be included with the work.
2. The work must be free to use or licensed under an open licence. Additional terms must not conflict with the licence.
3. The work must be delivered in a format that is easily processed automatically and organised by a computer (machine-readable) and allows for easy access to and modification of the work's various pieces. An open format does not have any rules about how you can use it or read it.

   Machine-readable formats are defined in the Open Data Handbook as structured data that can be processed automatically by a computer while in the United States, the Open Government Data Act of 14 January 2019 defines machine-

[4] http://opendefinition.org/od/2.1/en/ last accessed November 2021

[5] https://opendefinition.org/ last accessed November 2021

readable data as data that can be processed by a computer without human intervention while retaining semantic meaning.

While people can easily read standard documents such as PDF (Portable Document Format), HTML (HyperText Markup Language) and Word, computers frequently have difficulty doing so. Machine-readable formats such as spreadsheets and JSON (JavaScript Object Notation) contain a header of CSV (Comma Separated Values). Despite having a standard that is free to use, PDF is not machine-readable, making it unsuitable for OD publishing.

A "work" is a piece of information being transferred. A data file in a specific format can replace "open work" using this thorough description (O. K. Foundation, 2009). This means that any "open data" and "open content" made under the Open Definition must meet the new open work rules.

Furthermore, the concept of “open data” is introduced in the Open Data Handbook by The Open Knowledge Foundation (O.K. Foundation, 2009) as:

"Open data is data that can be freely used, reused and redistributed by anyone – subject only, at most, to the requirement to attribute and share alike"

Despite that the word "open data" has the same etymological roots as "open source", their differences are “open data “is about data and “open source” is about applications. While there are some similarities in openly available source code and data, there are substantial differences in terms of copyright, licensing, the original publisher, and contracts (Lindman & Nyman, 2014). The benefits of data openness are contingent upon the scope of that openness. If data was made available within an organisation, the benefits were restricted to that entity. Improved international communication and organisational performance are two examples of such benefits. If data were made publicly available over the Internet, perceived benefits would be gained on a global scale, such as enhanced transparency or economic development (Lindman, 2014). The goal is to not only promote transparency, efficiency, and public participation but also gain social and economic benefits.

Thus, different actors can expose their data depending on the purposes for which they publish it. One possibility is to explore open models, while others believe that more scaled-down alternatives are preferable. There are also hybrid methods for the openness debate, but ultimately, this choice is determined by the organisation's objectives.

The Open Data Handbook (O. K. Foundation, 2009) recommends three rules when opening data:

1. *Maintain simplicity*. Begin small, with the basics, and fast. There is no necessity that all datasets be made publicly available immediately. It is acceptable to begin even by opening a single dataset—the more datasets that can be explored, the better. This is about innovation. Moving fast is beneficial because it allows for the development of momentum and the accumulation of experience. Not every dataset will be valuable.
2. *Involve users early and regularly*. Engage actual and potential data users and re-users as early and frequently as possible, whether they are citizens, businesses, or developers. It is critical to remember that most data from publishers will not reach users directly but rather through 'infomediaries'.
3. *Address widespread concerns and misunderstandings*. This is particularly important when working with large institutions such as the government. When exposing data, numerous barriers and concerns may be encountered. It is critical to identify the most critical issues and solve them as soon as possible.

2.1.2. Accessing Open Data

Grzenda and Legierski (2021) conducted a study that investigated the typical relationship between publishing and consuming OD, data publication methods, legal difficulties, and file formats. Open Data Catalogues are websites that host OD resources. These data catalogues often include an API that allows the publisher and user to automatically obtain resources and meta-data. These databases are called "Open Data Portals."(Grzenda & Legierski, 2021).

A data portal is a site that allows visitors to browse, search, and filter datasets. This sort of dataset often comprises one or more data files (resources) that may be downloaded in various ways. The data is then stored on the portal or linked to external databases. A dataset also contains metadata about these resources, such as licence information and a title (Grzenda & Legierski, 2021).

Data portal software packages like CKAN (Comprehensive Knowledge Archive Network) are also available, in addition to tailored data catalogues. The Open Knowledge

Foundation created CKAN[6], an open-access distribution platform. Globally, towns, governments, and private data providers use the programme. With over 800 different institutions releasing data to CKAN every day, New Zealand Government is a leader in OGD. The US Government has announced plans to transition its OGD collection to CKAN, unifying datasets previously provided on several sites. CKAN's main capabilities include Content Management System (CMS) integration (like WordPress), community extensions, and aggregating many CKAN instances into one to operate as a meta portal of gateways (Kim, Gil, Nguyen, Won, & Moon, 2021).

2.1.3. Licensing of Open Data

In most jurisdictions, data are protected by intellectual property laws, which prohibit third parties from using, reusing, or disseminating information without explicit authorisation. Even when the existence of rights is in doubt, it is prudent to apply for a licence for clarity (O. K. Foundation, 2009). The correct licensing of disclosed data is vital to the OD movement. The Open Knowledge Foundation's website about licensing[7] noted that a licence is a declaration that formally enables the undertaking of an act that would otherwise be prohibited. It can authorise usage, reuse, ownership, or distribution. With the spread of open-source software came the need for licences that suited the interests of both users and publishers. Data-driven companies should be allowed to use open source code in a single software project, and consumers should be able to do the same. The licensing approaches are based on open source licences since the concepts are comparable.

According to the Open Definition[8], if a licence is open, it must meet permission requirements. A list of allowable licence requirements is also included in the definition. The term "share-alike" refers to the necessity to credit the source of the material and

[6] https://ckan.org/ last accessed October 2021

[7] https://blog.okfn.org/2009/02/02/open-data-openness-and-licensing/ last accessed October 2021

[8] http://opendefinition.org/od/2.1/en/ the latest access October 2021

release any changed work under the same licence. Its guide to OD licencing advocates open licences for creative work and open licences for databases. The Open Data Institute recommends releasing creative work under Creative Commons (CC) licences[9].

2.2 Open Government Data

OD are frequently referred to as OGD, which refers to government-produced and published data in an open format (Charter, 2015). However, a distinction between the two terms is necessary, so this section explains OGD and its relationship to OD.

2.2.1. Open Government Data: definition and concept

The enthusiasm for releasing public data was motivated by the open data movement, which is a movement that supports making data collected by governments available to everyone. The movement advocates for the increased transparency and accountability of government (Kalampokis et al., 2011). As indicated in Section 2.1, the Open Definition mentioned in the previous problem statement is an Open Knowledge Foundation project that has promoted open access for a variety of forms of content since 2004. Open source software and open access are both terms used by the Foundation. The term “Open government data” is in line with them.

It is not new to think of OD, specifically OGD, as information that is available to the public and may be reused for any purpose[10] . Many countries (including the United States, the United Kingdom, Canada, and New Zealand) announced in 2009 new programmes to open up their public data, making OD a significant topic of discussion in that year. In an executive order issued by the USA President in 2013 (White House, 2013), it is postulated that the most significant benefit of OD is the provision of information resources that are freely available, easy to find and accessible as open data has high value when shared, and little or no value when locked (Janssen, Charalabidis, & Zuiderwijk, 2012).

[9] https://theodi.org/article/publishers-guide-to-open-data-licensing/ last accessed October 2021

[10] https://www.oecd.org/digital/digital-government/open-government-data.htm last accessed October 2021

The Open Knowledge Foundation (OKF) defines Open Government Data[11] as:

> *"Data produced or commissioned by government or government-controlled entities"*
>
> *"Data which is open as defined in the Open Definition – that is, it can be freely used, reused and redistributed by anyone"*

OGD is a subset of government data and OD. The OKF (O. K. Foundation, 2021) identifies three primary aspects of OGD:

- Transparency: In an effective and efficient government, citizens need not simply to have access to government data; they also need to utilise, reuse, analyse, visualise, and share it more openly and freely among themselves.
- Social and economic value: In today's digital age, governments must unlock the potential of their long-held data and information to get additional social and commercial benefits from their data collections and stimulate innovation.
- Participatory governance: In an environment of OGD, citizens are more proactive and actively participate in decision-making processes. This is more than just openness; it facilitates the establishment of a fully 'read/write' society. Citizens are not passive recipients of information about what is happening in their governments; they are active participants in effecting change and transforming situations for the better.

Governments possess large high-quality data generated during routine operational activity. It is hard to estimate or conceptualise the entire body of benefits from releasing that data to the public domain, as there is an unlimited variety of emerging methods to use the data to create added value.

Furthermore, the value enhancement of OD based on their granularity, accuracy and congruence may contribute to creating new product and service offerings, coupled with

[11] http://opengovernmentdata.org/ last accessed November 2021

a higher level of accountability (McKinsey, 2014). As per the definition found in the OECD (Organisation for Economic Cooperation and Development) working paper, (Ubaldi, 2013), OGD are produced by governments with public funding as a set of policies that aim to boost transparency, accountability and value creation. However, there have also been concerns about how to open government-produced data in order to maximise the benefits of their usage. All levels of government agencies ought to develop policies and processes to unharness relevant, accessible, and beneficial open data to encourage innovation, foster a better-informed public, and build economic opportunities. Moreover, OGD will create a crucial distinction in promoting business innovation and the development of innovative services both within and outside the government that provide and use the data.

The Open Data Institute (https://theodi.org/article/what-makes-data-open/) argued that what can be defined as good open data is:

- *linkable, so that it can be easily shared and talked about*
- *available in a standard, machine-readable format, so that it can be quickly processed*
- *highly available and consistent over time, so users can rely on it being traceable, through any processing, right back to the providers so that users can be convinced of its validation*

As described above, the primary disclosure obstacle of the OGD value is the quality of the data sets. A report found that 60% of the time spent by data analysts is on cleaning up data. Non-machine readable or non-standardized formats and impermanent data are common in government data. Janssen et al. (2012) claimed that the open data process hinders innovation and the creation of value in the socio-technical framework.

Open data and OGD are related to (but are different from) the recently emerged concept of big data. Figure 2-1 shows a Venn diagram (USCCF, 2014) about interrelationships among OGD, OD and government data. The diagram identifies and differentiates big data and government data from the ideas of OD, as well as highlights areas of overlap. OD is characterised by how it is used, in contrast to big data, which is identified by its volume. Area one covers government data that are acquired for official government operations that are not publicly accessible. This includes, for example, census, military, and citizen health data. Area two refers to big data that is non-governmental. This comprises both massive datasets from the private sector and scientific research such as retailer customer and Global Positioning System (GPS) data. OD is intended for public

use in which benefit supports and stimulates any companies, not just in specific industries as shown in area three. This category includes, but is not limited to, business reports, customer complaints and feedback collected over a longer period. Area six describes that big, free data do not need to originate from the government. More scientists share their astronomy, genetics, and other findings. Other scholars analyse market trends utilising big data from social media. Area four discusses moderate-sized government datasets. This area may contain useful data that published for citizens, such as budget reports or information on local services. It is enormously valuable when governments publish big data as visualised in part 7. Government organisations can open massive data such as geospatial datasets with significant economic benefits.

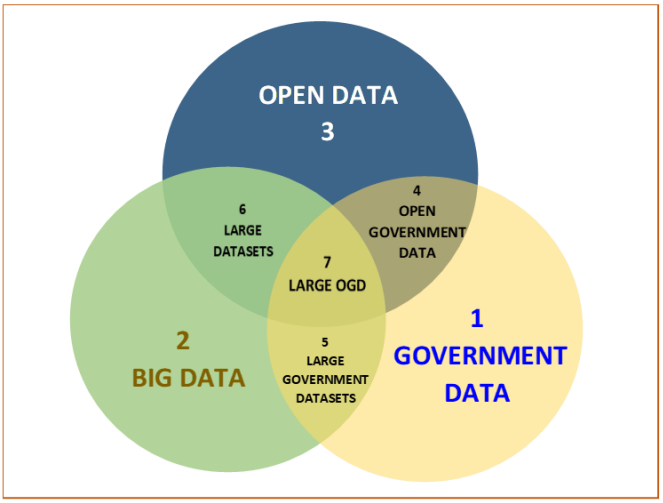

Figure 2-1 Interrelationship among big data, open data and government data. Adapted from (USCCF, 2014)

Open data may play a critical role in developing new business models while big data can facilitate strategic decision making within established businesses. For example, customer records held by businesses (an example of big data), are mostly used for internal purposes such as business analysis and marketing. Big data can also be open data; open data sets are designed for public use in all sectors.

2.2.2. Value of Open Government Data

As a result of the release of OGD, a wide range of stakeholders can benefit, from commercial businesses, communities, academics, and journalists to the public (Luna-Reyes, Picazo-Vela, Luna, & Gil-García, 2016). Having OGD makes it possible to combine and use data from government agencies for data-driven services (Janssen, Konopnicki, Snowdon, & Ojo, 2017) resulting in indirect benefits for data-driven service

end users. Thus, a significant enabler for co-creation has emerged with the onset of OGD (G. Magalhaes & Roseira, 2020). By and large, when public sector datasets are shared, they can be used in new ways, not just for the governments, but also for the benefit of private businesses and their employees and clients, for commercial reasons. The usage of OGD generates value for the public, ranging from tangible to intangible advantages, across a wide variety of disciplines, including culture, science, economics, statistics, meteorology, and the environment (W. W. W. Foundation, 2015, 2019).

According to a 2017 report published by The Open Data Impact's portal[12], the OD initiatives arise from matching market forces; therefore, its outputs and activities can serve more diversified users and goals (Verhulst & Young, 2017). Figure 2-2 depicts Verhulst and Young's open data logic model, which targets specific actions and outputs to enhance OD development. The model describes that as long as certain conditions (enabling and disabling factors) are met, governments and non-governmental organisations (NGOs) can use OD supply to their advantage in a variety of ways (actions and outputs) to improve government transparency, give citizens more control, boost economic potential, and address systemic issues (impact). These beneficial impacts depend on local, perspective factors and hindering variables.

According to Verhulst and Young (2017), the logic model is based on the hypothesis of twelve in-depth case studies that more impact open data initiatives arise from aligning supply to demand of actors that can implement open data toward specific roles and results. For this study, the model can be adopted as a fundamental concept of business models to examine OGD network, actors, context and business model possibilities.

[12] https://odimpact.org/developingeconomies.html Last accessed January 2022

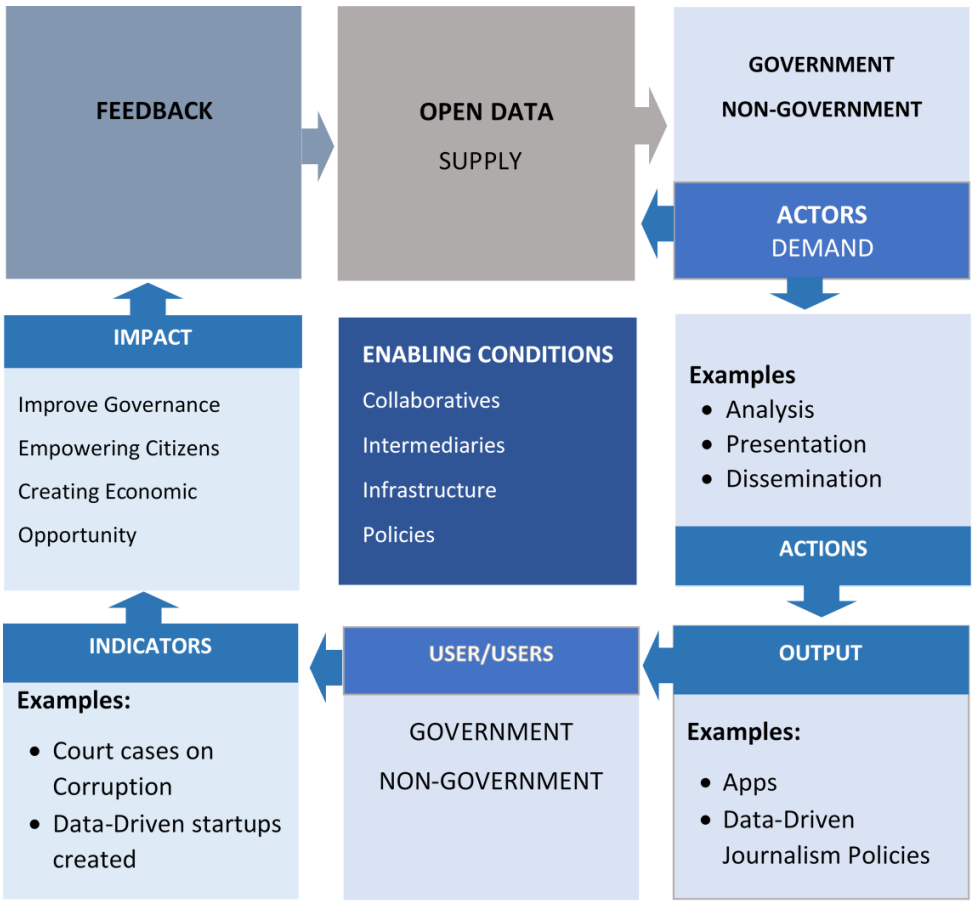

Figure 2-2 Logic model of Output and Activities of Open data's Actors. Adapted from Verhulst and Young (2017, p. 10)

To realise the claimed benefits of open government, researchers agree that a significant problem is ensuring that when data is published in the appropriate format, time, and location, it is actually used (Charter, 2018; Zuiderwijk, Janssen, & Davis, 2014). To ensure that data publishing and use are motivated by a societal incentive, OD initiatives in the so-called OGD ecosystem are used (Dawes, Vidiasova, & Parkhimovich, 2016; Zuiderwijk et al., 2014). An ecosystem must include stakeholders, responsibilities ranging from production to use, and paths connecting the various pieces. This method evolved from data-, program-, user-, and impact-oriented approaches and OGD's application of a holistic view of value (Dawes et al., 2016; Zuiderwijk et al., 2014). This logic implies that value is created in a local OGD ecosystem as data is published and used by municipalities and residents. Data specialists moderate this relationship. These data specialists are referred to in the literature as infomediaries (Janssen & Klievink, 2008, 2009; Janssen & Zuiderwijk, 2014), and they often possess the ability to contextualise data in such a way that it becomes tangible to citizens. After information

intermediaries and citizens have processed or examined the data, value is produced. Section 2.3 will discuss about OGD ecosystems.

All levels of governments need to develop policies and processes to release relevant, accessible, and useful open data sources to enable innovation, foster a better-informed public, and create economic opportunities. Moreover, OGD can make a critical difference in promoting a variety of business innovation for actors who provide data, use data, and develop innovative services. A report from Capgemini (2013) describes OGD Initiative findings from 23 countries that categorise based on positioning and pace of adoption, namely the beginner, follower and trendsetter. It looked at various aspects of data availability, political leadership and data usability.

According to the report, user participation was also higher in trendsetting nations such as the United Kingdom, the United States, France, Canada, and Australia, where data were given with greater granularity, and datasets were constantly updated. Good OGD primarily boosts economic growth and increases public values (Janssen et al., 2012; Pereira, Macadar, Luciano, & Testa, 2017; Susha, Grönlund, & Janssen, 2015). In addition, Capgemini's analysis revealed that over 60% of trendsetting nations were capable of initiating conversations with website users over the sharing of specific data. 56% of all data came from low-quality datasets, while 96% of nations failed to update their open data regularly. In contrast, most nations have adopted open data through a top-down strategy, resulting in a lack of information flow between the public and government.

2.3 Ecosystems and Open Government Data

2.3.1. Concepts of ecosystem

Many environmental scholars utilise the notion of ecosystems to emphasise the various and varied interactions between data suppliers, users, infrastructure, and establishments in the field. The term “ecosystem” is defined as "a network of people, practices, values, and technologies in a specific local environment" (Nardi & O'Day, 1999, p. 49); with an emphasis on people activities that are supported by technological means, these networks are socio-technical. Ecosystems are made up of components that interact and are linked together, signifying a high degree of interdependence. Depending on the ecology, different parts will have different properties. Systemic change is inevitable because of the interrelated and interacting components that impact each other. Since

there are so many players and resources that may be connected via ICT (Information and Communications Technology) and because an ecosystem's health depends on the variety of people, technologies accessible and ideas to adapt to change, an ecosystem is diverse both empirically and pragmatically.

Ecosystems, according to Nardi and O'Day (1999), have a movement of humans, behaviours, activities, and ideas in a dynamic motion. Constant adaptation and modification occur within the ecosystem's components, resulting in an ever-evolving state of flux. This is a normal feature of a healthy ecosystem's dynamic system that robust ecosystems have.

2.3.2. Creating Open Government and Open Government Data Ecosystems

An ecosystem is an organising structure for open government that O'Reilly (2011) initially introduced in one of the earliest documented studies. While ecosystems are natural phenomena that may be applied to any contemporary socio-technical sector and can be seeded, simulated, and enhanced, they can also be purposefully fostered to achieve a management or policy aim. The vision of O'Reilly (2011) about the open government ecosystem places government agencies at the centre, leading to a networked system organised to achieve specific objectives connected to innovation and good governance.

Furthermore, Zuiderwijk et al. (2014) created and defined the notion of an OGD ecosystem precisely. They define an ecosystem as a collection of interrelated actors, elements, and components within a multidimensional structure that functions cohesively. Ecosystems interact with socio-technical systems of organisations, infrastructures, and resources within the open government and OGD domains. To examine such ecosystems, Zuiderwijk and colleagues conducted a literature review and created a hypothetical scenario that included a setting, a series of individuals with defined goals, and a sequence of events that included those actors pursuing their goals. Figure 2-3 shows the scenario that consists of 20 distinct actions that are recurrent, interconnected, and do not always follow a linear sequence. The actions, however, are divided into two categories of actors: data producers, including the context of release, and data users. The data users may include app developers, but they may also include activists who utilise data to campaign for particular causes and journalists whose data analysis is seen by a larger or different audience. The authors identify three primary roles: producers, users, and infomediaries.

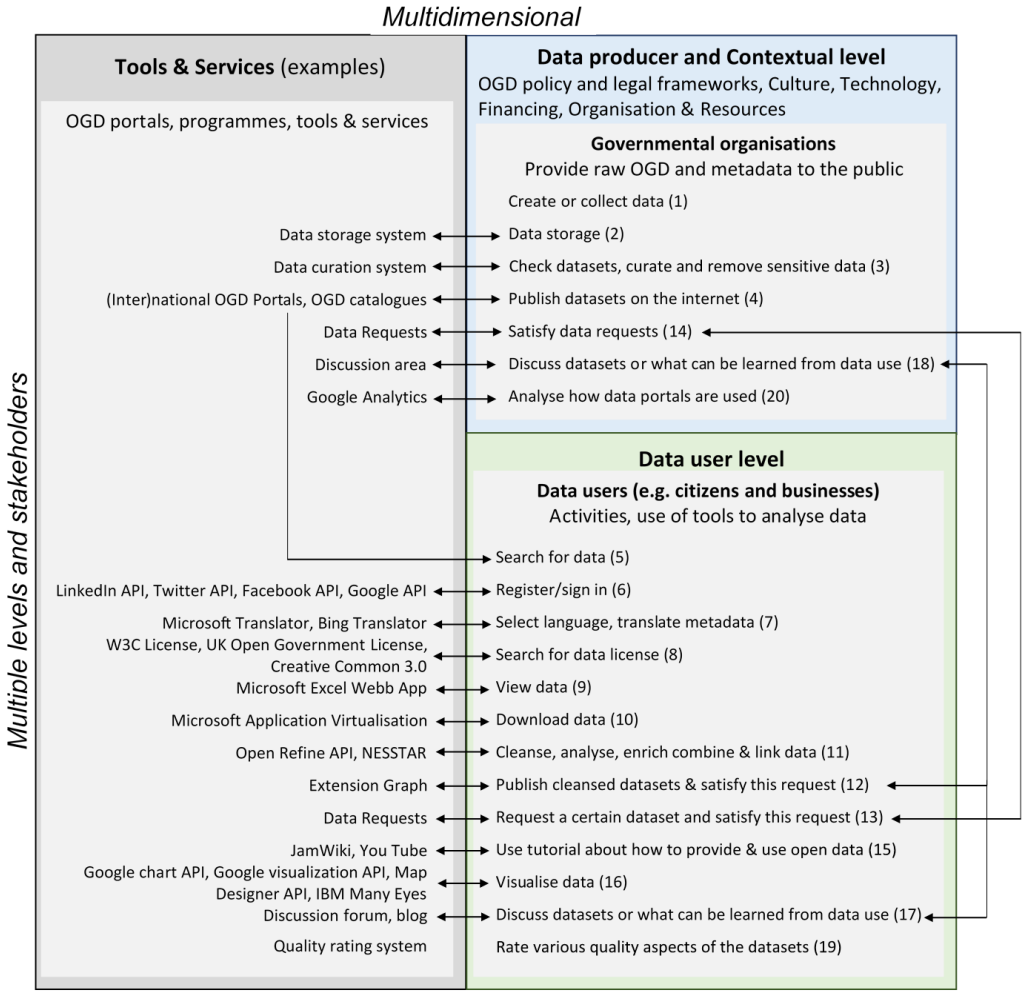

Figure 2-3 Elements of an OGD ecosystem. Adapted from Zuiderwijk, Janssen and Davis (2014)

Zuiderwijk et al. (2014) developed four critical elements of OGD ecosystems. The first is the online publication of data, which they describe as a fundamental and beginning step. Following this comes the discovery process, which includes looking for, reviewing, and displaying data and all associated licensing and intellectual property challenges. The third element entails data manipulation, analysis, and visualisation. The fourth critical component is the more intellectual component of interpretation, which entails sharing understanding with others and providing feedback to the government entity responsible for the release. Along with the critical aspects, Zuiderwijk and colleagues added three more elements that connect the previous four and help them create a coherent whole. These include how OGD can be used, a method for managing data quality, and metadata that connects all the above.

Other scholars (Dawes, Vidiasova, & Parkhimovich, 2016) adopted the ecosystem approach in comparative case studies of OGD released in USA and Russia. Dawes and colleagues described open government as a valuable model for designing efficient OGD ecosystems that emphasise growth through the co-creation of actor-process and self-organising networks. Although they began with a governance viewpoint, their final goal was normative, using case studies to integrate current methodologies into an ecosystem model that could be used to create and develop OGD programmes. Dawes and colleagues characterise ecosystems as complex systems of actors and processes but place a premium on feedback and long-term evolution. The study employed a mix of approaches to compare two empirical case studies, resulting in a preliminary ecosystem model. The model supports the planning and design of OGD initiatives by comparing program context, structure, interactions, productivity, and stakeholder benefits.

2.4 Business models

Research into the relationship between business models and key organisational viewpoints and limits has been extensive. Some of their business concepts are reused, while others are expanded upon.

2.4.1. Definitions and concepts

"Business model" acquired theoretical backing at the start of this century (Amit & Zott, 2012). As a matter of fact, the term was first used in the 1960s (Bellman, Clark, Malcolm, Craft, & Ricciardi, 1957). To understand the business model, there are two interrelated driving variables (Costa Climent & Haftor, 2021). Technology-based enterprises like Facebook, which grew at a previously unknown rate and size, were the first example (Parker, Van Alstyne, & Choudary, 2016). For the second factor, the prevailing theory on strategic innovation and business could neither explain nor foresee such value creation. As an example, the iPhone was introduced at a period when such an entry into the mobile phone business was implausible (Parker et al., 2016).

The way businesses are conducted has changed significantly with the rise of the internet and introduction of telecommunications technology, which has in turn led to a greater interest in the concept of business models (Allan Afuah, 2014). Other literature (Zott & Amit, 2007) considered that a business model is defined as a new unit of analysis, whether formally or implicitly.

Research on business model innovation has reached a consensus, according to Zott (2011). The study published a literature review that established obstacles to business model advancement in current companies, such as the arrangement of infrastructure and systems, and the failure of market leaders to recognise the value potential of a new business model. According to another academic (Wirtz, 2017), the business model is not only an organisational change and a facilitator of technology but also sensitive to strategy development in the utilisation and sharing of resources. However, these scholars often focused on a single actor, feature, or platform, and do not address holistic ecosystems' complexity adequately.

The foundation of a company's success is its business model. This is how a firm develops and utilises its resources to better serve and generate revenue for its customers than its competitors. It explains how a company is presently earning profit and how it expects to do so in the long term (A. Afuah & Tucci, 2001). This approach gives a company a sustainable competitive advantage and a better long-term performance than its rivals. It is reasonable to learn of its business model as a dynamic network of interconnected systems.

Various researchers have defined the term business model to refer to different perspectives that vary according to an organisation's goals. Given the importance of the business model, it has been described and categorised in a range of conceptualisations. Table 2.1 provides an overview of business model definitions.

Table 2.2 shows that definitions of business models emphasise the concept that a business model is made up of numerous elements that cover a wide range of organisational strategic goals and practice areas. In order to provide economic value to consumers and stakeholders, several business model conceptualisations emphasise the roles and duties of those involved.

Table 2.1 A compilation of business model definitions (sequenced by year and author's name)

Concept	Definition	Literature sources
Structure	A structure or system that collects resources for company success	Al-Aali and Teece (2013, p. 22)
	Designing the business's architecture and then planning expansion paths from there	(Teece, 2010)
	A comprehensive strategy based on the deconstruction and reconstruction of value chains	Timmers (1998, p. 4)
A conceptual tool	A conceptual tool that comprises key factors and their interactions that enables the firm's logic to describe its profitability	Osterwalder and Pigneur (2010)
	A network of independent activities that extends outside and transcends the bounds of the firm	(Amit & Zott, 2012)
Innovation	Increased market unpredictability and dynamism forces firms to constantly adapt their business models	Casadesus-Masanell and Ricart (2010)
	A focusing device that guarantees technology innovation creates economic benefit for customers	Chesbrough and Rosenbloom (2002, p. 549)
	"Who is the customer?" What does the customer value? How do we make money? How can we deliver value?	Magretta (2002, p. 4)
Substantial changes	Aside from economic concerns, sustainable organisations strive to integrate social and environmental objectives	Nidumolu, Prahalad, and Rangaswami (2009)
Information systems	A connection between business strategy and information technology-enabled business processes	Al-Debei and Avison (2010, p. 374)
Integration of business model and sustainability concepts	Developing firms that are self-sustaining rather than profit-maximizing	Boons and Lüdeke-Freund (2013)
	Integrated approach to sustainability's three components – social, environmental, and economic	Bocken, Short, Rana, and Evans (2014)
Unit of analysis	The value proposition of a business model must be ensured in terms of how it will retain its competitive advantage	Afua and Tucci 2003
	A business description that clarifies the scope of a firm's activities	Demil and Lecocq (2010)
A blueprint of a firm's logic	The objective of creating, distributing, and capturing value	Haaker, Bouwman, Janssen, and de Reuver (2017)
Profit maximisation	Profit maximisation is still at the forefront of business models	Schaltegger, Hansen, and Lüdeke-Freund (2016)
Integration of social and ecological values	Sustainable organizations strive to integrate social and ecological values	Massa, Tucci, and Afuah (2017)
Holistic reflection	A comprehensive examination of how a business's strategy is adopted	Lozano (2018)

Source: Author's compilation

Consequently, a business model is a sensible strategy or framework that incorporates the rationale, the method of action, and the period in which a company's business endeavours are carried out. It supports companies in developing, deploying, and pricing

products and services consistent with their value propositions (Osterwalder & Pigneur, 2010). Margretta's persistent questions are indicative: Who is the customer? What method of communication does the consumer prefer? In order for a firm to deliver value to its consumers at a reasonable price, what is the economic rationale? (Haaker et al., 2017). According to Amit and Zott (2012), business models are important because they play a critical role in explaining firm success. In business models, we can see how a company uses its resources to help its customers. It helps make the company more competitive (Schaltegger et al., 2016).

A traditional business model emphasises the integration of value creation and value capture within a company when used as a unit of analysis in an organisation's strategic assessment (Amit & Zott, 2012; Chesbrough & Rosenbloom, 2002; Demil & Lecocq, 2010). Lozano (2018) suggests that business models may help firms better understand how new opportunities are created by focusing on their entire business operations rather than just the most relevant ones and how various organisations function. The interaction of actors like government agencies, infomediaries, intermediaries, and private organisations leads to business innovation in the open data ecosystem (Immonen, Palviainen, & Ovaska, 2014). This work therefore assumes that OGD will have an ecosystem where each actor plays a role and has relationships with all other parties (Teece, 2010).

In addition to these conceptual bodies, there are simultaneous theory developments, such as innovative value (Schumpeter, 2010), externalities (Arthur, 1990), and network of relationships (Gulati, Nohria, & Zaheer, 2000). Researchers conducted experiments with the unification of several theoretical entities (Zott & Amit, 2007). For this business model to be effective, it had to include the theories of these theoretical entities (Teece, 2010). As opposed to Osterwalder and Pigneur's dynamic business model outlook, this theoretical synthesis represents a massive difference. It has the advantage of providing a viable conceptual framework for characterising a company's business model (Osterwalder & Pigneur, 2013).

2.4.2. Business ecosystems and frameworks

According to Amit and Zott (2012), business models are recognised as a new unit of study. Some studies looked at business models from the viewpoint of focal organisations and their boundaries. Some of them are identical in terms of the components of their business models, while others have novel elements. Even if this brings multiple

interpretations, most discuss how data users and providers might benefit from open data. According to Amit and Zott (2012), there was consensus on some core issues of research on business model innovation. The study conducted a literature review that identified barriers to business model innovation in existing firms, such as the configurations of assets and processes and the skill inability of firm's leaders to recognise the potential value of a new business model.

Another group of scholars acknowledged the business model is not only a catalyst for innovation, but it can also be subject to strategic change (Wirtz, Weyerer, & Rösch, 2017). Those scholars, however, often focused on a single actor, feature, or platform, and did not adequately address the complexity of holistic ecosystems. Further studies have shown that the idea of cooperative networking between actors as a public-private partnership is necessary for future public sector informatisation (Janssen & Zuiderwijk, 2014). Furthermore, business ecosystem literature is focused on J. F. Moore (1997), who described the business ecosystem as the framework of interactive organisations. The literature on business ecosystems includes platform architecture (Milinkovich, 2008) and dynamic networks (Corallo, 2007). In Figure 2-5, Moore noted that in a business ecosystem, organisations are increasing their innovation capabilities: they work together to facilitate the flow of data processes and ultimately implement disruptive technologies.

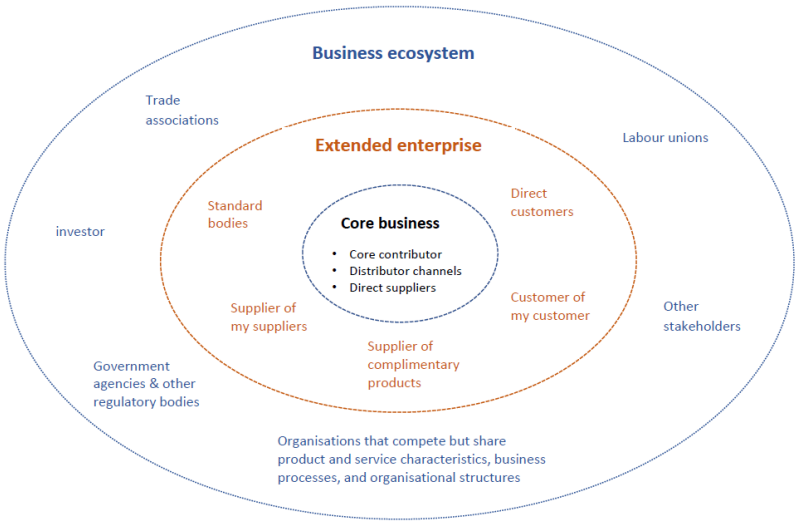

Figure 2-4 A framework of a business ecosystem. Adapted from (J. F. Moore, 1997)

The framework describes three broad classifications applied to the central actors in a business ecosystem: *core business*, which includes core contributors, distribution channels, and direct suppliers; *extended enterprise*, which includes customers,

customers of customers, standards bodies, suppliers of complementary products, and suppliers of suppliers; and *business ecosystem*, as the umbrella concept, which includes government agencies and regulators, as well as groups and standards bodies representing customers or suppliers. To a greater or lesser extent, an ecosystem includes enterprises that are the direct competitors, as well as other businesses that have the potential to compete or any other key community members. However, a business ecosystem also consists of these major actors' owners and other stakeholders. This framework can be used to pinpoint the strengths and weaknesses of an ecosystem and to determine an ecosystem's potential for future growth.

The key principle of a business ecosystem is that networks between organisations need to be examined at a higher conceptual level rather than from the level of individual organisations. The scope of a business ecosystem is the group of dynamic relationships between actors. Notwithstanding the strength of the organisation, all players in the business ecosystem are connected and share the success or failure of the network.

Unlike many business ecosystem models where data is provided on a regular basis, open data ecosystems operate differently. Open data from the government agency as the primary source is often generated within natural monopolies (Heimstädt, Saunderson & Heath, 2014). If, for whatever reason, the government agency fails to provide data publicly, its value proposition cannot be affected. On the contrary, data-driven companies that create OGD-based businesses will not be able to continue their business. For this reason, the OGD ecosystem must have robust mutual interdependence rather than one-sided dependence. Finally, with the ecosystem open data business model, any open data provided by government agencies must be processed cyclically. The business model can make symbiotic connexions to the open data process, enabling high quality and continuity of open data and reciprocal relationships between actors, particularly government agencies and DDO.

Each organisation shall develop its business models in order to deliver targeted value, starting by analysing them, testing them and then reviewing them when necessary (Downes, 1998; Magretta, 2002). Perhaps the most important reason for this research to build business models across government agencies and DDOs is that they have an appropriate programme to create, deliver and obtain OGD value (Micheli, Schoeman, Baxter, & Goffin, 2012; Zeleti & Ojo, 2017). Ecosystem business models need to be sustained as to how these entities will develop value on a scale and represent the relationship between the organisations.

A business model is not only useful for profit-oriented companies; all organisations should have business models that may vary across sectors. While non-profit entities such as government agencies do not offer financial returns, they are still accountable for providing stakeholder interest on a scale by turning interest into a sustainable business model. Marijn and George (2009) described that government agencies are often organised in a hierarchical and bureaucratic manner. The scholar examined the relationship between the six elements of the E-Government Business Model, as shown in Figure 2-6. Every organisation (1) having a collection of business processes (4), resources (5) and complex capabilities (6) to be incorporated (3) to create a service offering (2). Business process (4) needs resources (5) and networks (6) to provide service (2) repeatedly over a period of time (7). Interestingly, aspects of the external environment, such as the dynamics of the public sector, the pressures of private companies and the motivation of policymakers and citizen engagement, have a major effect on creating a sustainable business model. From another perspective, I can say that one of the key external environments associated with the OGD initiative is DDO as users.

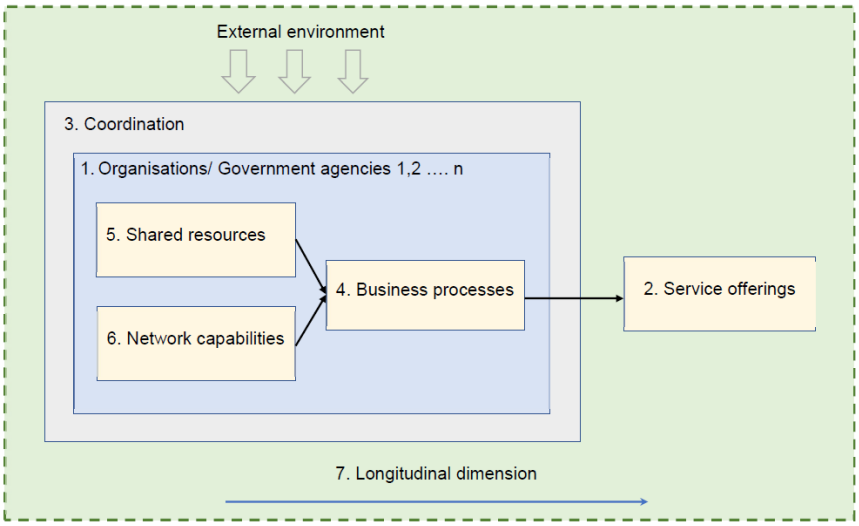

Figure 2-5 A framework of E-government business models. Adapted from Janssen and Kuk (2007)

In this section, the study will focus on the premise that government agencies, as dataset providers, must develop a strategy for managing the interdependencies amongst DDOs by adapting to the OGD initiative.

In addition, DDOs must also make efforts to create a shared ecosystem for OGD. Le Dinh, Phan, Bui, and Vu (2018) investigated the need for these organisations to establish

a new generation of knowledge management systems to leverage all available data. This means organisations must promote the co-creation of information between their business environments and government agencies to generate innovation. The full advantages of business models can be realised by focusing on five areas: personnel management, technology, leadership, company culture and decision making (McAfee, Brynjolfsson, Davenport, Patil, & Barton, 2012).

2.4.3. Business model tool: Osterwalder's Business Model Canvas (BMC)

Osterwalder and Pigneur (2010) invented the Business Model Canvas (BMC), currently known as the BMC, a widely used approach for building business models. Customer segments, value proposition, customer relationships, channels, key resources, key activities, key partners, cost structure, and revenue streams are the nine building blocks of the BMC, which may be used to organise and create business models. According to previous research, the BMC is the most often used business model representation as a current reference for business models (Täuscher & Abdelkafi, 2017), aside from the fact investigated by Marco et al. (2017), that it has several potential uses.

The BMC has been used to improve concepts in the literature on business models and to create a long-term business plan.(Barquet, de Oliveira, Amigo, Cunha, & Rozenfeld, 2013; Heyes, Sharmina, Mendoza, Gallego-Schmid, & Azapagic, 2018). Therefore, this research adopted the BMC for designing ecosystem business models. The BMC provides a template with nine building blocks as seen in Figure 2-7.

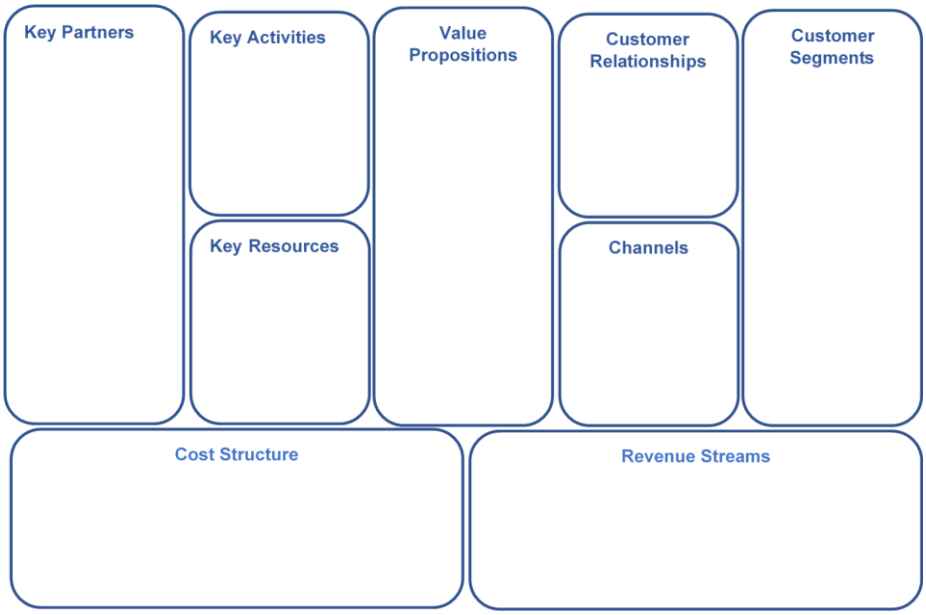

Figure 2-6 A template of Business Model Canvas (BMC). Adapted from the official template of Business Model Canvas[13]

The nine-block framework is described below:

1. Customer segments

As a result of its importance, this is the cornerstone around which a company's service offerings will be based. To be successful, a company needs to put its customers first (Osterwalder & Pigneur, 2010). A company's value creation or enhancement is aimed at a specific market sector, known as its "target market segment."(David-West, Iheanachor, & Umukoro, 2019).

2. Value proposition

A client's problem is solved, and a customer requirement is met by this economic and social value (Chen, Cheng, & Mehta, 2013; Osterwalder & Pigneur, 2013). In order to attract and keep customers, every value proposition includes a specific set of products

[13] https://www.strategyzer.com/canvas/business-model-canvas. Last accessed June 2021

or services tailored to meet the needs of a specific market niche. Value innovation distinguishes good company value propositions from those given by competitors.

3. Channels

These are how goods and services are made available to clients. Through channels, a company connects with and delivers goods to its customers. Understanding market segmentation helps establish the best ways to serve clients (David-West et al., 2019).

4. Cost structure

This element helps the company answer questions like: What are the essential costs connected with the business, and what are the options for covering them? Operational efficiency is directly related to the company's operating costs structure (Osterwalder & Pigneur, 2013).

5. Revenue streams

Osterwalder and Pigneur (2013) raised an important issue that all firms must deal with: what are customers willing to pay for? Revenue sources must be included in the business model once the client demands have been determined to be appropriate.

6. Customer relationships

With customers, either directly or indirectly, these are the kinds of interactions established (Osterwalder & Pigneur, 2010). A company's relationship with its customers directly impacts customer loyalty.

7. Key activities

In order to provide a customer's value proposition, these are the actions an organisation engages in (Chen et al., 2013). According to Ahmadi Zeleti, Ojo, and Curry (2016), these tasks are the most important measures an organisation must take to ensure the sustainability of its business model.

8. Key resources

To carry out essential activities, a company must have access to a variety of financial and nonfinancial resources, collectively known as its "key resources" (McNally, 2013; Chen et al., 2013).

9. Key partners

Long-term inter-organisational partnerships are crucial to the strategic success of the partnering organisations in these major networks. Business model innovation requires a

broader perspective of the value network that includes stakeholders other than the company, its customers, and its shareholders (Chesbrough & Rosenbloom, 2002; Osterwalder & Pigneur, 2003)

2.5 Open Data and Open Government Data Business models

2.5.1. Open Data business models

Few researchers have investigated the topic of business models in terms of open data; two research organisations conducted notable studies, McKinsey (Manyika et al., 2013) and Deloitte (Foulonneau, Martin, & Turki, 2014; Manyika et al., 2013), by justifying the possibilities for innovation offered by open data. As part of Deloitte and the Open Data Institute's open data study, there were four types of open data business models: suppliers, aggregators, developers and enrichers (Foulonneau et al., 2014; G. Magalhaes et al., 2014).

On the other hand, studies on the topic of OGD business models are limited. Research into 13 Italian companies with data reuse industry sectors by (Ferro & Osella, 2013) developed eight typical business models for open data re-use. Ferro and Osella's examination of the OGD business model archetypes was more financially informed. By examining the real-time of re-used datasets, (Foulonneau et al., 2014) investigated how open data-based services are evolving. They suggested distributing applications based on specific themes using open data portal datasets. Although their study focused on using open data, it falls short of identifying its potential value.

2.5.2. Open Government Data business models

A few scholars have studied OGD business models to date. Each business model "archetype" was developed in terms of centrality and the significance of OGD value by (G. Magalhaes et al., 2014). Governments and OGD users may use the approach to outline the argument regarding the economic benefits of OGD. However, the networking and ecosystem of OGD were not discussed. Magalhaes' analysis identified three OGD business model "archetypes": enablers, facilitators, and integrators. Explanations of each type are shown below.

- **Enablers.** These firms offer applications and software tools designed specifically for use with OGD to data users. Governments rely on enablers to provide emerging technologies for data collection, management, and public disclosure on the supply side (G. Magalhaes et al., 2014). Governments at all levels will need to cope with vast amounts of data in the years to come, and IT developers, for example, might

play a significant role in making this possible. For end-users, enablers offer services that integrate multiple data types in a novel way.

- **Facilitators.** Access to OGD is encouraged by facilitators who accelerate data access and interchange between the data supplier and data consumers. As a result, facilitators assist other private sector organisations and government agencies in delivering mandatory data to the public sector (G. Magalhaes et al., 2014; L. Magalhaes, 2015).
- **Integrators.** OGD-enabled enterprises use this business model to enrich their current product or service portfolios. An integrator is a data-driven company across many sectors that uses OGD integrated with its data to enhance its business value (G. Magalhaes et al., 2014). As a result, they can reveal potential benefits from OGD to add value to their services/products (L. Magalhaes, 2015).

Another study from (G. Magalhaes & Roseira, 2020) conducted a case study of U.S. firms using OGD in various industries. The study presented twelve atomic models of how open government may bring economic value to companies, which are then decomposed into 12 atomic business models.

The 12 atomic business models are advocacy, consultancy, data refining, data structuring, single purpose apps, interactive apps, data platforms, open data portals, business intelligence, process optimization, product/service improvement, and research and development.

OGD business model patterns were developed by investigating the conceptual framework of Open Data Business Models (Ahmadi Zeleti, Ojo, & Curry, 2016). As a design artefact for analysing current OD business models in practice, Zeleti and colleagues developed a 6-Value business model framework. The BM framework is based on five basic ODBM patterns, and then the scholars added a new pattern: usefulness, process improvement, performance, and customer loyalty. Despite the 6-V business model framework supporting the government's ability to sustain business models, the existing key patterns are not OD models but revenue models, pricing strategies, distribution models, and marketing methods.

2.6 Data-driven organisations (DDO) and Open Government Data (OGD)

Lately, organisations have turned to analytics to stay competitive by adopting the strategy of becoming data driven. Thus, the goal of evolving into a data-driven decision-making organisation pushed them to overcome challenges in both their technological and human resource infrastructures (Power, 2015). The concept of data collection and analysis adopted by organisations, for example, Computerised Decision Support Systems (DSS), started to be implemented to support business in the mid-1960s. Information System implemented by organisations to integrate their data for providing business information and knowledge has been expanded since the 1970s (Srinivasan, 2016).

Being a DDO is not about gathering better or more data from different sources, but instead about how integrating data into organisation's decision-making process. When data is collected as it is generated, properly processed and guided in decision making, analytics and data-driven decision support may become the standard for decision making (Joseph, 2020).

Anderson (2015) defines data-driven organisations as "*a data democracy and has a large number of stakeholders who are vested in data, data quality, and the best use of data to make fact-based decisions and to leverage data for competitive advantage*." Yet to benefit from a data-driven culture, organisations should use and analyse data to drive action or an intentional inaction (Halper & Stodder, 2017).

Anderson's research reveals the practices of a DDO, and the study was used as a model for creating strategic directions for firms (Anderson, 2015). Several factors for creating strategic directions for a DDO have been identified as follows:

- Leadership in which data is an important strategic asset and should be preserved to make smart decisions.
- An open and trustworthy culture. DDO are defined by their data culture: a collection of beliefs, behaviours, and practices that support an open and transparent data-driven culture. Aside from collaborating with other departments, everyone is needed to establish interactions with the company's key partners.
- A culture of self-service analytics, with ad-hoc analysis and predictive analytics taking up the majority of time. Most regular reports are generated automatically.

The top three North American corporations use data-driven decision making, and McAfee et al. (2012) discovered that these companies are 5% and 6% more profitable than their competitors. The more data-driven a company is, the better positioned it will be in terms of financial and operational metrics.

Zeleti and Ojo (2017) developed a framework of the competitive capability to examine how governments, as producers of open data, may become key partners for a DDO by perceiving OGD as a strategic resource for businesses. Figure 2-8 describes an organisational capabilities framework encompassing four critical areas and value-adding activities. This proposed framework can acquaint a DDO with the areas in which they must plan and establish a strong picture and actionable foundation for leveraging OGD-related sources and capabilities to boost competitiveness.

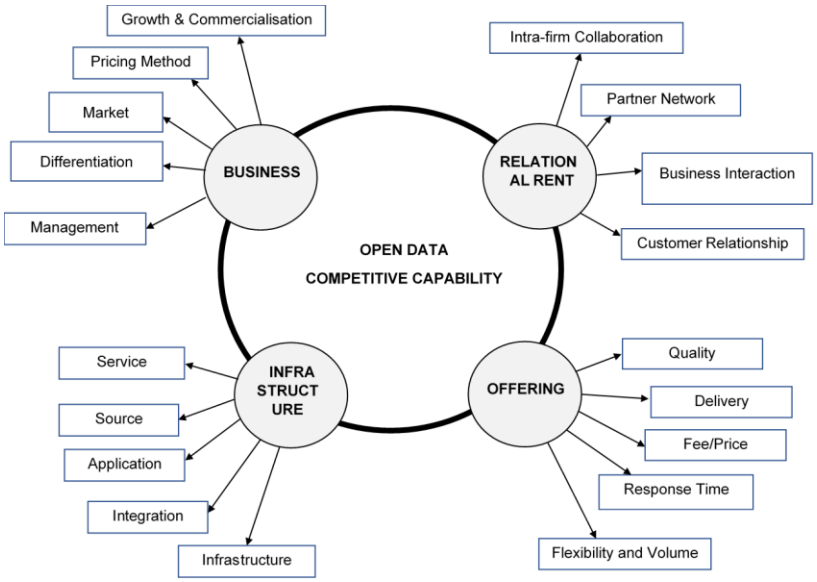

Figure 2-7 Open data competitive capability framework for a DDO. Adapted from Zeleti and Ojo (2017)

The framework assists a DDO in developing a comprehensive vision and actionable foundation for leveraging and exploiting related resources and skills to enhance competitiveness. This framework consists of four categories and value actions that integrate the company's business and technological expectations and assists them in many ways. By utilizing the relational rent structure, a company can establish relationships across stakeholders, lowering business and technology risks.

Thus, the framework defines a complete vision and actionable foundation for successfully harnessing and exploiting OD-related resources and skills to boost

competitiveness. Moreover, to connect DDOs' business and technical expectations and provide strategic support. It also helps the company have direct and effective interactions with business stakeholders, lowering business and technological risks.

2.7 Summary of Chapter 2

This chapter provided a literature review of the broader concept of open data as the foundational review for OGD, as well as discussing the important definition and how OGD efforts facilitate co-creation by making public data more available. The chapter discussed the results of a literature review on the concept of an ecosystem and how Open government concepts can be used to construct OGD ecosystems.

In addition, the chapter examined the type of business models in terms of centrality and relevance to the OGD ecosystem, as well as the strategies of a DDO to remain competitive by capturing OGD value.

Chapter 3 Open Government Data Initiatives

This chapter examines the various central concepts of OGD initiatives and the significant potential benefits they provide. Open government data initiatives are essential for assuring public access to government information. This chapter discusses the main ideas of open government data initiatives, the research landscape, and an overview of some successful open government data initiatives. This overview is divided into four sections. The first section elaborates an overview of OGD frameworks to support OGD policies, concepts, and potential implications for developing OGD programmes. The second section explains the significance of OGD and its success model for generating economic advantages for users and the government. This study serves as preliminary research to enhance my knowledge about OGD benefits. Section 3 highlights the many OGD efforts implemented in various nations. In addition, section 4 presents more OGD projects implemented in various nations. This plan includes several commitments that have contributed to developing government transparency in New Zealand.

3.1 Open Government Data Frameworks

Open Government Data initiatives are a crucial factor in changing government policy emphasis to an outward-looking rather than an inward-looking approach, with an increased focus on public interests and preferences (Camilleri, 2019). The Open Data Charter suggested the Open data framework (Charter, 2018a) in Figure 3.1 as a way to support policy attempts to establish OGD programmes. The framework highlights two overarching premises: (1) High-quality data generation and management are required for data sharing, and (2) In order to maximise benefits, the public as users must be able to access, use and reuse published data.

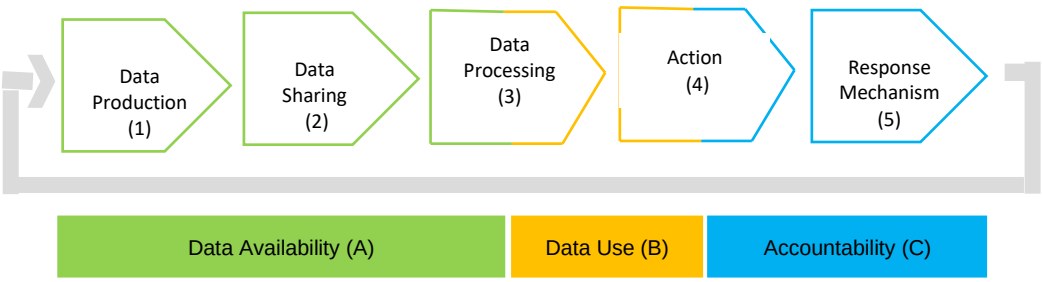

Figure 3-1 The framework of open data use and impact. Adapted from Charter (2018a)

Based on Verhulst and Young (2017), Figure 3.2 illustrates the six characteristics of open data that are of particular relevance to developed economies. Scrutiny, for example, refers to the provision of details that enhance data quality. In contrast, flexibility refers to providing a data format that allows the use and reuse of data in a different context. Another feature, trust, can bring higher levels of accountability and transparency.

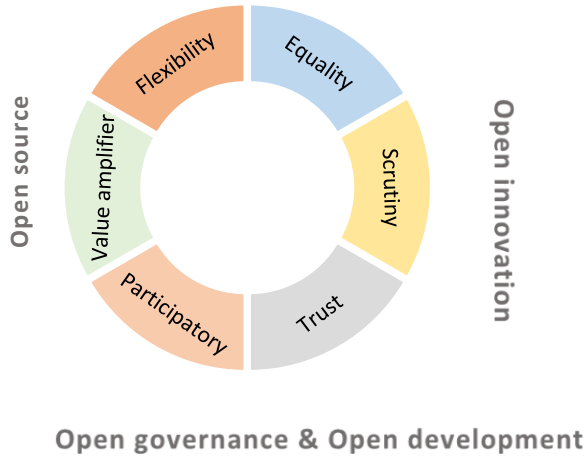

Figure 3-2 The characteristics of Open Data. Adapted from Verhulst and Young (2017)

The adoption of OGD by different government institutions to exchange public data internally and externally poses problems in terms of the improvement of the culture of work and the advancement of institutional and structural reforms (Matheus & Janssen, 2019). Focusing on the "Open by default "principle, The Open Data Barometer Leader report (World Wide Web Foundation, 2018) posited that having an OGD initiative and an "open by default" policy was not sufficient to bring open data up to stimulate creative use. It involves complex shifts in both government culture and systems to adopt the "open data by default" principle. Besides, four indicators are needed to ensure that the principle can be well adopted. Those indicators are sufficient resources, appropriate government policies, and a Right to Information (RTI) and protection framework.

Considerations on the implementation of the "Publishing with Purpose" strategy begin with the monitoring of the global adoption of the six principles of the Charter (Charter, 2018b). The following six principles were developed by governments, professionals, and community stakeholders that collaborated in the Open Data Charter to establish a set of worldwide standards for publishing OGD:

1. *Open by Default*: All government entities adopt a data-sharing culture. To the maximum extent practicable, data should be freely accessible.
2. *Timely and Comprehensive*: Disseminate data without unreasonable delay to preserve relevance.
3. *Accessible and Useable*: Publish data in a machine-readable format to promote public analysis and reuse.
4. *Comparable and Interoperable*: Adherence to the agreed-upon data standards will guarantee the quality of the open data sets and boost their value.
5. *Improved Governance and Citizen Engagement*: Open data improve information exchange between governments and the public, increases public confidence in governments, and encourages public participation in decision making.
6. *Inclusive Development and Innovation*: Integrating OGD with other data can enable users to innovate and create new social and commercial value.

Organisations supporting OGD initiatives recognised, over many decades implementing the OGD programme, that most open data were not motivated by user demand, and instead ended up simply opening up data without addressing certain considerations such as data timeliness, transparency and comparability. A paper by Crusoe, Simonofski, Clarinval, and Gebka (2019) concluded that most of the open data published today are greatly underused. Some scholars (Styrin, Luna-Reyes, & Harrison, 2017) compared three countries with open data ecosystems and found that the potential impact of OGD initiatives was highly dependent on political leadership, the active promotion of the OGD initiative, and government incentives (W. W. W. Foundation, 2019). A relatively recently published paper (Wang & Shepherd, 2020) looked in detail at information about the United Kingdom Open data—a leader in OGD movement. Sampling the most common dataset options, they observed that only 15% of the database was accessible to ordinary users, equal to 0.05% of the population with all datasets available at the UK OGD portal (data.gov.uk). On top of that, approximately 60% of datasets did not contain granular data, while 40% of datasets were significantly aged (more than 30 months). The investigation revealed that the UK OGD initiative did not comply with the Open Data Chapter's principles number 2, 3 and 4.

In summary, the OGD framework is a means to increase government transparency and accountability in which the government can better fulfil its responsibility to serve the people. OGD initiatives can facilitate innovation, economic growth, and social progress by increasing the number of people with access to OGD. The adoption of open data

presents obstacles to enhancing work culture and advancing the government's institutional and structural reforms. However, OGD can be seen as a series of principles and best practices to enable the availability and accessibility (together with its re-usability) of data to make it available for everyone to use and republish as they wish. Thus, there are several factors contributing to the slow adoption of OGD. One is that the advantages are not always transparent. For instance, whether the release of data improves the quality of information; and how the governments know when they have successfully made data accessible. The following sections elaborate investigation made to find the best practices from the OGD initiatives' implementation in several countries and successful case studies in exploiting the benefits.

3.2 Towards success models of Open Government Data initiatives in other countries

This research elaborates on two successful models of OGD initiatives related to DDO as the data users, capturing the interrelated network within the United Kingdom and the United States OGD. In the first year of my PhD programme, I conducted this study analysis as a preliminary research to develop my understanding of OGD benefits and include the analysis in my full research proposal. These cases have successfully exploited the value of OGD and have generated economic benefits for the companies and their respective governments. The following cases summarise an in-depth assessment of the business model analysis to provide a basic concept for what this research can learn to develop an ecosystem for a follower, such as the New Zealand OGD. Mastodon C and Zillow as the DDO were selected for their innovative actions to enrich OGD within contrasting approaches. I analyse the case studies based on the Infomediary Business Models of Janssen and Zuiderwijk (2014). Based on the V^4 ontological structure developed by Al-Debei and Avison (2010), four central elements of the case studies analysis framework are:

1. *Value proposition* – the business logic for creating value for customers by offering product and services to targeted segments.
2. *Value Network* – collaboration and coordination with other organisations.
3. *Value Architecture* – an architecture for technological and organisational infrastructure used.
4. *Value finance* – as public value, the costing, pricing and revenue breakdown associated with sustaining and improving the creation of economic benefit.

The V^4 structure defines the four dimensions of an organisation as a targeted value-proposition in which products and services must meet the criteria of excellence preferred by its customers. However, there is a strong correlation between the characteristics of the offered products and services and the architectural arrangements. On the other hand, the value architecture depends on the company's existing resources and the resources it can obtain through its value-network. Value-finance, by contrast, deals with any financial commitments required concerning the other three-dimensional values.

3.2.1. Case study 1: HSCIC UK - Mastodon C: Constellation of value

The Health & Service Care Information Centre (HSCIC) is an executive non-departmental public body sponsored by the United Kingdom Department of Health and Social Care. The Strategy Report for 2013-2015 provided by HSCIC (2014) reported that the main priorities were to identify and exploit opportunities for making better use of the information assets. Mastodon C is a big data start-up company nurtured by the Open Data Institute and Open Healthcare in the UK[14] whose main role was to identify and capitalize on possibilities to use information assets better. The company examined the prescription dataset containing 37 million rows of data from HSCIC Open Data to examine prescribing trends of branded statins that are 20 times more expensive than the generic alternative for the identical medication benefit. Statins are a type of cholesterol-lowering medication. In addition, Mastodon C mapped and studied the amount of money spent on two branded statins. The investigation results showed that Mastodon C contributed to the potential savings of £200 million if general practitioners prescribed cheaper generic medications than branded statins. It has provided doctors, NHS (National Health Service) administrators, public health practitioners, the government, and the public with detailed feedback on saving the government money (ODI, 2012).

The case study analysis revealed that Mastodon C has the potential to generate value by opening data from the Health and Social Care Information Centre (HSCIC). The key

[14] Open Health Care is a consortium of NHS (National Health Service UK) doctors and technologists dedicated to improving patient care by opening up health data

to unlocking this value is to understand the V^4 ontological business model, which is the current framework under which it operates. By understanding the V4 ontological business model, we can better understand how Mastodon C can generate value by opening data from the HSCIC. The case study analysis generates a four-dimensional framework consisting of:

- HSCIC's *value proposition* is that comparative public health and social care data enables patients to make more educated treatment decisions while the selling proposition of Mastodon C is to provide a service that assists businesses in evaluating their data usage (HSCIC, 2014).

- The HSCIC value network has a significant impact on the behaviour of regulators. Concern exists regarding how the Department of Health (DH) of the United Kingdom (UK) conducts policymaking, followed by establishing groups and organizations to aid in policy implementation and to guarantee the measurement of the policy's impact (Granickas, 2013). The Mastodon C incorporates the value network developed at the Open Data Institute and Open Health Care UK firm. The team is headquartered in London and collaborates with global leaders to improve the quality of their data and analytics. The startup assists huge corporations in maximizing the value of their data. The objective is to contribute to the development of an equal opportunity in which everyone has access to the open data

- The HSCIC provides various services to help you save time and money when accessing health, social care, and other government services. HSCIC data services allow the public to access information and services more efficiently, often, and affordably. The value finance data scheme applies at no cost to the end users but with a fee for customised service and expert assistance for professional use. The fee covers the costs associated with processing and providing the service. This fee helps expand processing capacity and provides services to more needy people. Each product's price is comprised of four components: Application & Setup, Annual Service Charge, Processing, and Report (HSCIC, 2015). Mastodon C is an independent organisation that is financed by the Open Data Institute, NHS physicians and programmers. It provides a platform for data sharing in the digital health domain. The primary goal of Mastodon C is to promote data transparency, data sharing, and data validation. It also strives to provide a platform for the open exchange of ideas and knowledge.

- HSCIC systems are an important part of the health and social care system. Based on the National Information Board (NIB) framework (NIB, 2014), the HSCIC structure is centrally managed, rigorously tested, and designed to be exceptionally robust. The systems use an open data-coherent architecture, allowing a sizeable raw dataset to be analysed and disseminated. Mastodon C builds and deploys big data solutions using an open source platform on a cloud architecture. The platform's goal is to provide a pipeline that turns massive, unstructured client datasets into a useful format for the client, who can then use the solution to solve their business problems. This platform is built on the principles of decentralisation and open source software.

Table 3.1 describes the four-dimensional structure of the V4 ontological Business model for this case study to illustrate how Mastodon C might derive value from HSCIC's open data.

Table 3.1 A business model overview of the HSCIC UK data and Mastodon C case study

Open Data	**Value Proposition**	**Value Network**	**Value Finance (public values)**	**Value Architecture**	**References**
Health Service Care Information Centre (HSCIC) http://www.hscic.gov.uk	The UK's national provider of health and social care information, data, and IT systems to run the Health and Social Care Act 2012.	HSCIC, a non-departmental executive UK government, and NHS are important actors in achieving the Department of Health's goals. HSCIC is a part of NIB members	Two schemes: free for public and paid for bespoke service and expert support for professional use.	- Data-coherent design architecture for health and social care with the big datasets. - Analyse and distribute health and social care data.	HSCIC (2014, 2015)
Private **company**	**Value Proposition**	**Value Network**	**Value Finance (public values)**	**Value Architecture**	**References**
Mastodon C https://www.mastodonc.com/	Applying cloud computing to help companies use open data. Mastodon C mapped massive data to save the goverment's expenditure.	An Open Data Institute and Open Health Care UK-incubated big data startup. NHS doctors and programmers founded this startup	A non-profit organisation that supported financially by ODI	Designing and delivering big data solutions using cloud infrastructure and open source.	ODI (2012, 2015)

Furthermore, the research combined the Value Networks of HSCIC and Mastodon C to extract a network among actors and roles of both in Figure 3.4. There is an interrelated network of HSCIC, partnership and Mastodon C as the customer to enrich the value of the transferred dataset. The network illustrates the interrelationship across actors of this case study of HSCIC and Mastodon C. Four blocks define the four key players in this network: OGD provider, customers, stakeholders and supporting partners. The UK health department and the HSCIC as governmental bodies play roles as the OGD providers, while Mastodon C, ODI, co-funded by government and business, and Open

health UK are the data users. Other key players are patients, researchers, government agencies, and public partnerships such as NHS and ICT developers, who perform as key supporting partners. Mastodon C exploits and innovates with big data from the HSCIC assisted by ODI and funded by Open health UK. The health department performs the role of the sponsor for the HSCIC. The stakeholders, such as patients, are connected with Mastodon C because the patients are the participants of the Mastodon big data project. Those key partners consist of the public body and ICT developers. The public bodies perform the responsibility as decision and policymakers for this case study. For example, NHS-backed research was conducted by Mastodon C thru the HSCIC. At the same time, NIB defines an informatic strategy to agree on the requirements for national infrastructures, and the independent advisory council evaluates the HSCIC's function for public health and social care.

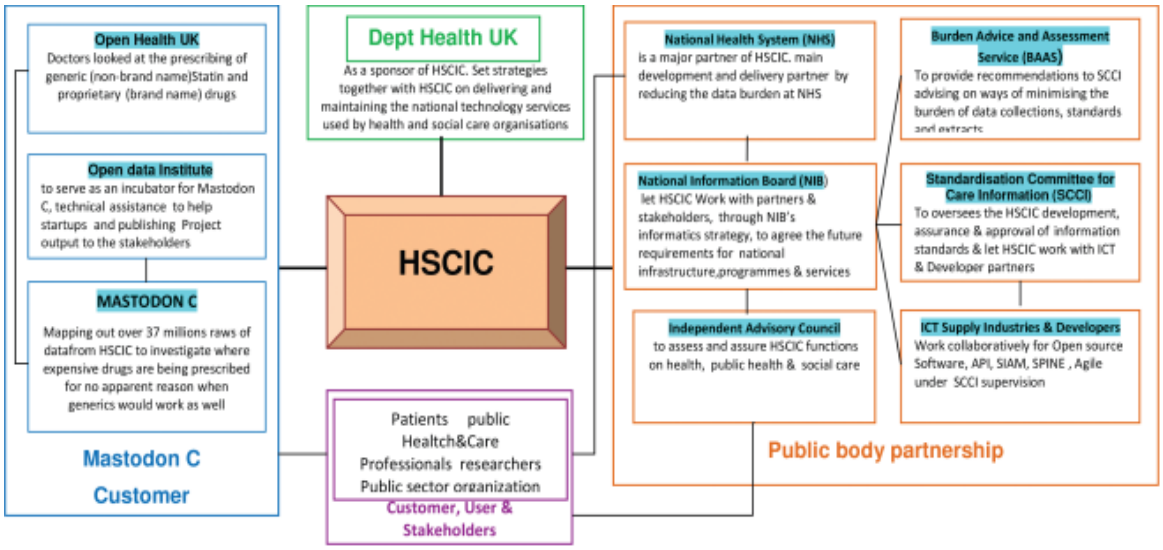

Figure 3-3 HSCIC – Mastodon C interrelated network (actors and roles)

In summary, the HSCIC has a unique value network where numerous players from different parties across multiple jurisdictions rely on one another to fulfil the tasks outlined in the Health and Social Care Act of 2012. The case study analysis describes that successive UK Governments have reinforced their strong political support for Open Data to assist, reassure, and convince all parties to participate actively in a community dialogue. All values quantify the benefits experienced by the HSCIC as the OGD provider and Mastodon C as the data consumer.

3.2.2. Case study 2: Zillow - Enriching value of open data

Without open public data, Zillow (zillow.com), the rapidly expanding online real estate marketplace, could not operate. Zillow routinely collects datasets from US Open Government Data, including the Bureau of Labor Statistics Dataset, Federal Housing Finance Agency, and Department of Commerce (Economist, 2014). The objective is to enable third parties to reuse Zillow's aggregated data in conjunction with data from other sources, such as property agencies and realtor data, to power home-search services on its websites and develop new apps.

Zillow connects prospective homebuyers and landlords with real estate brokers, mortgage lenders, and advertisers seeking to reach them. According to the US Securities and Exchange Commission's Quarterly Report for 2014, over 74% of Zillow's revenue comes from fees agents pay for customer leads and apartment leads, 8% comes from fees banks pay for mortgage leads, and 18% comes from advertisements (Economist, 2014).

However, the success of Zillow depends far more on OGD obtained through the US data portal. It should be noted that, once Zillow captured the value of OGD, the datasets merged with data from property agencies, realtors and Zillow's partners. OGD use relies on a business application finder and the data publisher (the US OGD). Because of the dependency on the OGD availabilities, there is a risk that Zillow's business might be hampered if the data are not delivered regularly or in a consistent format. These impediments were elaborated by scholar Zuiderwijk et al. (2012) based on literature, interviews, and workshops. According to other scholars (M. Kaasenbrood, A. Zuiderwijk, M. Janssen, M. De Jong, and N. Bharosa (2015), the essential requirement for a private organization to use the OGD are a valid source, a legal licence, and continuity of data supply.

It is noteworthy to overview the business models supported both by the US OGD and Zillow as shown in Table 3.2. It provides a summary of the business models supported by both the US OGD and Zillow. Zillow processes more than 3 million new images per day, including property listings, images for lenders and brokers, and images of home improvement projects. Approximately 17,000 images per second are uploaded from client devices during peak usage (Amazon, 2013). The bandwidth, scalability, performance, and disaster recovery issues would frustrate users if they had to search again.

Table 3.2 A business model overview of the US Open data and Zillow practical case

OGD provider	Value Proposition	Value Network	Value Finance (public values)	Value Architecture	References
The US Open Government Data (https://www.data.gov/)	- As a national catalogue publishing almost 300K datasets - Integrating diverse datasets creates innovation and benefits.	- Agencies open machine-readable data at [dept].gov.data. - GSA conducts usability tests and uses APIs for usability training.	OGD are, for the majority, free and do not require registration to use	Data.gov is powered by CKAN and WordPress and maintained on GitHub. An information-centric strategy decouples information from its presentation, disseminating data in a machine-readable format through web APIs.	(White House, 2013, 2014)
Data user	**Value Proposition**	**Value Network**	**Value Finance (public values)**	**Value Architecture**	**References**
Zillow (http://www.zillow.com)	Connect customers as the potential buyers and sellers with real estate agents, mortgage lenders, and advertisements. Estimating surrounding neighbourhood home and rental value help users make housing decisions.	Integrated datasets from The US Open Data and other sources then shared vital information about the home, real estate, mortgages and home improvement. Its integrated Portfolio are: Zillow, Trulia, StreetEasy, and Hotpads	- Selling advertising space using a media business model. - Zillow does not handle transactions directly. - The main advertising revenue streams are marketplace and entity advertising.	- With Zillow API, sites become mini-property sites. - The Zillow app notifies users of for-sale or rent homes. - The MLS and Zillow develop Partnership Platform (ZPP) - Scalability, performance, and disaster recovery are improved by AWS. - Zillow stores 100 TB on AWS.	Economist (2014) Amazon (2013)

Figure 3-5 depicts the interconnected value network of Zillow and the US OGD initiative network that demonstrated a high-level commitment. Like the UK OGD initiative, the US OGD had safeguarded its policies to be implemented as instructed within the specified timeframe. However, the United States emphasised federal and independent agencies as data suppliers. The Digital Service Innovation Center was formed to train and support government agencies in producing high-quality open data (White House, 2013, 2014). President Barack Obama expressed the strategy directly and designated four Executive Officers as the president's closest advisors. Additionally, this approach actively engaged community resources to facilitate the adoption of open data principles.

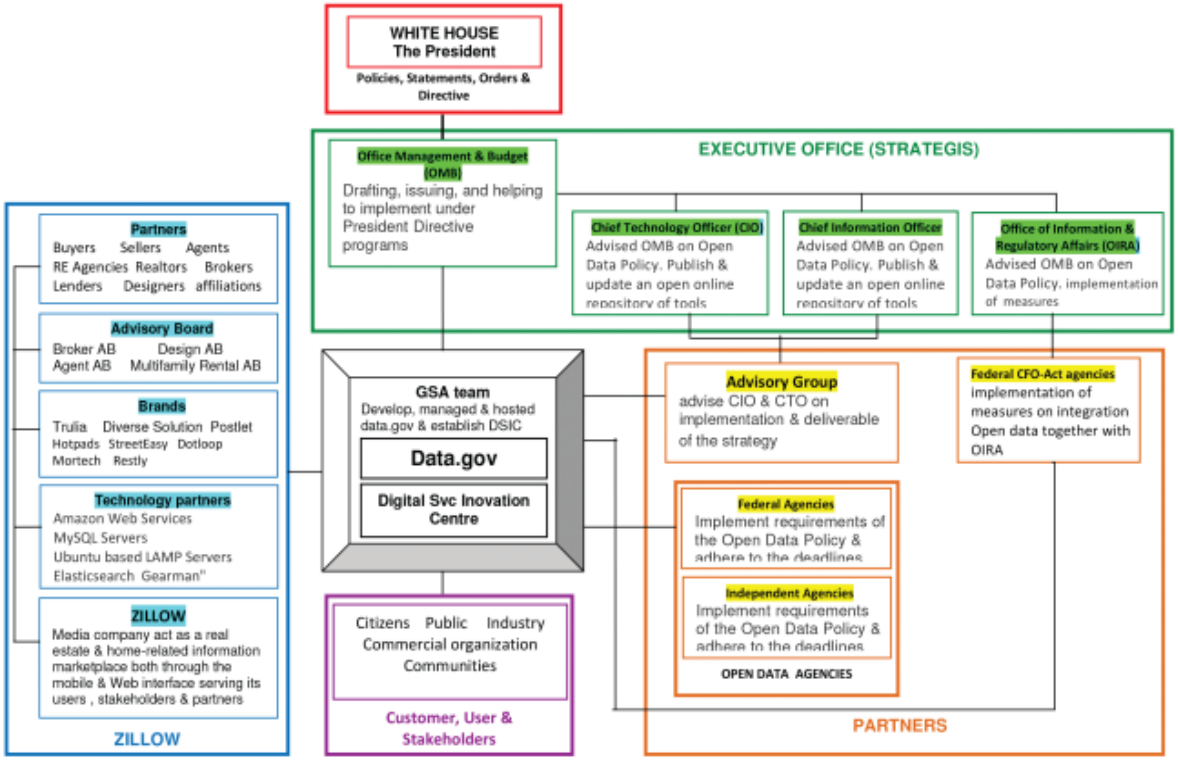

Figure 3-4 Zillow – The US OGD interrelated network

The interconnected network of Zillow and the US OGD as shown in Figure 3-5, exemplifies the collaboration of parties to harness the economic potential of open data. There are six blocks representing six actors: Zillow and its partners as data users, stakeholders as customers, federal and independent agencies as key partners, government executives as data leaders, and the US OGD project as a data provider. Zillow has built a massive database to link big data captured from the US OGD, such as geospatial data on the local value of the property, house process, tax data, listing of home sales and purchases, and mortgage data. The company has amassed big data. As the highest-ranking leader in OGD, the United States president plays a crucial role in securing the initiative's implementation. To implement the mandates, the Executive Office, including the Office of management and budget, the Chief Technology Officer, the Office of information, and the Office of regulatory affairs, are responsible. The government agencies are responsible for carrying out the president's directives, advising on OGD policy, and executing OGD measurements. The jobs are essential for maintaining OGD quality and creating value. Thus, the US OGD, as the data provider, plays a crucial role in the publication of large datasets for Zillow. The open data agencies consist of independent and federal entities, while the advisory group and Federal CFO-act agencies serve as the advisory body for OGD implementation.

A business model is a link between company strategy and business processes. To ensure the successful implementation of OGD initiatives, all participants in demand and supply data must communicate the concept precisely. As described in two case studies, business models facilitate the extraction of the potential value of innovative OGD and offer an understanding of the relationships between actors. In the introduction, it was said that 96% of OGD initiatives do not always give quality open data. All actors should use a sustainable design of business models to create economic value for the government as a data supplier, for private enterprises that use data, and for users, citizens, and communities as the public. Other obstacles to the open data movement include:

- Some governments faced problems on how to minimise the administrative burden of data collection on providers (HSCIC, 2015).
- Government agencies complain about demands to open their data, particularly the cost (Zuiderwijk et al., 2012).
- Innovation in government is difficult since government workers are buried in so many of the operations and the day-to-day, it is hard to step above it and look out beyond what is possible. As mentioned before, the Open Data movement is learning how to face the paradigm/cultural change (ODI, 2015).

3.3 OGD benefits from existing studies in different OGD initiatives

I investigated how several countries implemented OGD to understand better how they extracted the most benefits from public data. The findings were published in a 2019 research paper titled "*The Benefits of Open Government Data Use: A Cross-Country Comparison*" in the proceedings of CONF-IRM 2019 (2019 International Conference on Information Resources Management) under AIS eLibrary https://aisel.aisnet.org/confirm2019/21/. The research paper reviewed existing studies on how different OGD initiatives have created benefits, based on five studies conducted to outline categorised benefits based on OGD actors' perspectives in five countries and one political and economic union. The investigation was guided by research questions of how OGD benefits might be defined and what government regulations create barriers to OGD adoption.

A systematic literature review based on Machi (2016) was conducted to examine existing OGD research. These criteria were used to select the studies: having been published within the past two years, conducting an empirical investigation and literature review, focusing on OGD nations within one of the four country clusters, and evaluating the benefits experienced by various categories of OGD users and factors influencing OGD regulation. For relevant articles, multiple keywords were used to search the Scopus, Elsevier (ScienceDirect), IEEE, and Google Scholar databases. The first search found 31 papers; after deleting duplicates, 17 publications remained. After assessing the papers to determine which met the criteria, the number of papers was reduced to five.

As shown in Table 3.3, the five studies used qualitative and empirical methods from diverse perspectives and backgrounds, with three focusing on OGD in the earlier period and the other two different studies investigating Taiwan in OGD's early stages. All public studies examined the OGD ecosystem, business strategy, adoption, and user perspective difficulties to demonstrate benefits. Ahmadi Zeleti, Ojo, and Curry (2016) applied Design Science Research (DSR) to design a 6-value business model framework for examining the Europe Union OGD while Styrin, Luna-Reyes, and Harrison (2017) compared the US, Russia, and Mexico OGD ecosystems based on policy and practice. A research model by Wang and Lo (2016) examined Taiwan Government agencies early in OGD programmes to find a correlation between perceived advantages, government readiness, and external barriers. While Wirtz et al. (2017) found that Germans valued OGD based on usefulness and ease of use, another conducted study run by Yang and Wu (2016) developed a research model to investigate the determinants that influenced Taiwan Government agencies' intention and behaviour to implement OGD.

Table 3.3 A summary of the five selected studies. Adopted from Mokobombang, Gutierrez, and Petrova (2019)

Paper ID	Reference	Context	Topic	Methodology
1	Ahmadi Zeleti et al. (2016)	Europe Union	OGD Business model	Qualitative research with the Design Science Research (DSR)
2	Styrin, Luna-Reyes, and Harrison (2017)	US, Russia and Mexico	OGD Ecosystem	A comparative textual data approach
3	Wang and Lo (2016)	Taiwan	Implementation of OGD Initiatives	Based on the technology–organisation–environment (TOE) framework
4	Wirtz et al. (2017)	Germany	Citizens' expectancy of OGD	A convenience sample of an online survey
5	Yang and Wu (2016)	Taiwan	Socio-technical determinants of OGD	Based on a literature review

Furthermore, the selected studies' contents were examined and coded for their meanings using thematic analysis (Boyatzis, 1998) to explore themes. The selected studies provide a complete overview of the OGD ecosystems. In some circumstances, OGD value is enhanced by building mutual relationships between government agencies and private firms. The thematic analysis generated three themes identifying OGD benefits that may affect OGD adoption, as well as the impact of OGD-related actions as perceived by content-specific actors within the OGD ecosystem. The emerging themes categorised the OGD benefits as technical and operational, economic, and political and societal.

Based on findings of technical and operational, quality and permanence of data are the primary impediments to gaining benefits from OGD adoption. The advantages for citizens and government agencies highlight the necessity of getting user feedback and evaluating the data repository. These results imply that adopting a collaborative strategy to promote OGD by developing appropriate policies to guarantee OGD quality will boost the value of OGD for users.

The second theme of OGD benefits is economic, related to ecosystem maturity. The USA and Russia OGD initiatives already receive economic benefits, such as growing private company portfolios and establishing new facilities for residents. These

governments have saved money on their health budgets by working with open data analysts to uncover innovative ways to cure illnesses.

The theme of political and societal benefits implied that the implementation of OGD initiatives has established a paradigm for how the highest levels of government, as policymakers, communicate with government agencies that deal with OGD. The programme provides better transparency, enhanced service delivery, and access to government information for the public. Nonetheless, the implementation of the OGD programme creates additional significant value by demonstrating how government entities interact with stakeholders and the larger society. Through increased transparency, improved service delivery, and citizen access to OGD, this value is fulfilled.

To summarise, the five selected studies allowed for a preliminary knowledge of how OGD may provide value for data providers and users. The OGD benefits in technical and operational, economic, and political and societal may be created through OGD initiatives in the countries and region investigated. In addition, the production and use of OGD encompassed multiple actors with diverse roles and a broad range of opportunities. The results of a cross-country comparison study indicate that adopting a collaborative approach to promote OGD by establishing better policies to ensure OGD quality would significantly increase the perceived value of OGD by users.

3.4 New Zealand Open Government data

New Zealand's Cabinet has adopted numerous policies to promote open government and the release of open data. It is beneficial that these rules and principles are understood in order to inform agency debates around data access and openness. These policies, in conjunction with many open data principles, can assist government agencies in increasing their open and transparent data use (Government, 2020, Open data policies).

Data portal.govt.nz was launched in 2009. The portal is not a repository of data, but rather a catalogue of existing websites of government agencies. The website acts both as a portal and as a citizen engagement platform to make non-personal government information more discoverable, usable and relevant (NZDIA, 2009). An independent analysis conducted in 2011 (Stott, 2011) found that while the portal was well-designed and properly operated, the databases were still under-used and not well established internally and externally. The study was based on interviews, online polls, literature

references, and comparisons with other government portals. The critical obstacles for the New Zealand Government in adopting the Open Data Action Plan were the transition to a sustainable open data culture, the lack of funding for and use of open data, the lack of sufficient skills, and the complexities of providing data from diverse sources and formats (StatsNZ, 2018).

The principles for managing New Zealand Government data and information were approved by the New Zealand Cabinet in 2011, stating that data should be open, protected, readily available, reliable, well managed, reasonably priced (preferably free) and reusable (N. Z. Cabinet, 2011). The Declaration on Open and Transparent Government in 2011[15] outlines a strategy for the New Zealand Government to increase its openness and transparency by actively disclosing high-value public data that it gathers and holds on behalf of taxpayers. It stated that government promises to actively distribute high-value public data to let the private and community sectors use it to grow the economic, social and cultural fabric, and environmental sustainability. Then it is released to encourage industry and the community input on government decisions and anticipate more efficient and responsible government. The third National Action Plan's commitments build on New Zealand's long and proud history of open and transparent government. This plan comprises several commitments that have aided in the advancement of transparent government in New Zealand.

[15] https://www.data.govt.nz/assets/Uploads/cab-min-11-29-12-8-august-2011.pdf the latest access in June 2021

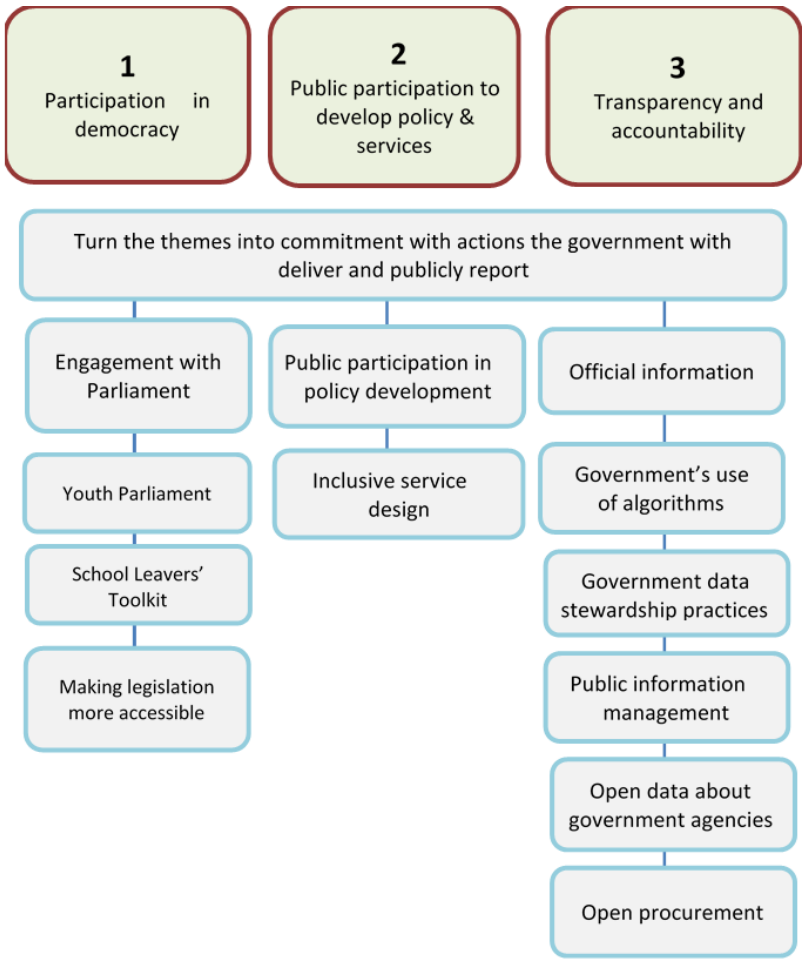

Figure 3-5 The National Action plan's 2018-2020 themes. Adapted from (NZSSC, 2018)

As shown in figure 3-3, the National Action Plan comprises three themes: participation in democracy, public participation to develop policy and service and transparency and accountability. The government pledges to turn the themes into commitment and actions, and relies on participation of citizens, community groups and government agencies. To implement the principal for ensuring high-quality open data, the commitment was reaffirmed in the National Action Plan 2018-2020 (NZSSC, 2018). The plan has discussed widely resulting in 449 ideas being incorporated into these three themes to develop the plan.

The plan also sets the framework for how the government opened up data over three years and makes clear the government's commitments to increase the accessibility and use of government data. The government relies on the involvement of citizens to ensure the best use of the data. This has already started to impact the quality of open data being produced and used by the public.

3.5 Summary of chapter 3

This chapter has examined the fundamental review of the existing key concepts that serve as a framework to analyse OGD initiatives and their related findings connected to this study. In this chapter, a literature analysis was undertaken on how OGD initiatives made government policy more outward-looking, but, in another perspective, how adopting OGD inhibits institutional and structural advances. A review of the New Zealand OGD programme was also presented on factors affecting how New Zealand's Cabinet has embraced the open government and open data policies to develop their National Action plan and commitment.

Furthermore, this chapter outlined two practical cases that I conducted on how data-driven companies in other countries, Mastodon C in the United Kingdom and Zillow in the United States, led by being success models to generate economic benefit from OGD use. Finally, it briefly presented the preliminary research with a systematic literature review approach that I investigated based on five existing studies by categorising OGD's benefits in five countries and one region.

Chapter 4 Design of the Empirical Study

This study's research method will be evaluated, and a data analysis approach will be chosen based on the results of that evaluation. This chapter explains why I decided to use the research design I used by looking at the process as a whole. Subsequent sections outline the philosophical assumptions and worldview, the research method, data collection techniques and data analysis including the designing of a multiple case study approach.

4.1. Philosophical assumptions and worldview

In order to answer research questions presented in Chapter 1, the philosophical assumptions and worldview should be stated clearly at the onset of this research because they underpin and impact any subsequent research process.

The philosophical assumptions and worldview are a broad philosophical viewpoint on the world and the nature of research, and as the researcher (Creswell, 2018), I should acquire knowledge of the facts to this study (Myers, 2013).

A philosophical assumption is a central point underlying the design of a study. Philosophical assumptions consist of ontological, epistemological, and methodological assumptions. Ontological assumptions are introduced as a solution to concerns about reality. Ontology is a description of reality and what we can learn from it. The ontology includes two opposing perspectives: objectivist and constructivist. The objectivist thinks that there is a real world outside of us. On the other hand, the constructionist thinks that reality is the consequence of a collective social process (Creswell, 2018). In this study, a constructivist approach was adopted because it focuses on making sense of what people say in different social contexts by interviewing them (Myers, 2013).

The epistemological assumptions of any study method are linked to the nature of the information (Yin, 2014). I started this research by reviewing literature and by getting the perspectives that there are multiple realities about OGD benefits subject to each organisation dealing with them. The epistemological assumption fits with this study as it aims to pose questions about the truth, the real knowledge, and the relationship between the researcher and what is being investigated. With the epistemological assumption, I aim to get as close to the participants being interviewed as possible. As a result,

subjective data is compiled based on individual perspectives involved in the OGD. This is how understanding is gained: through people's expertise and experiences.

In terms of science's epistemology, positivist, interpretative, and critical are all subcategories. According to Myers (2013), qualitative evidence is used to better understand and characterise social processes in information systems through qualitative analysis. Therefore, positivist assumptions are not suitable for this study because they are not meant to create an interpretation of the social context. The critical assumptions also are not suitable because this research does not aim at changing people’s social and economic context. This qualitative research focuses on an interpretive epistemology, which attempts to explain the phenomenon by interpreting the data and understanding the OGD context and investigation process.

The methodological assumptions help in the identification of effective data collection tools and methods. The choice of suitable methodology depends on the scope of the research investigation. Positivists, for instance, usually use polls and tests as effective testing tools, while interpretivists prefer to use in-depth interviews (Creswell, 2018; Yin, 2014).

There are four paradigms of philosophy: Postpositivism, Transformativism, Pragmatism, and Constructivism (Creswell, 2018). Postpositivism assumes that the truth is objective and should be studied by a scientific approach by measuring data numerically and statistically, while pragmatism does not commit to any ways of thinking about reality. On the other hand, Transformativism feels that research inquiry must be integrated with politics and a political reform strategy to overcome social inequality while Constructivism believes that the research aims to comprehend participants' views on whatever is being examined in terms of their socially constructed realities. Constructivism identifies that people form opinions about the world based on their social experiences. Therefore, this study has adopted a constructivism paradigm because of the use of a multicase study approach with semi-structured interviews conducted to understand participants' views and socially constructed realities on OGD initiatives.

4.2. Research method

Quantitative, qualitative, and mixed approaches are all options for research methods. Some consider the quantitative and qualitative approaches completely distinct, while others prefer to combine the two approaches. There are many differences between qualitative and quantitative research regarding how they collect and use data (Bryman &

Bell, 2015; Creswell, 2018; Myers, 2013). According to Myers (2013), quantitative analysis was initially developed in the natural sciences to study naturally occurring phenomena. It is necessary to know qualitatively and quantitatively, independent of the choice of effective approaches.

Alternatively, qualitative analysis has been created to allow researchers to investigate a wide range of social and cultural phenomena from various angles. Historical information, documentation, and interviews are examples of qualitative evidence (Yin, 2014).

Using a quantitative technique in this study is not recommended because it may be challenging to comprehend the occurrences from the participants' perspectives. The qualitative approach was chosen because it provides tools for explaining various phenomena and the circumstances in which they occur. In qualitative research, people's interactions with one another and their social contexts serve as the foundation for the significant philosophical idea (Creswell, 2018; Myers, 2013; Yin, 2014). There appears to be no better approach to conducting this research than using qualitative methods.

The research gathers empirical data for designing ecosystem business models by conducting extensive literature reviews and a qualitative multiple case study in New Zealand with participants from government agencies, IT companies and DDO. Recruiting the required number of participants is planned to get more evidence and including various sectors to analyse the supply and demand side of OGD. The intention of using a case study research method is to present multiple perspectives on actors, activities, policies, documents, and issues to identify and interpret the different views of every case (Stake, 2006). Focusing on good research results and outcomes, the attraction of doing this study is based on two factors: to understand rich, contextual and detailed data and to emphasise good management of complex findings (Stake, 1995).

There are six steps to perform dynamic analysis, and to obtain acceptable validity and reliability of the research. The four phases of the research design are as follows:

1. Define open data terminology, theoretical framework and design principles.
   In this first part, the researcher has conducted in-depth literature reviews to define key terminology and set an analysis framework that was referred to as open data, data-driven companies and ecosystem business models throughout the literature. Design principles were prepared to help researchers make design decisions properly.

It is essential to look at the principles when designing ecosystem business models because they have rules, guidelines, and concerns that must be taken into account.

a. Glossary: A brief glossary of terms that covers the principal terms used in the literature review were used as keywords for “open data”, “open government data”, “business model”, “value creation’, “value proposition”, “data-driven”, “ecosystem,” “firms” and “private companies”.

b. Literature review method: To examine what has been investigated about this topic, a literature review method was conducted as an extended survey for important articles, catalogues and other sources as follows:

- Review of a systematic collection of sources from AUT’s library about business models, open data, and ecosystems. The following bibliographic sources from AUT’s library system were searched: AUT collection catalogues, Scopus database, ScienceDirect database, Google Scholar, ACM digital library and IEEE explore. However, the majority of the selected references was retrieved from the Scopus database which includes peer reviewed articles in English.
- Gain broader knowledge about current trends and issues in OGD topics by joining the community of egov-list (http://mailman11.u.washington.edu/mailman/listinfo/egov-list and an online community that works in an open government project: the Open Government Ninjas online group (http://groups.open.org.nz/groups/ninja-talk/). The NZ OGD programme supports the group as a local initiative for giving feedback about open government data implementation.
- To manage the extensive data collection, this research uses the combination of Endnote and NVivo applications to collect articles, website information and case study data (interviews, papers and visual-audio recordings), to store its coding and then interpret them (Jackson & Bazeley, 2019).

c. Theoretical framework: Define the research problems and objectives and provide a justification on the theory and models of open data and ecosystem business models used as a framework based on the existing studies.

2. Identify and select case studies.

This research was conducted using a multiple case study design (Stake, 1995; Yin, 2014). The OGD programme and its use in New Zealand was the focus of the study.

Case studies are excellent opportunities to learn about the process in detail, what works well and what could be improved, how actors feel about the whole thing, how actors compare and how to deal with various evidence, interviews, documents and observations (Yin, 2014). Case studies may allow multi-case studies, journalistic skill and include quantitative and qualitative evidence. This research adopts a multiple-case study design which involves investigating the experiences of a set of individuals affiliated with entities related to OGD initiatives. However, the study taken as a whole covers several organisations. Therefore, the decision to undertake multiple-case research depends on developing a rich set of cases involving different participants from different types of entities and the desire to explore a particular issue in greater depth than can be achieved through a single case study.

a. Selection criteria: To compare and provide grounds for evaluation of the ecosystem business models this research specifies the criteria to select relevant case studies of DDO in New Zealand with the government as the vital data supplier. It represents findings for categorising ecosystem business models.
b. Long-list: to create a long list of New Zealand OGD agencies and DDO for case studies using research group consultations and desk research.
c. Guide to design and conduct the case studies: this research outlines a plan that includes clear instruments/protocols to carry out the case studies. The study used multiple sources and techniques such as in-depth interviews, website searches and documentation reviews.

3. Gather data by conducting case studies.

Case studies generate large data from interviews and organisation's documents as primary and secondary data. The primary data was collected from government officers and related organisation personnel. The secondary data was collected from the NZ OGD websites and from records of the organisations studied.

a. Validation: Triangulation for each case study implemented to validate data by comparing all audio and video recordings, secondary data and transcripts of interviews. Participants' and supervisors' validation will be included in the triangulation process. Thematic analysis coding is used to encode qualitative findings from case studies.
b. Models: A model built based on each case and replication process will help the researchers identify cross-case patterns.
c. Analyse the identified ecosystem Business Models from different categories.

4. Summarise findings: Using all of the data obtained from case studies to summarise findings.
   a. Generalisation: The findings enable the cases to contribute to the business model and open data study. Representative DDO and government agencies reflected the full criteria for categorising ecosystem business models.
   b. Summarise findings: this research sums generalised findings and has a list of enablers and barriers encountered in the case studies.

5. Design and evaluate ecosystem Business models
   a. Ecosystem business models design: Based on the findings of the multiple case studies, the design principles were justified first before being translated into design features. Afterward, the design of ecosystem business models commenced in this part.
   b. Evaluation: result on design evaluated. An iterative cycle is developed to reveal flaws in the design.
   c. Design principles demonstration: each designed business model is analysed and checked against the design principles.

6. Project evaluation and publication

   Demonstration of the project evaluation and results to be presented in supervisor, peer, and research group meetings to interpret the design output. The results will be submitted for publication to indexed International Journals in the areas of Open Data and Business Models. Lastly, a thesis examination will be commenced including a thesis defence at a ‘viva voce’.

4.3. Ethical considerations

Because this study would collect data from individuals, prior permission from the AUT Ethics Committee (AUTEC) was required. The interview protocols (attached as Appendix A), a participant information sheet (attached as Appendix B), and a consent form (attached as Appendix C) were approved by AUTEC on 24 June 2019, with the application reference number 18/398 (Appendix D).

The Oxford Learner's Dictionary defines ethics as *'moral principles that guide or affect a person's behaviour*' or *'a set of moral principles or standards of behaviour'*. The second interpretation is the one that is most pertinent to this study. The objective of the ethical procedures is to avoid discrimination and to protect the privacy and rights of both the

participant as an interviewee and the researcher as an interviewer (Yin, 2014). As a result, ethical considerations for research must be anticipated thoroughly and addressed throughout the research process (Creswell, 2018).

4.3.1. Minimisation of risk

In order to ensure that no harm was done to research participants, this study adhered to the ethical norms established by AUTEC (AUT Ethics Committee). This study did not make use of, or require manipulation or deception, which is typically discouraged in social scientific research. As part of this study, all of the people who took part were at least 21 years old, which AUTEC says is the minimum age of maturity.

Participants were told that their participation in this research was entirely voluntary and that they could stop and withdraw the collected information at any time during the research process.

4.3.2. Respect for Rights of Privacy and Confidentiality

The participants' identity and the information they submitted were kept confidential. The approved ethics application included specific confidentiality provisions to protect the information of selected respondents. Codes were employed to hide participants' identities, including any response in each interview transcript that may be used to determine the participant's identity. For example, replacing particular information about participants with general words such as [organisation’s name], [participant’s name], [the department of the organisation].

4.4. Data collection

For collecting valuable information on the phenomenon of cases, this study used a purposeful sampling approach (Yin, 2014). The qualitative study positions me – the researcher – as the key instrument by incorporating my personal viewpoints into the data gathering process and interpretation. Choosing a suitable data collection tool entails determining which method can maximise data output in the most successful analysis strategy (Creswell, 2018). This study aimed to gather data on OGD programme implementation in New Zealand as well as on the ecosystem business model for DDO using OGD.

An interview method was selected to provide the researcher with the ability to gain in-depth insights and opinions from the participants and to justify or clarify the information

requested. In accordance with the research objective stated in Chapter 1, a series of semi-structured open-ended interviews with participants in New Zealand was adopted as the primary source of the data gathering methods. Some of the benefits of semi-structured interviews include the ability to question, explore and gather primary data (Eriksson & Kovalainen, 2016), to see what is not normally seen and analyse what is looked at but rarely viewed (Myers, 2013), and the opportunity to clarify any uncertainty (Wengraf, 2001).

The interview protocol was established iteratively using the approach described in Myers (2013), Wengraf (2001) and Yin (2014), to ensure that the interview questions aligned with the research questions while also taking into account the contextual factors influencing participants' work practices/roles, such as their employer's purpose.

4.4.1. Sampling

A sample is required since data collection from the entire population is impracticable in most studies (Myers, 2013, p. 167). Additionally, the sample should be unbiased and sufficiently large to meet the study project's requirements (Eriksson & Kovalainen, 2016, p. 88).

Despite the fact that there were several viable participants from multiple organisations in New Zealand, it was required to design a sample of participants to offer contextually relevant information. A non-probabilistic sampling method called "purposeful sampling" was employed to collect data when doing qualitative research (Creswell, 2018, p. 151). In related studies, purposeful sampling was commonly employed. For example, Iheanachor, David-West, and Umukoro (2021) examined the influence of financial service agents' business models and their capacity to create value using purposeful sampling to focus on specific agents' business models. V. Wang, Shepherd, and Button (2019) examined some of the OGD obstacles faced by officials in the UK in a sample of participants chosen based on their experiences at publishing open data. Similarly, Ma and Yang (2021) chose participants from central and local Taiwanese Government agencies for a study on the data collection process of Open Data Initiatives.

Thus, a purposeful sampling approach was chosen for this qualitative study because it allowed the researcher to identify participants with relevant knowledge and background (Pankowska, Bakker, Oberski, & Pavlopoulos, 2021). It also provided rich data for in-depth analysis and was the most viable strategy when a specific set of subjects was targeted (Yin, 2014).

The researcher's objective was to collect a representative sample from a diverse range of government agencies and DDO in New Zealand. The researcher can make correct generalisations about the wider population. Creswell and Creswell (2018) suggested that a properly chosen sample can provide several benefits, including increased validity and accuracy and reduced administration works.

4.4.2. Semi-structured interviews

Considering the study's research objective, a semi-structured interview approach was used. According to (Galletta, 2013), semi-structured interviews have several advantages, including the capacity to stimulate, probe, and collect more data, some flexibility in the order of the questions answered, and the chance to explain any uncertainty. Additionally, the open-ended character of the question not only identifies the subject under inquiry, but also allows the interviewer and interviewee to examine some subjects in greater detail. In comparison, structured interviews would have left less flexibility for interviewees to reply, whereas unstructured interviews would have prohibited the use of a predefined list of questions (Bryman & Bell, 2015; Wengraf, 2001). The semi-structured open-ended interview was, therefore, determined to be the most appropriate method for this study, as, while specific information was required, an open-ended approach allowed participants to freely express their thoughts and perceptions on the broad subject of open data initiatives within their organisations.

Based on research questions, Interview Protocols were developed with a set of pre-formulated questions for carrying out the semi-structured interviews within the members of the New Zealand OGD initiative. Initially, the interview protocols were included in the application for ethical approval. The protocol contained approximately 40-42 questions divided into five sections: demographic questions, questions related to research question RQ1, research question RQ2, research question RQ3, and research question RQ4. Moreover, the questions were formulated in such a way as to identify the expert's opinion both on specific aspects of OGD as a whole and in relation to the overall context of New Zealand Government procedures on data management and DDO as the users of open data.

Two distinct interview protocols were developed for this project. One was designed to elicit the experiences of government-agency participants, and the other was designed to elicit the experiences of private-organisation participants. This allowed for various perspectives to be captured in the interview. The interviewee was able to discuss their

experiences in detail, providing examples of their successes and challenges depending on their roles. They understood the scope of the New Zealand OGD implementation and potential issues, providing insights into how these could be addressed. Through this, I could better understand the participants' experiences of the OGD initiatives project. Having this information will provide primary data for this study. In addition, the protocols included instructions on how each interview should begin with the following opening:

a) Establish rapport by introducing the researcher and the research's purpose and objectives.
b) Explain why the researcher is interviewing the participant.
c) Describe how the interview findings will assist the New Zealand Government, the public, communities, and organisations make better use of OGD.
d) Confirming participants' availability and detailing processes, as the interview should last approximately 40 - 60 minutes.

Four interview sessions took place in the participants' offices, while six were held in virtual/online sessions through Zoom or Skype at the participants' request. The interviews were recorded with sound recorder tools on two mobile phones for the face-to-face meetings. The first smartphone was the primary recording, while the second was a backup. Recording of the online session using the Zoom application resulted in two types of files, MP4 (Motion Picture 4) video and M4A audio, while recordings from Skype sessions were MP4 files.

The study used a two-phase data collection process. At the first point, the primary data were obtained through semi-structured interviews with ten participants from six government agencies and three private companies in New Zealand. The second phase involved the compilation of secondary data from the New Zealand OGD and private companies' websites and policy documents. Semi-structured interviews using open-ended questions were used to answer research questions; these interviews were also accompanied by a follow-up of "Why" or "How" questions. Each participant was interviewed at a predetermined time in their office or through virtual sessions. Given the geographical dispersion and interview requests, most interviews were performed via Skype or Zoom virtual meetings. Each interview was recorded and subsequently transcribed.

The questions were designed to encourage mutual respect and benefit on the expectation that participants will be able to provide their meaningful feedback without

getting offended on the subject based on their practical knowledge (Galletta, 2013). As the researcher, I was the person to conduct interviews; therefore, I could ensure a professional interview approach. The interview protocols were structured to provide primary data to answer research questions. The semi-structured interview questions initially were simplified as shown in Table 4.1 and Table 4.2 to describe the question context and its objective and how each question was linked to the research questions. The list in Table 4.1 was designed for semi-structured interviews with participants from New Zealand Government agencies, whereas Table 4.2 contains a list of participants linked with private companies, such as DDO.

Table 4.1 The interview question and objectives for participants from government agencies

For participants from government agencies	
INTERVIEW QUESTIONS	**CONTEXT OBJECTIVES**
Section I. Demographic questions	
Sector representation	To know which sector is represented by the participant
Participant's current role	To know for sure that the participant's role linked to the Open data
Participant's duties	To let the participant describes the duties primarily related to the Open data
Understanding on OGD	To discover whether the participant has an adequate understanding of the OGD program
Section II. Semi-structured, Open-ended questions	
A. The questions related to the Research question 1 (RQ1)	
Background & roles related to Open data	To find the participant's background to gain the necessary skills to implement the OGD program
Satisfaction of the current OGD	To know what reviews the participant has given for the current OGD program implementation
People's awareness	To discover what efforts have been made to improve NZ citizens/people's awareness about OGD
Policies & regulations	To know how government data policies such as open data, secrecy, and quality define and play a role in the OGD implementation
B. The questions related to the Research question 2 (RQ2)	
Organisation's motivation	To evaluate government agencies' motivation and whether they need adapt their work culture to implement OGD.
Barriers & concerns	To find out what barriers and concerns in creating the value of OGD
Top-level commitment	To find out whether the top management in the government agency is giving their commitment to helping facilitate OGD implementation in their organisation
NZ gov commitment	To know how the government supports each government agency's OGD initiative implementation.
C. The questions related to the Research question 3 (RQ3)	
Tools	To discern whether the agency uses any tools/special software to draw the direction/plan
Customers & Users	To know what types of users were using OGD
Key players	To investigate the key players in the government agency/organisation dealing with OGD
Action plan's key factors	To explore what key factors needed to build the OGD action plan
Effectiveness & measurement	To identify what the participant reviews on the effectiveness of the current datasets and how they measure
Privacy & personal information	To find out how the government agency manages the privacy and personal information linked to open data
Objectives	To explore how the agency plans its objectives to implement OGD
Benefit measurement	To observe how to measure OGD benefit to users
D. The questions related to the Research question 4 (RQ4)	
Key partners	To know who the key partners are in implementing OGD
Guidance/procedure frameworks	To find out how the OGD governance structure in managing the OGD implementation
Challenges & obstacles	To find out what the obstacles found during the OGD implementation and whether it is too complex to publish or not.
Key actors	To investigate the key actors deal with OGD initiative
Stakeholders	To observe who are the stakeholders in providing OGD
Quality monitoring	To perceive how the agency is concern with data granularity in OGD publication
OGD contribution	To investigate what OGD contribution has given
Key sources	To determine how the government agency provides appropriate facilities and manpower for the program
Cost and Revenue	To observe how the financial resources/cost budget allocated for OG implementation

Table 4.2 A list of interview questions and objectives for participants from private companies

For private companies/data-driven organisations	
INTERVIEW QUESTIONS	**CONTENT OBJECTIVES**
Section I . Demographic questions	
Sector representation	
Participant's current role	
Participant's duties	
Understanding on OGD	
Section II. Semi-structured, Open-ended questions	
A. The questions related to the Research question 1 (RQ1)	
Background & roles related to Open data	To find whether the participant has obtained the necessary skills to use OGD
Satisfaction of the current OGD	To know what reviews the participant has given for the current OGD program implementation
OGD used & interest	To discern what OGD datasets the participant used and what datasets they will be interested in to get
B. The questions related to research question 2 (RQ2)	
Desired outcomes	To perceive the participant's desired outcomes to carry out activities in using OGD
OGD's websites & datasets	To know which datasets were used by the participant/organisation and taken from which website
Dataset licenses	To find out the awareness to know about the data license for use and reuse
Inquiries & feedbacks	To perceive whether the participant/organisation have raised any inquiries or feedback regarding the datasets that are being used
Organisation's motivation	To investigate what motivation to use OGD
Barriers & concerns	To know what barriers and whether there are any concerns about using OGD
C. The questions related to the Research question 3 (RQ3)	
Tools	To find out whether the organisation uses any tools/software to plan its business objective
Customers & Users	To know the segmentation of the organisation's customers
Key players	To investigate the key players in the organisation dealing with OGD
Action plan's key factors	To explore what key factors needed to build the OGD action plan
Effectiveness & measurement	To identify what the participant reviews on the effectiveness of the current datasets and how they measure
Privacy & personal information	To know whether the organisation is concerned about the privacy of information
Objectives	To explore how the organisation plans its objectives to use OGD
Services/products dependency	To find out whether any services/products directly depend on the OGD availability
Output measurement	To observe how the organisation measures output with one of the sources was OGD
D. The questions related to the Research question 4 (RQ4)	
Key partners	To know who the key partners are in using OGD
Guidance/procedure frameworks	To find out how the OGD use managed to explore the benefit for the user
Challenges & obstacles	To find out what obstacles faced to use and get benefit from OGD
Key actors	To investigate the key actors related to OGD initiative
Stakeholders	To observe who are the stakeholders involved
Quality monitoring	To perceive whether the organisation think that data quality is needed to make data easy to use
OGD contribution	To investigate what the OGD benefit or positive
Key sources	To discern what infrastructure and manpower that organisation have to support the datasets use
Cost and Revenue	To observe how the financial resources allocated and whether OGD use give revenue benefit
Service customisation	To observe whether the organisation need to customise its service/product because of OGD use
Other resources	To find out if any resources needed to gain OGD benefit
Technical problems	To find out what technical problems faced in using OGD
Potential revenue/benefit	To know if any potential revenue/benefit earned by using OGD
Data integration	To find out whether any difficulties were experienced when integrate OGD with other data

These two lists were developed in connection with the four research questions. There are distinctions between these two lists because the question posed targeted the

participants and their organisations' responsibilities in the OGD initiative. For instance, questions about the OGD used and interest were asked to the participants of private companies to determine which OGD datasets the participant used and which datasets they would be interested in acquiring, but not by government agencies. Participants from government agencies were asked about their policies and regulations, whereas participants from private enterprises were not asked similar questions.

4.4.3. Participants' profiles

Following the Auckland University of Technology Ethics Committee (AUTEC) ethics approval in June 2019, the recruiting of the participants began with a long list of participants. The participants were selected for their expertise and experience in OGD implementation and use in New Zealand. Participants were recruited using a purposeful sample strategy, which involved selecting participants from around New Zealand to get more data and represent a more diverse range of organisations.

The long list provided 20 potential participants who were either government officers or employees in private organisations collaborating in OGD programmes. However, some prospective participants did not respond to email invites, others proposed alternate participants, and others declined the invitation to join. The final list resulted in 10 participants from 9 organisations ranging from six government agencies, two DDOs and an Information Technology (IT) company. Table 4.3 provides the final list of participants with their affiliated organisations and when and how the interview sessions were conducted. Experts in the interviews can be considered leaders and successful participants in open data initiatives. Each is a specialist with professional expertise in data analysis, database management, archiving and document management, both in the private and public sectors. All participants had technical skills related to OGD and knew how the data were used or published within their respective organisations.

Table 4.3 A list of the participants

No	Participant's role	Organisation type	Interview session time	Interview session type
1	A leader	Local government agency	4 September 2019	Online via Skype meeting
2	A leader	Crown entity government agency	5 September 2019	Combining an online session via Skype and answering by email
3	A leader	Private company/ IT company	9 September 2019	Face-to-face at the participant's office
4	An open data leader	Central government agency	12 September 2019	Online via Zoom meeting
5	One of the chiefs	Private company/ Property data provider	18 September 2019	Online via Skype meeting
6	One of the chiefs	Banking industry	16 October 2019	Face-to-face at the participant's office
7	A manager	Local government agency	6 November 2019	Face-to-face at the participant's office
8	A manager	Local government agency	12 November 2019	Face-to-face at the participant's office
9	A manager and product owner of open data	Central government agency	4 March 2020	Online via Skype meeting
10	A senior technical and strategy staff	State-owned enterprise	5 March 2020	Online via Zoom meeting

Participants' perspectives on OGD implementation offered an accurate and trustworthy representation. The findings' synthesis assisted in summarising and comparing them to existing evidence from the literature and secondary data.

4.5. Data analysis

As a strategy for arranging and organising data in qualitative research, data analysis can be thought of as one that reduces the amount of information collected by using detailed coding (Creswell, 2018; Myers, 2013). The iterative aspect of the analysis is emphasised because it begins with the organisation of the data into an easy-to-manage list, then analyses the data and takes notes, and ultimately explains the data.

The research gathered empirical data for designing ecosystem business models from the literature, documents and organisation policies, and from the qualitative multiple case studies in New Zealand. The intention of using the case study research method was to present multiple perspectives on actors, activities, policies, documents (Yin, 2014), and issues to identify and interpret the different views of every case (Eriksson & Kovalainen, 2016; Stake, 2006).

Each participant in this OGD initiative could participate in an ecosystem since it created a value chain. A way to maintain quality and permanency of providing open data such as an agreement to data process for opening, delivering, combining and boosting useful data emerged as a valuable ecosystem (Kitsios, Papachristos, & Kamariotou, 2017).

Data processing was a continuous iterative process that happened during this research. However, no approach was thought to be particularly suitable for analysing qualitative data. The data analysis employed the Thematic Analysis method, a method for defining and analysing qualitative data patterns (Boyatzis, 1998). The semi-structured interviews were analysed using inductive thematic analysis, which aligns with the social constructivism worldview (Creswell, 2018) described in section 4.1. Figure 4-1 presents the study's data analysis approach (Eight, 2018) is loosely modelled after Creswell (2018) chart.

Several steps comprise the data analysis process based on Creswell (2018) as shown in Figure 4-1, which can be described as follows:

1. The initial step in the data analysis was to transcribe the interview recordings in order to acquire a better understanding of the interviews. Although time consuming, this procedure is necessary for gaining a thorough knowledge of the participants' responses during the interviews. It allows for identifying specific words or phrases that may be confusing or misleading. There are transcription files as a result of the transcription procedure.
2. The next phase in the data analysis is to read through all primary and secondary data, including transcripts, recordings, and information from websites and the data portal that pertains to the participant's statements. The objective is to gain a deeper comprehension of what the participant said and to identify any patterns. It will enable me to define how the multiple case studies will be conducted.
3. When planning the interview session with the interview protocols, I assume to investigate two collective case studies. Case study A focuses on exploring and analysing participant replies about government agencies. In contrast, case study B examines participant responses related to data-driven organisations. After reading the transcripts and relevant information from the literature review, organisation websites, and open data portals, I realised that a third case study would be advantageous to the thematic analysis of the multiple case study. The study will contribute to a more in-depth investigation and provide more profound conclusions regarding the implementation and actors' relationships to implement the New Zealand

OGD initiative. Therefore, the third case study (case study C) focuses on the IT company, which was identified based on its relevance to the participants' transcripts as a key partner for the government agencies.

In addition, the multiple case study analysis includes four stages. The first two stages were conducted in each case study using a deductive and inductive approach, followed by two stages in the cross-case analysis to check the analyses of the three case studies to develop thematic analysis findings and themes.

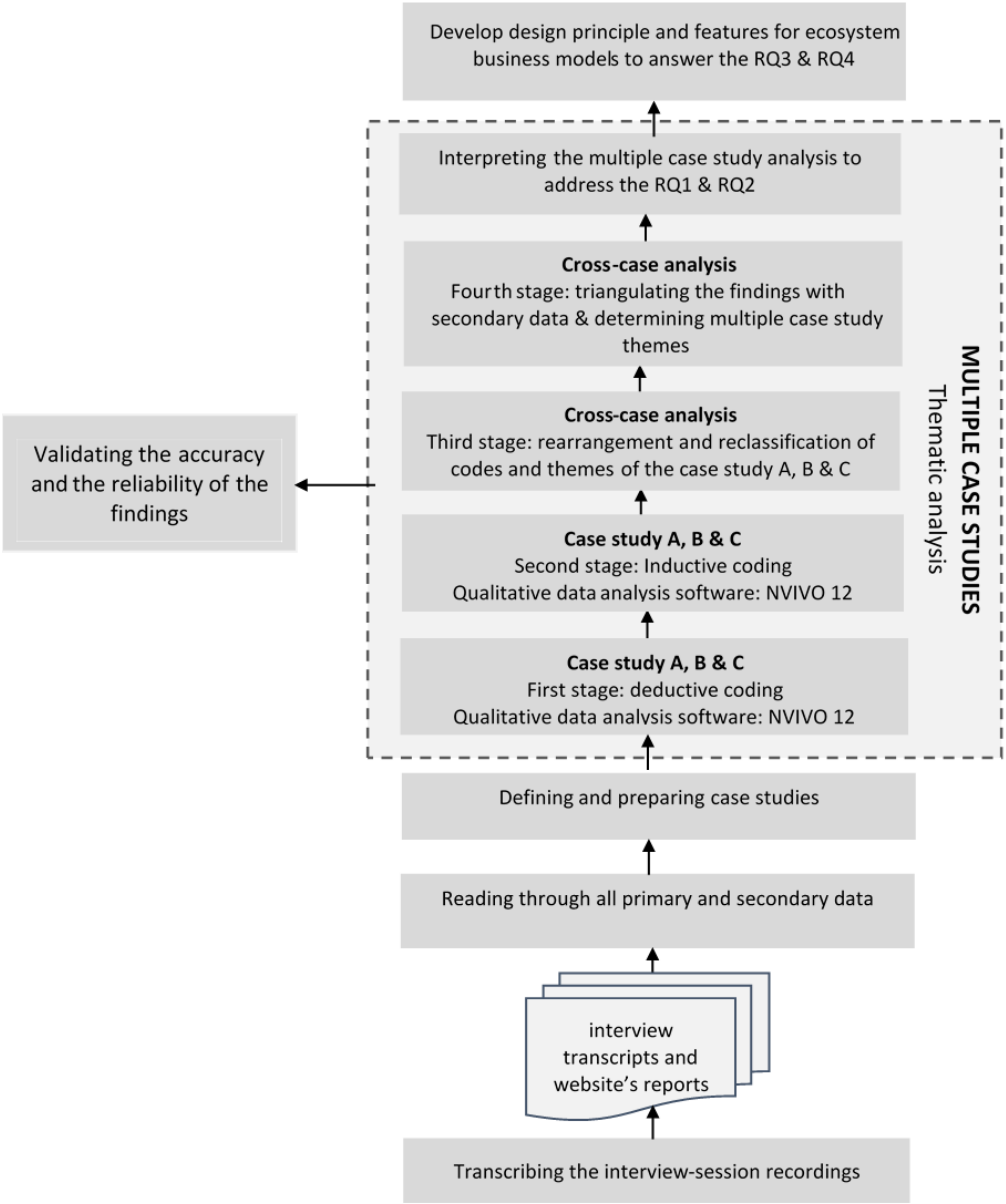

Figure 4-1 Data analysis process

4. Drawing from the multi-case study analysis, the findings elucidate the roles of the OGD actors and how OGD impacts DDOs and their work as well as explores what opportunities and challenges exist of OGD value in addressing research questions RQ1 and RQ2.
5. Interpreting the themes and coding for developing design concept and figures of ecosystem business models in designing ecosystem business models using the platforms of Business Model Canvas (BMC), value creation models, and Open Data Business Models (ODCCs).

In summary, the data analysis process is developed to achieve the study's aims to examine organisations dealing with OGD programmes in the context of an ecosystem for OGD to develop business model designs. Additionally, it seeks to understand how DDO and government agencies can successfully translate OGD value creation as the potential source of impact (Eriksson, 2016; Myers, 2013; Yin, 2014).

4.5.1. Method of analysis

"Analysis is a matter of giving meaning to first impressions as well as to final compilations." (Stake, 1995, p. 71). Stake elaborates that analysing essentially entails dismantling something. We deconstruct our impressions, our observations. Researchers follow particular methods that enable them to derive systematic implications from prior knowledge and minimise misunderstanding. The page does not write itself; rather, by locating the appropriate ambience and moment for analysis, by reading and rereading the story, and by engaging in deep thought, insight creeps forward and the finding is analysed. The data analysis in this qualitative research aims to comprehend the phenomenon being investigated by generating valid results from the collected data, which is consistent with the qualitative study's objectives.

Patton (2002) emphasised the importance of three strategies in qualitative data analysis. To begin, a researcher must organise and consolidate data in chronological sequence. Second, massive data must be summarised and compacted. Thirdly, a qualitative researcher must sift through the data in search of patterns and themes. This study adopts Patton's approach by transcribing the interview recordings using the non-verbatim method as the first process in the data analysis. Then thematic analysis was conducted as the primary approach in the multi-case design. Finally, the coding result of the cross-case analysis elaborated themes to find the linked concepts to build typologies of the OGD ecosystem and business models.

As a result of this study's overall data analysis strategy, the inductive theme method was chosen. According to Creswell (2018), an inductive approach can be employed in a constructionist framework, making it in line with the interpretive epistemology and Constructivism paradigm as the study's philosophical assumption and overview (as explained in section 4.1. Additionally, it enables the identification of emergent themes and coding patterns across the entire dataset. As (Bryman & Bell, 2015; Creswell, 2018; Myers, 2013; Stake, 1995, 2006; Yin, 2014) argue, this is certainly relevant in multiple case study research.

4.5.2. Transcribing interview recordings

Transcription is *"a method of transforming what people say and do into forms of text"* (Vanover, Mihas, Saldaña, & (editor), 2022, p. 64). In contrast to the technical approach, transcription is more of an act of interpretation, and the close examination required for transcription may uncover previously unnoticed events (Bailey, 2008; Jackson & Bazeley, 2019). Because a transcript cannot represent the entire complexity of human interaction, listening to or watching the recorded data is essential to get a sense of how and what was said (Davidson, 2009).

Transcribing, as the first process in this study's data analysis, was conducted in two stages (Figure 4-1). To begin with the first stage, each audio recording file was transcribed using the Live Transcribe application on the smartphone. The technique generates all forms of data to review how raw data looks and sounds. The second stage entailed the researcher closely observing the recordings using an up-to-date audio/video player while checking the rough-text transcriptions generated in the first stage. This study employs a non-verbatim transcription method – also known as clean verbatim – to make a transcript easier to read by removing unnecessary speech without changing the text's message or structure[16]. Non-verbatim transcription eliminates all excessive noise, such

[16] https://viqsolutions.com/media-center/verbatim-transcripts-vs-clean-verbatim-whats-the-difference/ last accessed October 2021

as thinking sounds or laughing, without altering the conversation's meaning or structure. This strategy improves the readability of transcripts in general.

The transcribing process was then meticulously carried out for each case by pausing the audio player at each phrase or sentence and listening repeatedly (Vanover et al., 2022). Analysing data can benefit from this engagement with the recordings and focus on what has been there by listening to the audio or seeing the video and then transcribing it into a written text (Saldaña, 2016).

4.5.3. Multiple Case Study Analysis

In-depth studies based on case studies are frequently utilised in conjunction with statistical verification when researching organisations (Yin, 2014). The case study is an effective approach for validating and analysing patterns (Myers, 2013). The case study is more appropriate when the research investigates a specific organisational unit or a broad range of conditions of interest (Bryman & Bell, 2015) or when the enterprises are involved in managerial activities (Eriksson, 2016). However, researcher's bias may exist; this can also be an issue when generalisations are drawn from only one or two cases. Yin (2014) stated that obtaining data from the data gathering process can help increase the generalisability of case study research. The researchers emphasised that generalisability is contingent upon the diversity of the data gathered. In terms of the interpretations established by recurrent research, a multiple-case study is objectively more valuable than a single-case study (Yin, 2009).

This is why, among all possible approaches, this study chose a multiple-case study as its fundamental research method to overcome the shortcomings and limits of a single case study. Six government agencies, two data-driven companies, and one software developer company were chosen to participate in this study in an effort to comprehend the how, why, and where of the organisations' motivations, activities and experiences in the New Zealand OGD initiatives. The multiple-case study was constructed by conducting in-depth interviews with senior employees of these organisations. The analysis of the multiple case studies is represented as graphs, charts, maps and tables in thematic analytical reports.

As illustrated in the data analysis flowchart of section 4.5, the multiple case study investigation is carried out in two coding cycles to refine codes and categories for the case studies A, B, and C. First cycle deductive categories and codes were extracted from the interview data and through comparative analysis of the initial three case studies.

The second inductive cycle reorganised in refining and validating the deductive coding clusters resulting from the first cycle. In this cycle, the constant comparative method of data analysis was employed to inductively analyse the reorganised coding clusters to develop each case study's themes. The third and fourth cycles involved a cross-case analysis across all case studies. The three case studies' coding clusters and thematic maps were reorganised and classed in the third cycle. This allowed for a more comprehensive understanding of how different organisations are involved in the OGD initiative. The fourth cycle consisted of triangulating the findings with secondary data, constructing multiple case study themes to answer RQ1 and RQ2, and developing concepts for the ecosystem business model to answer RQ3 and RQ4.

To accommodate the design of the multiple case studies, I classified and identified the participants (Table 4.3) based on their affiliated organisations and their responses as stated in the interview transcripts in collecting data needed for conducting the case study A, B and C analyses. Experts who have engaged in the interviews can be referred to as leaders and successful participants in the open data initiatives. Each of them is a specialist with professional expertise in data analysis, database management, archiving and document management, both in the private and public sectors. The list of the participants' classification is shown in Table 4.4.

The participant identifiers were developed to maintain confidentiality. Each participant has an identifier that was assigned with three to four characters that began with the letter P (Participant) then followed by the letter A for the participant's interview transcripts that served as the primary data for case A, the letter B for case study B, and the letter C for case study C. The last character was a number assigned based on the time order when interviews were conducted. For instance, PA1 refers to a participant who is affiliated with a government agency and whose transcript will be categorised as part of case study A.

Table 4.4 A list of the participants' classification

Participant code	Role	Background	Organisation type	Case study
PA1	One of the leaders in a local council	Being trained as an urban planner and involved in a small open data program 7 years ago.	Local government agency	Case study A - Government agencies
PA2	One of the leaders in a government agency	Working in and around open data for the last 6 years. Previously, involved in science communication, including open access.	Crown entity government agency	Case study A - Government agencies
PC3	One of the leaders in a limited company	Being involved in a Hackathon open data in 2014 and provided IT support in open data projects for several government agencies	Software developer limited company	Case study C – IT companies
PA4	One of OGD leaders	30 years in government and IT roles. Started working for the OGD in 2013	Central government agency	Case study A - Government agencies
PB5	One of the chiefs in a company related to real estate	As the expertise in computational mathematics and joined the company about a scientist to work on some of the algorithms and think how they can use the public data as advices	Property data provider	Case study B – Data-driven organisations
PB6	One of the chiefs in an international banking company	Worked at this company since 2010 as senior staff to predict common economy so that relevant for company's traders and customers	Banking industry	Case study B – Data-driven organisations
PAC7	Manager in local government council	the background is in sociology, then managed the research analysis and monitoring team to make data available to council, decision-makers and communities	Local government council	Case study A - Government agencies Case study C – IT companies
PA8	Manager in a local government council	Previously was the principal data analyst, providing data to New Zealanders through various methods.	Local government council	Case study A - Government agencies
PAC9	One of the managers and product owner of open data	Previously as the regular user of the organisation data service and very aware of their operations. So being very familiar with the service for a long time	Central government agency	Case study A - Government agencies Case study C – IT companies
PA10	A senior staff	Being involved in setting and determining the research strategy for the organisation and supervised the forecasting research Department	State-owned enterprise	Case study A - Government agencies

The participant is the person who was interviewed for the first time. Another example, PAC7, is a participant from a government agency whose transcript will be included as data for case studies A and C, because, as a government official, the transcripts typically will be included as the data for case study A. However, because several participant's responses during the interview corresponded to information required for case study C, the code became AC. Finally, number 7 was chosen because the interview was the seventh session.

4.5.4. Reliability and Validity

Reliability. Reliability is founded on data adequacy, which enables the demonstration of consistent support for one's interpretation among participants (Creswell, 2018). Data adequacy refers to the extent to which the data provided is sufficient to support the analysis that is being performed. In this qualitative research, I attained reliability through triangulation. Triangulation was applied by gathering data from multiple sources.

According to Myers (2013), triangulation would aid in examining and confirming the viability in this study. This study used the method of conducting interviews, compiling government reports, and observing the open data portals and websites of DDOs and IT companies to obtain primary and secondary data.

Validity. Validity refers to the researcher's ongoing checks and verifications to make sure that the data is accurate. Qualitative research is predicated on the premise that validity is a matter of utility, and trustworthiness (Creswell, 2018). Qualitative research's trustworthiness can be measured by several criteria, including the following: credibility, transferability, dependability, and confirmability. The two most critical components, however, are credibility and transferability (Mohajan, 2017). The credibility of qualitative research is often judged by how closely the findings reflect the experiences of the participants because the qualitative research should be based on the direct experiences of the participants, rather than on the researcher's interpretation of those experiences. Transferability, or the ability of the findings to be generalised to other situations (Siccama & Penna, 2008), is also an important criterion for judging the credibility of qualitative research. I strengthened the internal validity of my research by doing regular reviews on data collection procedures and multiple case study analysis with supervisors. As Eriksson (2016) notes, qualitative research and sample size calculations are about achieving redundancy. When researchers run out of new topics, data saturation occurs. To ensure data saturation, I asked identical questions during each interview by closely sticking to the interview protocols (see Appendix A) during the data collection and employed the coding technique until no additional coding was possible in the thematic analysis of all case studies.

Additionally, I employed a triangulation research approach as a form of validation, to strengthen the validity of this study, which is defined as the use of multiple approaches to the same event (Vanover et al., 2022). Triangulation is an effective research strategy for validating data by comparing it to data from two or more sources. It is critical to minimise subjectivity in data gathering (Yin, 2009), analysis and interpretation (Creswell, 2018). Researchers from different disciplines have different understandings of triangulation, but a common definition is that it includes the use of multiple methods, multiple sources or multiple perspectives to study a phenomenon (Vanover et al., 2022). Thus, it is a primary data collecting approach in this study, which acquired data through interviews, documentation and email correspondence. The interview transcripts were reviewed by participants and supervisors. Additionally, the case study followed Yin's

(2009) research protocols, and questions for the interviews were developed adopting procedures developed by Turner (2022), Wengraf (2001) and Galletta (2013). Each case study analysis conducted a cross check between coding results that are excerpted from interview transcripts and secondary data. Furthermore, cross-case analysis was conducted to validate all case studies' analyses to elaborate main themes (Stake, 2006; Turner, 2022))

Triangulation is critical for ensuring the dependability and authenticity of data and findings. According to Tashakkori and Teddlie (2010), triangulation adds depth to the data obtained by researchers. When conducting interviews, it is critical to ensure that participants do not say what they assume the interviewer wants to hear; this is referred to as reflexivity (Yin, 2018).

4.5.5. Thematic Analysis and NVivo

Thematic analysis is the method used in qualitative research. It is used to identify and display content themes or patterns in classifications. It displays the facts in considerable detail and discusses various themes based on the provided interpretations (Boyatzis, 1998).

The best way to discover meaning is through thematic analysis by reading and interpreting the transcripts. A methodical approach to data analysis is provided by this method (Braun & Clarke, 2006). An analysis of a theme can be linked to the rest of the content using this method. The research becomes more precise and complicated, which raises its real significance. Braun and Clarke noted that thematic analysis develops a more comprehensive understanding of any problem (Braun & Clarke, 2006).

According to Namey, Guest, Thairu, and Johnson (2008), thematic analysis aims to discover obvious and hidden meanings more than counting phrases and words. There are several ways in which these codes can be used, including comparing the frequency of themes or subjects in clustered data, recognising code covariance, or plotting the relationships between the codes to each other.

Thematic analysis enables the researcher to carefully establish linkages between concepts and compare them to replicated facts (Boyatzis, 1998). By utilising thematic analysis, it is possible to connect the numerous concepts and perspectives of the participants and compare them to the data acquired in various situations and at various points throughout the project (Namey et al., 2008). All interpretations are possible.

I decided that thematic analysis with an inductive approach was appropriate for this study because good qualitative research requires the ability to draw interpretations and be consistent with the collected data that begins with a specific objective of OGD implementation in New Zealand and progresses to broader generalisations about how providers and users interact with OGD, and finally to design ecosystem business models. Keeping this in mind, thematic analysis can detect and identify elements affecting any topic raised by participants. This is consistent with the characteristics of the thematic analysis process.

Furthermore, a combination of NVivo 12 Pro and the thematic analysis was adopted to analyse the interview transcripts. Siccama and Penna (2008) recommends that NVivo assists in analysing qualitative data to make the handling of large amounts of qualitative data more manageable. There were several advantages to utilising NVivo in this research, one of which was managing to code using nodes. In addition, putting data in a single project file makes it more searchable from multiple locations, which is a second advantage of doing so. Additionally, NVivo offers the capability of visualising the matrix or tree of data and organising coding clusters with query tools effectively (Jackson & Bazeley, 2019). However, even though NVivo can show how data is organised, NVivo is less effective in identifying emerging themes.

4.5.6. Coding

Code can be a single word or short phrase that applies a significant, summative and descriptive feature for visual information (Saldaña, 2016). A single word, a paragraph, a video, or moving images can all be coded in the initial coding cycle.

In a qualitative approach, the researcher generates a code that symbolises or translates data and therefore assigns interpretive meaning to each datum for further detection, categorisation, theory construction, and other analytical procedures (Stake, 1995). Iterative inductive coding was used in this investigation. It enabled a detailed understanding of the meaning of each datum to be developed without restricting the analysis to a set of codes. Participants' transcripts were excerpted to generate codes, and these codes were then organised into categories, and finally, these categories were combined into themes.

The study was coded both inductively and deductively. Deductive coding is suggested by (Onwuegbuzie, Frels, & Hwang, 2016) to ensure that data is organised and focused in order to stay on track with the study's goals. Following the initial deductive coding,

iterative inductive coding was used to generate a more detailed meaning of the data to predetermined categories or codes (Creswell, 2018).

Specifically, in the multiple case study analysis, each case study has two coding cycles to refine the codes and categories. The first cycle included a deductive coding approach. Following the second inductive cycle, the case study's themes were generated. The third and fourth (final) cycles included cross-case analysis to find out thematic findings and triangulate them with secondary data. The findings from the multiple case study resulted in fundamental concepts and themes to design ecosystem business models.

4.6. Summary of Chapter 4

This chapter described the various research methodologies and provided a justification for the ones that were chosen. Initially, this was achieved by describing the philosophical assumptions and worldview driving the study. Secondly, this was accomplished by detailing the research plan and the tools used to collect data. The third section of the chapter discussed the ethical considerations that guided the rigorous investigation. Lastly, the data analysis method known as multiple case study analysis with thematic analysis was examined.

Chapter 5 Multiple case studies: An iterative search for meaning

This research begins with a thorough evaluation of the literature and the careful and thoughtful formulation of research questions on the topic of building ecosystem business models for organisations that deal with Open Government Data. Following the process, this chapter addresses the step-by-step multiple case approach. Planning a multiple case study analysis makes little sense until a single case study provides thorough findings and initial conclusions (Stake, 2006). I can only then begin to evaluate how the findings of the single case study can be used to inform and broaden the initial conclusions. This method of elaborating initial conclusions is often referred to as multiple case study analyses.

The multiple case study method was used to design the research. A particular aspect of New Zealand's OGD implementation was closely investigated through three case studies. This method of research design can be used in a variety of circumstances. However, this was the primary analysis when I wanted to investigate an inherently complex phenomenon, subtle and challenging to measure, such as human expertise and experience dealing with OGD. This chapter provides an overview of the fundamental logic of multiple case study design, emphasizing sections 5.1, 5.2, and 5.3 that detail the design process. The following sections 5.4, 5.5, and 5.6 will examine the analysis of each case study in further detail, including the case setting, participant, and thematic analysis. This chapter addressed research questions RQ1 and RQ2:

(RQ1) What are the value-creating roles played by different actors in Open Government Data and data-driven organisations?

(RQ2) What is the motivation of Government agencies and data-driven organisations to publish and use Open Government Data?

5.1. Case study stages

The study conducted a literature review, analysed and examined government documents, and conducted a qualitative multiple case study in New Zealand. The purpose of recruiting participants was to obtain new evidence and sectors for studying the supply and demand of OGD. The goal of conducting multi-case studies was to

provide numerous viewpoints on individuals, behaviours, policies, and documents (Eriksson & Kovalainen, 2016; Stake, 2006). The purpose of the case study setting was to better understand OGD through the collection and analysis of secondary data and to conduct in-depth interviews with participants in the OGD sector in New Zealand. The secondary data that was used in the study was primarily data from government agencies, data-driven organisations, and IT companies. The semi-structured interviews were conducted with participants from government agencies to examine the quantity and quality of their open data. All the participant's names and affiliated organisations were omitted to ensure anonymity. In contrast, the participants from data-driven organisations were interviewed to examine the value-added of OGD that they used. The interviews with participants from IT companies were used to investigate how they supported their clients in the OGD implementation. The in-depth interviews were conducted with selected participants based on their expertise related to OGD initiatives, type of organization, and opinions on the topic.

The study adapted the stages of a multiple case study method described in Figure 5-1 from Yin (2014, p. 60). The multiple case study is an observational design that involves collecting data from multiple cases. It can be developed using a variety of different theories and techniques.

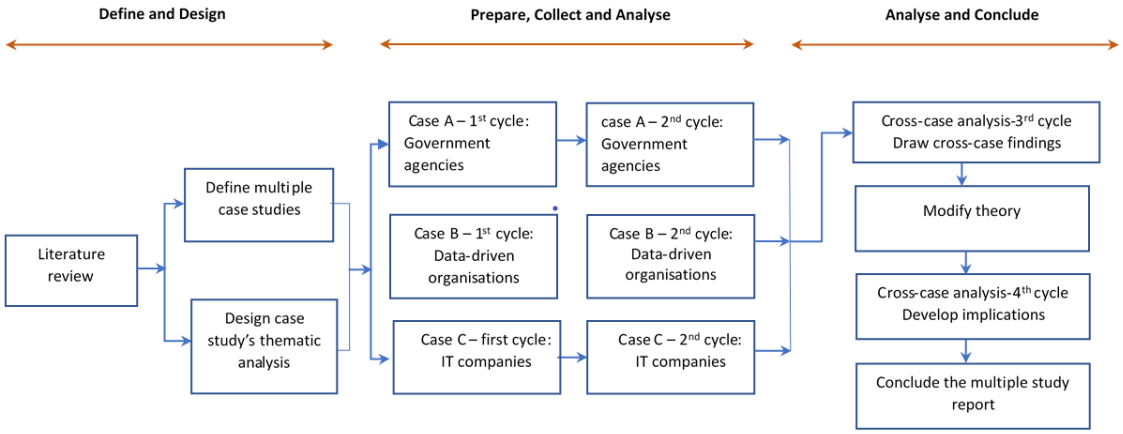

Figure 5-1 Multiple case study stages. Adopted from (Yin, 2014, p. 60)

Figure 5-1 shows that the initial step in designing the multiple case study is to develop a theory by reviewing the literature on the OGD subject. It illustrates a logical process of

the embedded multiple case study. The logic of the design had been discussed with the supervisor before beginning the multiple case study analysis. This provided direction and focus for this research and identified gaps in the literature that I, as the researcher, should pursue. I should then select the cases to be studied and define the specific measures used in the study and preparing an interview protocol. The researcher should also consider how the data will be analysed, and whether secondary data should be incorporated(Yin, 2014).

Each case study within the embedded multiple case study contains "a complete story"; The findings were presented alongside facts as the information-rich replication by other individual cases (Yin, 2009, p. 56). Thus, each of the three cases gives an in-depth examination of a single example. Then several cases provide aggregated findings, inferences, and implications based on replication logic. In the prepare, collect, and analysis stages, each case study was a complete investigation in and of itself, in which convergence evidence regarding the case's facts and conclusions was sought. The findings of each case were then considered to be the information that required replication in another case(Stake, 1995). A summary should focus on both individual case and multi-case results. The outcome explained how and why a specific theme analysis was elaborated in each example(Yin, 2014). Across the cases process described in the analysis and conclusion stage, the investigation determined the replication result's extent, which helped address the study's RQ1 and RQ2. Additionally, the outcome provided the themes for developing an ecosystem business model, discussed in the following chapter, Chapter 6.

The dashed-line feedback loop is a significant element of Figure 5-1. The circle depicts a scenario in which a considerable discovery arises throughout conducting one of the individual case studies. This finding could have implications for some or all of the study's theoretical hypotheses. Before continuing further, the redesign should occur. I had to change the initial design of the case study for infomediary companies, such as interviewed participants and how the interview transcripts were coded. This happened due to a six-month delay in data collection and no response from contacted participants when the pandemic Covid-19 resulted in restrictions due to New Zealand’s hard-elimination strategy for COVID-19 from March to June 2020. Such redesigns included modifications to the case study process. Without this redesign, I could face accusations of altering or omitting the discovery to meet the design process. With revisions made,

our study avoided an accusation of being selective in the case study analysis to fit predetermined notions.

I conducted two coding cycles to fine-tune codes and categories in each case study. The initial codes and classifications were included in the first cycle with a deductive approach. The inductive second cycle rearranged and reclassified the initial codes, resulting in the case study themes. The third and fourth (last) cycles were conducted as a cross-case analysis to mobilise thematic findings from three case studies. The third cycle saw a more comprehensive reorganisation, rearrangement, and reclassification of codes and themes from those three case studies. The primary objective was to subclassify the nodes within each category. The fourth cycle entailed performing a final check by triangulating the findings with secondary data and determining multiple case study themes to build concepts included in the design of the ecosystem business model and addressed research questions RQ1 and RQ2.

5.2. Study setting

The study's data were collected from July 2019 to January 2021 in New Zealand (population estimated at 5,127,200 in December 2021[17]). This site was chosen for a variety of reasons. New Zealand is well-regarded in terms of open government, having been placed by Open Data Barometer in their global report 2015[18] as the top 5 high-capacity countries based on a cluster analysis of OGD readiness and impact variables. Open Data Barometer's report put New Zealand as one of the countries that have created open data rules, which are generally well-supported politically. The New Zealand government has spread an open data culture beyond a single government agency, with open data principles embraced by many government agencies and, increasingly, city

[17] Taken from https://www.stats.govt.nz/indicators/population-of-nz

[18] Open Data Barometer Global Report second edition 0f 2015 https://opendatabarometer.org/assets/downloads/Open%20Data%20Barometer%20-%20Global%20Report%20-%202nd%20Edition%20-%20PRINT.pdf

governments. It has the potential for government, citizens, communities, and private companies to benefit from open data. Furthermore, New Zealand stands out as a leader in making government data transparent. New Zealand is placed eighth in Open Knowledge International's 2016-2017 Global Open Data Index[19].

Open government means the citizens of New Zealand can contribute to and influence what the government does and how it does it. Transparency, involvement, and accountability are the cornerstones of New Zealand open government. Citizens understand how their government works and how it affects them, and governments are accountable to the citizen[20]. Approaching open government as primarily an informational activity, with both administration accountability and being publicly accessible, fits the study's focus and the researcher's perspectives.

Data collection restrictions were also considered while choosing the selected government and data-driven organisations located in the smart cities Auckland, Wellington, and Christchurch. Access to the potential participants was made following identified public and private organisations dealing with Open Government data in New Zealand. It involved contacting the leaders first by email, explaining the study, and gaining permission to conduct interviews with the selected participants.

According to Yin (2014), there are numerous reasons for picking a location for a multiple case study. They may be exemplary in some way, representative of a set of circumstances, reveal previously unstudied phenomena or be crucial for testing established hypotheses. The measures carried out by New Zealand government officials to redevelop their open data programme and how private companies from different

[19] OKI's compare-country snapshot available of the state of open government data publication https://index.okfn.org/place/

[20] How New Zealand involves in open government https://ogp.org.nz/open-government-partnership/open-government/

industries started to use OGD to add value to their services were considered an excellent source for the study's in-depth examination.

5.3. Case study A: New Zealand Government agencies

The purpose of case study A was to examine the involvement of participants from New Zealand's government agencies in an expert context surrounding Open Government Data. By analysing patterns in interview transcripts and in a context where each participant is highly experienced, this case study provides an in-depth study of how OGD was adopted and how participation contributed.

5.3.1. Snapshot of New Zealand government agencies

According to information from the New Zealand government website[21], New Zealand is a constitutional monarchy governed by a parliamentary system. The current head of state is Queen Elizabeth II, represented in New Zealand by the Governor-General. New Zealand consists of three branches: Parliament/Legislature, Executive branch/government and a judiciary, and the public sector, whereas each of these agencies play a crucial part in the government structure of the nation. In New Zealand, the government is the ultimate authority and is responsible for enacting laws, governing the country, and safeguarding the safety of its citizens.

New Zealand government agencies are structured to serve the needs of the people of New Zealand. New Zealand has 39 government departments, 150 Crown organisations, and 200 different agencies[22]. According to information gathered from a website of the New Zealand Public service commission, there are two types of agencies, central and

[21] https://www.govt.nz/browse/engaging-with-government/government-in-new-zealand/ last accessed on 10 December 2021

[22] https://www.beehive.govt.nz/release/government-reviews-more-state-agencies last accessed on 10 December 2021

local government[23]. The central government agencies are public service, non-public service, crown entities, independent statutory legislation, public finance act schedule, reserve bank, office of parliament, state-owned enterprises and mixed-owner model companies. The central government supervises local councils. Their tasks include policy development, regulation, monitoring, and managing local government issues (D. o. t. P. M. a. Cabinet, 2019). On the other hand, the local government has two roles in forming national-led policy: an intermediary or bridging between the central government and local communities and a key partner in delivering and monitoring policies and services to communities.

The local government and authority consist of 78 regional, district, city, and unitary councils. Each agency was established to provide services in a particular government area and is responsible for carrying out the government's policies and priorities in that area (Affairs, 2011). The agencies are also responsible for providing advice to the government on policy and program development and performing functions delegated to them by the government.

New Zealand's government is recognised for its openness and transparency; releasing government data supports this reputation. The New Zealand government has made a series of changes to increase the accessibility of government data and information with the OGD programme.

5.3.2. Participants of case study A

According to the table 4.2 presented the summary of participant profile in the chapter 4, there are seven participants affiliated with government agencies for this case study A. They have been interviewed to gain a deeper understanding of their role and experience with OGD and its problems and opportunities. The participants are described below:

[23] https://www.publicservice.govt.nz/our-work/state-sector-organisations/ last accessed on 10 December 2021

1. Participant PA1 is one of the leaders of a local government. PA1 has dealt with open data for approximately seven years. He/she has pushed to expand the public's access and use of government data. He/she is accountable for overseeing the OGD strategy and implementation throughout the entire municipality. Following the participant's request, the semi-structured and open-ended interview was conducted through Skype on 4 September 2019.
2. Over the past six years, participant PA2 has worked with and around open data. Historically involved in science communication, particularly open access. He/she is one of the leaders of a Crown agent. The crown agent is part of New Zealand's state sector, constituted under the Crown Entities Act 2004 on a corporate model where governance and management are separated[24]. The interview was held on 2 September 2020. However, the interview was stopped during the Skype meeting due to a poor internet connection. The interviewee preferred to respond to the remaining questions through email.
3. The participant PA4, one of the leaders in public service, is already thirty years in government and IT roles. The public service assists New Zealand government in seeking the long-term public interest and promotes active citizenship[25]. Concerning the participant's preference to interview at a Zoom meeting, the online video session was held on 12 September 2019.
4. As a senior local government manager, participant PAC7 is responsible for managing the team to make data available to the council, decision-makers, communities and the public. The interview session was held at the participant’s office on 6 November 2019.
5. PA8, a participant from local government, is a manager of a system that produced and published government data. Previously, he/she served as a principal data analyst, supplying New Zealanders with data through different method. The interview took place on 12 November 2019 at the participant's office.

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[24] https://teara.govt.nz/en/crown-entities/page-3 last accessed on 10 December 2021

[25] https://www.publicservice.govt.nz/about-us/ the latest access on 10 December 2021

6. Participant PAC9 is one of the senior managers of public service dealing with OGD implementation. As a former regular user of an organization's data service, he/she has been familiar with the service for a long time. The interview session through Skype was conducted on 4 March 2020.
7. As a senior employee of a state-owned enterprise, participant PA10 has participated in developing the research strategy and supervising research operations for the agency. According to the participant, the state-owned enterprise is “expected to operate profitably as private owned company that one and only shareholder, I believed is New Zealand Government”. His/her current position dates back roughly five years, although he/she has been with this organization for much longer. As requested by the participant, the interview took place through Zoom on 5 March 2020.

5.3.3. First cycle: deductive coding analysis

Qualitative researchers employ codes to symbolically assign summative, salient, and expressive characteristics to data derived from linguistic or visual representations (Saldaña, 2016). During this first stage of the initial coding cycle, a single word, a paragraph, and a page of text were coded. This stage used a deductive method to organise and focus the research on the data to guarantee that they remained consistent with the study's objectives (Onwuegbuzie et al., 2016).

Deductive or "a priori" analysis is the process of applying theory to evidence in order to justify the theory. It is a data analysis technique that is used to undertake "top-down" data analysis (Jackson & Bazeley, 2019). A deductive coding system was built using predetermined objectives of the interview protocols and outcomes of the interview transcripts. This strategy assisted the researcher in remaining focused on the research topic, as qualitative data can be complicated to analyse.

The purpose of the coding process in the first cycle techniques is to ensure that the detected themes are indicative of the original data, relevant with research questions, and eventually generate a set of logical and valid themes (Boyatzis, 1998). The interview transcripts were coded using In Vivo or Literal Coding (Saldaña, 2016). The coding technique was adopted to identify, and extract meanings close to the actual phrases used by the participants. The thematic Coding analysis was organised systematically using a qualitative data analysis software (QDAS) programme, QSR NVivo Version 12 Professional for Windows (NVivo 12 Pro, from now on simplified as NVivo). All discovered themes are coded in NVivo utilising the 'nodes' feature; a node is a virtual

area in NVivo that contains content/references to structures, concepts, themes, and cases. Figure 5-2 illustrates how the actual nodes associated with each construct were built during the coding phase. In NVivo, free nodes are used to store the coding. In general, the term 'node' refers to a connection's terminal point in a branch network or to the point at which a particular notion (e.g. a labelled phenomenon or an abstract representation of an event) branches out into a network, and nodes store coding about themes (Jackson & Bazeley, 2019). Later in the second cycle inductive process, themes were derived from the mapping cluster.

The following examples of In Vivo Coding were excerpted from the interview transcripts to demonstrate how the coding method works. Each coded segment of the sample transcript was followed by the participant code (as indicated in Table 2.2), and the time code was corresponding to the response (minute: second). The first extract below details the interview's coding scheme. NVivo replicated the structure of how transcripts were coded.

A participant affiliated with a central government agency gave a response when asked how he/she knew people's awareness about the potential use of OGD. This is an example of how the transcript was coded with the In Vivo code. Take note of how all codes in the right column are shown in capital letters alongside the data, with a superscript number connecting the data excerpt to its unique code. Every line of important information has been coded.

> *Well, this is a very difficult question. [1]We're about to be back on our research to try finding that ourselves, but it's difficult because people use it but don't tell you. [2]So, the only measurement we have is, well, it's more decentralised, so we know who goes to data.govt.nz. That's the only good idea to find that data. [3]It's no measurement of how much they access or how often they access the data because the data is from the source agency.* (PA4, 09:47)

[1] PEOPLE USE IT BUT DON'T TELL YOU

[2] KNOW WHO GOES TO DATA.GOVT.NZ

[3] NO MEASUREMENT ON HOW MUCH OR HOW OFTEN WAS ACCESSED

Another line-by-line coding example for a long sentence responds to the interviewer's question of what his/her barrier when opening data, especially related to data quality. There is no set method or formula for determining the average number of codes with In Vivo coding per page or the recommended code-to-text ratio (Saldaña, 2016). As the

researcher who did the interview and analysed the transcripts, when something in the transcripts popped out, I excerpted it as a code. As the interview was open-ended and semi-structured, this was a sample of how the response could be extended to answer the following questions: privacy and security. The codes for this lengthy response were included in different categories: ‘Barriers and concerns on creating OGD value’, ‘Privacy and personal information protection’, ‘Implementation obstacles’ and ‘Government agencies’ supporting tools’.

[1]so data quality doesn't concern me terribly much. [2]The data was good enough to make a decision from normally. So that should be good enough to release. [3]To be honest, releasing data is the best way to improve data quality because more people are looking at then tell you what's wrong with it. [4]You just got to be going to be quite mature to understand that big criticism coming from a good place and is very useful. [5]The other one, the major concern are things like the cultural appropriateness of data. So, you've got things like Vision Mātauranga, which is the part based sovereignty. So when you're dealing with some of those more sensitive data sets, normally, I take the position that data is processed into information. The lens you use is up to you when it comes to some of those cultural data. So, the lens is actually the important part. So okay, they have to be treated a bit differently. The other one is around privacy. [6]So, privacy happened on two levels within datasets and between datasets. So, within a data set, it's making sure that there aren't things like say, contacts details or if you're dealing with movement data that you aren't pinpointing movement paths down to people's front doors. When it comes to between data sets, as you pile up data, sometimes the anonymization goes away again. So, you have to just gotta be a little bit careful of that. [7]We do it by working using the officer of the Privacy Commissioner tools. [8]So they've been very generous, particularly on our programs, helping us understand how to do privacy

[1] DATA QUALITY DOES NOT CONCERN ME MUCH

[2] DATA WAS GOOD ENOUGH

[3] RELEASE DATA IS THE BEST WAY TO IMPROVE DATA QUALITY

[4] BE MATURE TO FACE BIG CRITICISMS

[5] CULTURAL APPROPRIATENESS OF DATA

[6] PRIVACY WITHIN AND BETWEEN DATASETS

[7] WORKING WITH THE PRIVACY COMMISIONER TOOLS

[8] PRIVACY ASSESMENT IS A DESIGN DRIVER

assessments and making sure that privacy is a design constraint, sorry, design driver rather than something that you retrofit at the end. (PA1, 17:18)

A coding query was run to look how the code was written and checked if there were any trends. A piece of content may be coded with a particular code, cross-referenced with another code or collection of codes, files, queries, or categories (Jackson & Bazeley, 2019). This is a technique for detecting overlap between categories and specifying outcomes within them.

Figure 5.2 presents a screenshot of the text search query tool as a tree with branches reflecting the outcomes after all transcripts have been coded using the word/phrase 'quality' to indicate a possible relationship between coding about data quality. This is to help in determining what codes should be included in the category with data quality. This function also assisted in viewing the participant's opinions about quality in a holistic pattern. Since most interviews related to data quality, this illustration of words related to "quality" gave me an idea of government officials' perspectives on quality. For example, while quality is unimportant, another participant said that it was needed to provide some level of quality.

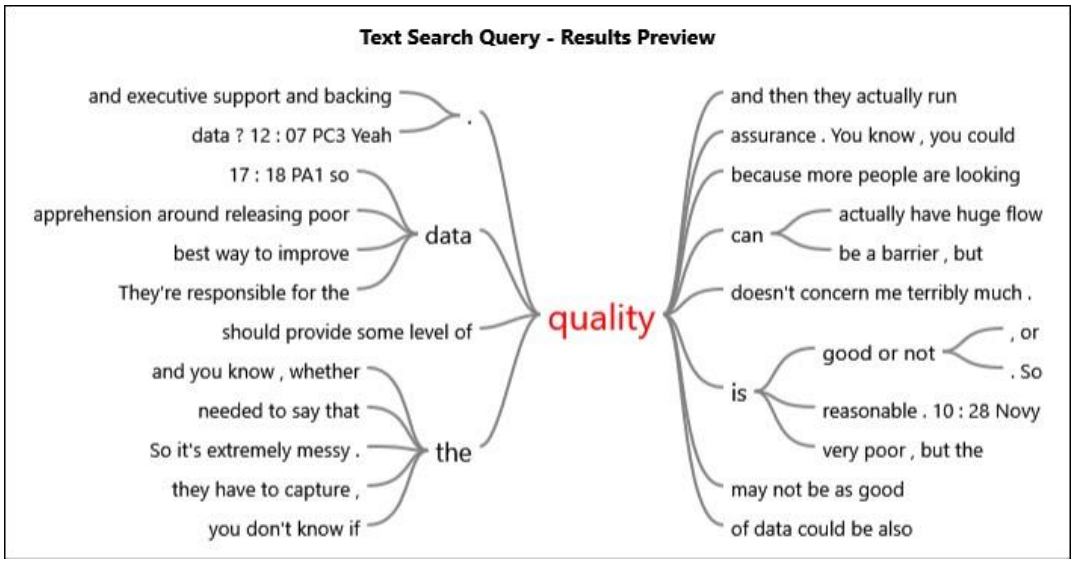


Figure 5-2 Screenshot of text “quality” search query in assisting in finding a big picture of what participant’s perspectives about data quality

I used screen captures of the NVivo visual presentation to enrich, deepen, and clarify the case study analysis process and to explain how coding methodologies and validity risks were avoided. (Siccama & Penna, 2008).

Figure 5.3 illustrates another association by conducting a text search query for "use" to ascertain the relationship between OGD use and a variety of coding terms and/or phrases. It also provides a flexible technique for examining any coding associated with the term 'use' to get a sense of what is happening in the data to construct comprehensive queries for a more focused perspective and then generate meaningful themes.

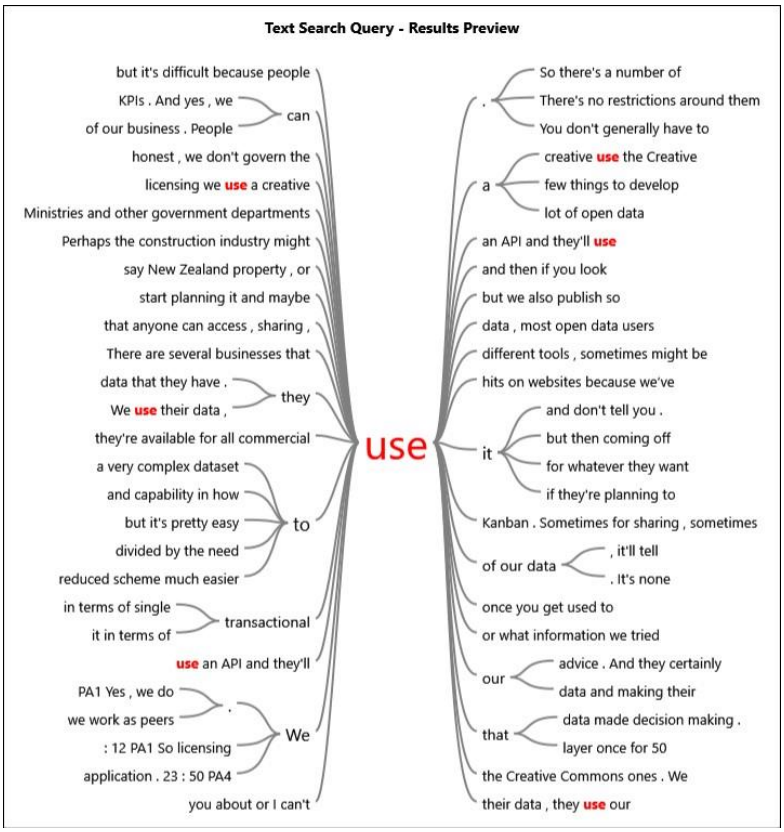


Figure 5-3 A text search query for the word "use" to analyse any coding linked with it

This exploration of coding reviewed some of the issues and challenges that come with coding. For example, how to figure out what a coding decision is for, how reliable it is, and how valid it is.

A total of 856 codes resulted from interrogating data from interview transcripts in which participants affiliated with government agencies as the OGD provider shared their experiences dealing with OGD publishing. The codes were classified into 27 categories as defined in the context objectives explained in Table 4.1. The comprehensive sample

below illustrates the initial categorisation of codes using In Vivo coding technique. The sample code mapping of three categories of the case OGD providers' code was extracted from three categories: Barriers and concerns on creating OGD value, Benefit measurement and Implementation obstacles. Appendix E contains a sample of the use of NVivo for the thematic analysis of the case study's initial deductive cycle.

FIRST CYCLE OF DEDUCTIVE CODING ANALYSIS:

Initial categorisation with In Vivo/Literal coding

Case study A - OGD PROVIDERS

Category 1: Barriers and concerns on creating OGD value

Related codes:

SIMPLIFIED LAYERS
DESIGN CONSTRAINT
SELF-ALIGN TO SPECIAL FORMATS
ANONYMISATION
ANXIETY OVER PRIVACY
BROKEN API
API STABILITY
BETTER COORDINATION
CANNOT GET TO CITY SCALE
CLEAR METADATA
CREATIVE COMMON LICENSE
CULTURAL APPROPRIATENESS
CULTURAL DATA
HUGE DATASETS
DON’T FACE ANY BARRIERS
DATA WAS GOOD ENOUGH
ENCOURAGING AGENCY TO LICENSE
EXECUTIVE SUPPORT AND BACKING
GLITCH IN THE SERVER
HEAPS OF METRICS
HUGE FLOW ON EFFECTS
MALICIOUS REUSE
MORE MONEY GO A LONG WAY
MORE PEOPLE ARE LOOKING FOR DATA
DATA MOVEMENT
PRESSED TO LEARN
POOR DATA QUALITY
SENSITIVE DATASETS
THE RESOLUTION IS NOT GOOD ENOUGH

TROUBLE TO NEGOTIATE DATA SHARING

WEATHER DATA HAS CODES ALREADY

Category 2: Benefit measurement

Related codes:

FREELOAD COMMUNITY GATHERINGS

A LOT OF LONG-TERM BENEFITS

APPLIED NATURE AS IMPORTANT AS WELL

INTANGIBLE BENEFITS

BRIEF CASE STUDIES

CANNOT NECESSARILY MEASURE DIRECT BENEFITS

DELIVER SIGNIFICANT VALUE

DEPEND ON USERS

DON'T MEASURE BENEFIT NOW

GET STORIES ABOUT HOW PEOPLE HAVE EVER USED

IMPACT IS MEASURED DIFFERENTLY

IMPROVED COMMUNITY, INDIVIDUAL, BUSINESS DECISION MAKING

IMPROVED DATA RELATED CAPACITY AND ACCOUNTABILITY

IMPROVED GOVERNMENT DECISSION MAKING AND ACCOUNTABILITY

IMPACT IS MEASURED BY CITATIONS

ONE OF THE MOST VISITED WEBSITES

OPEN DATA MEETUPS

PEOPLE USE IT AND DON'T TELL YOU

SIGNIFICANT PUBLIC GOODS

THOSE STORIES REALLY BY NETWORKING

VERY WIDE BENEFITS OF WEATHER INFORMATION

Category 3: Implementation obstacles

Related codes:

CONFLICT OF BELIEF

BLIND FAITH

CAN BE VERY FRUSTRATING

CAPABILITY IN USING DATA

CHALLENGE TO RELEASE

CREATE NEW STORAGE

DATA THAT HAS BEEN LOCKED DOWN

DID NOT REALLY PUSH BACK

DO NOT WANT TO HARD CODE IN PRODUCT

GENERAL LACK OF KNOWLEDGE

PUBLISHED PRIOR TO THE COMMON ADOPTION OF DATA GOVERNANCE

MISSED SOME STEPS

NOT NECESSARILY CONTROL OF THE USER EXPERIENCE

ONE REPOSITORY

PUBLISHED A COMPLETE EXTRACT OF THE LAND ONLINE SYSTEM

PUBLISHED HUNDREDS OF DIFFERENT INTER-RELATED TABLES

COMPLEXITY OF SENSING DATA

STORAGE CAPACITY AND DIFFERENT DATA FORMAT

USING VARIOUS DIFFERENT METHODS

VERY COMPLEX DATASETS TO USE

CAN NOT OPEN WHAT WE DON'T KNOW

MANY CLICKS TO PUBLISH

USED HAVE TO GO AND COLLECT DATA

DO NOT OPEN WHAT WE DO NOT KNOW

The first cycle produced a rough depiction of meaning clusters organised into predetermined categories. Throughout this cycle, the data were represented using a small number of widely defined theory-driven codes. Considering the previous observation, most lengthy sentences in interview transcripts have many "meanings".

The screenshot in Figure 5-4 shows how the codes included in the 'Government Key Players' category could be traced from the transcript's highlighted text. This screen capture demonstrates how a part of the participant's interview transcript was coded and then included under a specific category using deductive analysis. As described previously the deductive analysis groups the codes with predefined categories, as shown in Table 4.1.

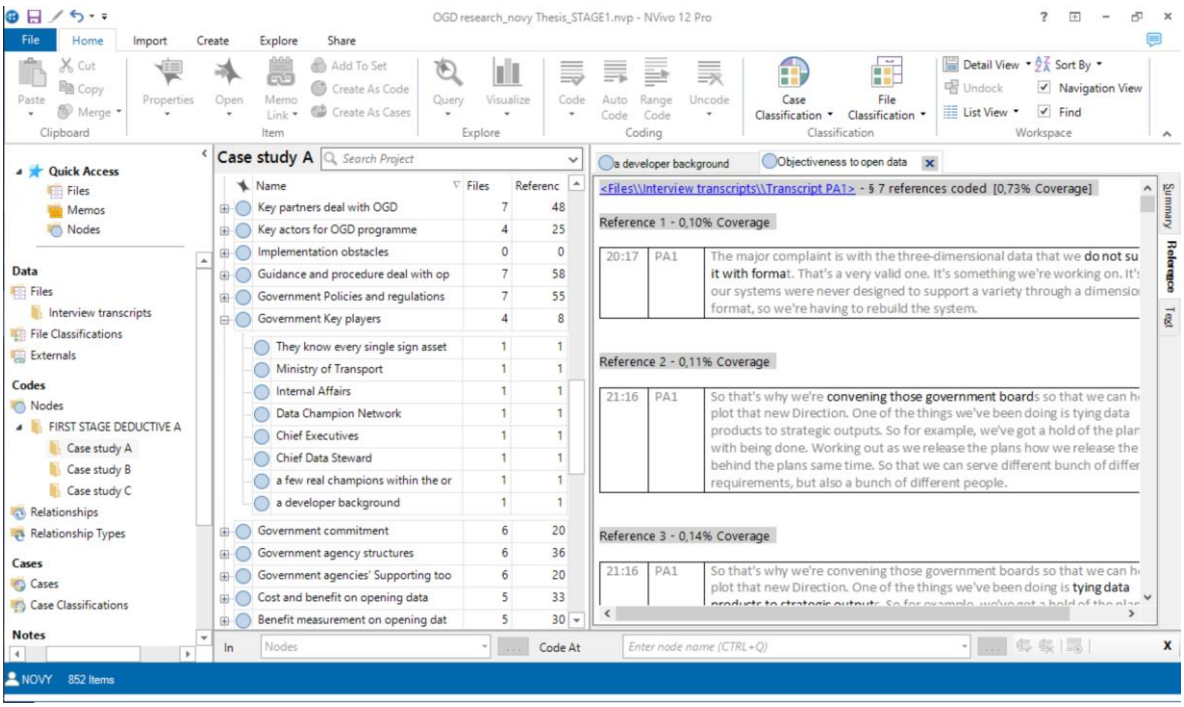


Figure 5-4 Screenshot of NVivo displaying Node used within the case study A

Following the experience of storing and organising coding in NVivo, Figure 5-5 shows the list view of 27 categories resulting from case study A (the case of OGD providers) during the first cycle. This initial analysis step entailed a thorough, slow, thoughtful examination of early writings; line-by-line coding, reading between the lines, finding themes, re-group of codes, new categories and speculating on probable meaning of the interview transcripts (Jackson & Bazeley, 2019). Each category in the list view has several files and references information representing how many transcript documents were excerpted by the category, while the number of references associated with how many codes were created for each category. This information describes the contribution of each participant to providing information for context objectives (as explained in Table 4.1) needed to answer research questions. For example, all seven transcript files documented interview results with the participants from New Zealand Government agencies providing information for the categories of "Government policies and regulations", "Guidance and procedure dealing with open data", "Key partners dealing with OGD", "OGD users", "Participant demography", and "Top-level government commitment". While only two participants responded clearly to two categories: "OGD effectiveness and measurement" and "OGD stakeholders".

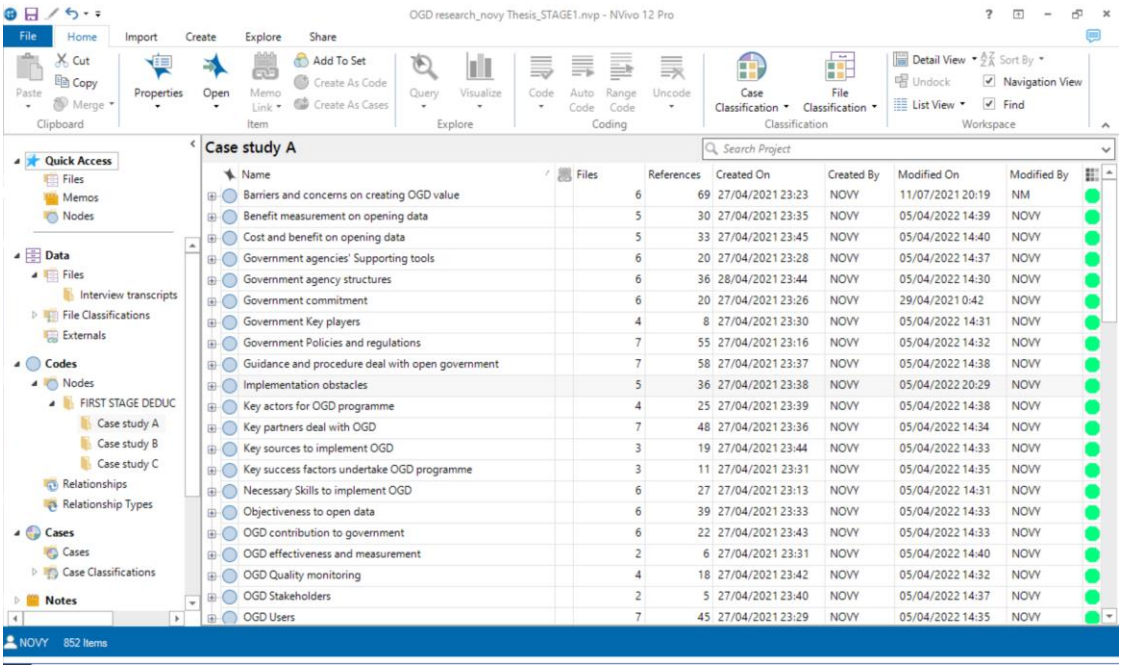


Figure 5-5 The excerpt of a list of categories as seen in NVivo List view for the case study A

In summary, to show participants' active engagement during face-to-face interviews, 25% of the categories were interrogated data from all transcripts, 37% from 6 transcripts, 15% from 5 transcripts, 10% from 4 transcripts, and 7% from 3 transcripts. This study

relies on the expertise and experience of the interviewees to disclose pertinent perspectives, which affects the quality of the data (Myers, 2013; Turner, 2022; Wengraf, 2001). All the government officials who took part in this study have at least six years of experience working with open data as leaders, chiefs, and managers in government agencies (refer to the participant list in Table 4.2).

Throughout the session, the rate at which participants answered interview questions varied. Some participants made comprehensive responses, while others provided brief responses, and a few people provided no response. Figure 5-6 illustrates another technique for determining participant engagement during interviews: generating a comparison diagram of nodes coded from interview transcripts. The first diagram indicates that all transcripts contained responses to questions about the categories 'Government policies and regulations' and 'Guidance and procedure dealing with OGD'. The second diagram suggests that five participants responded to a question related to the category 'Implementation challenges,' while six transcripts were coded for the category 'Barriers and concerns on creating OGD value.'

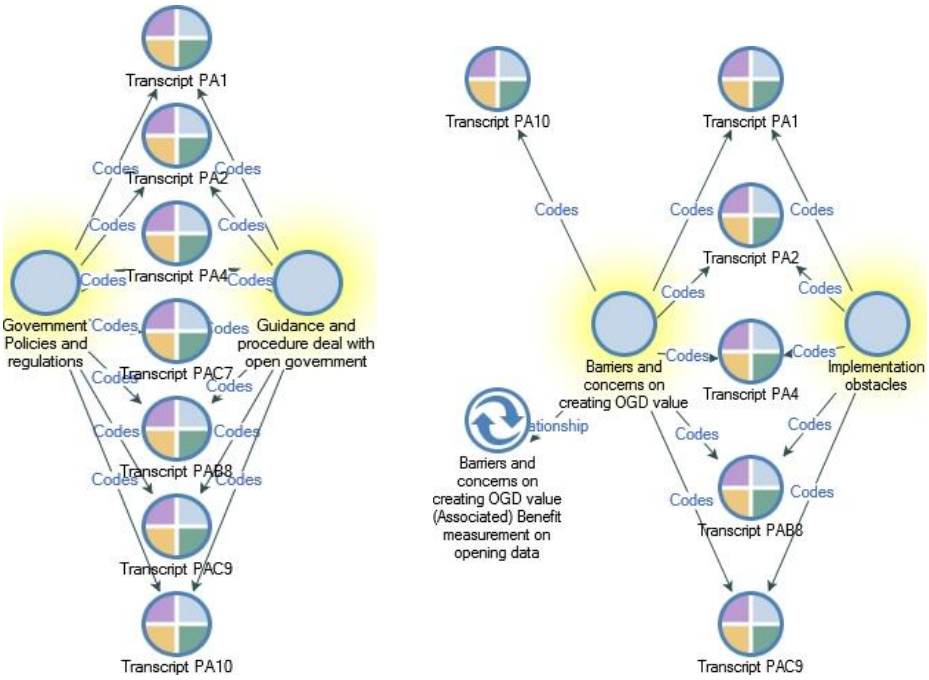


Figure 5-6 Screen capture of NVivo Diagrams to compare two nodes as categories

To demonstrate how a part of a transcript was coded and then categorised, the screenshot in Figure 5-7 shows how the code included in the category ‘Guidance & Procedure deal with Open Government’ was extracted from the highlighted text in the transcript.

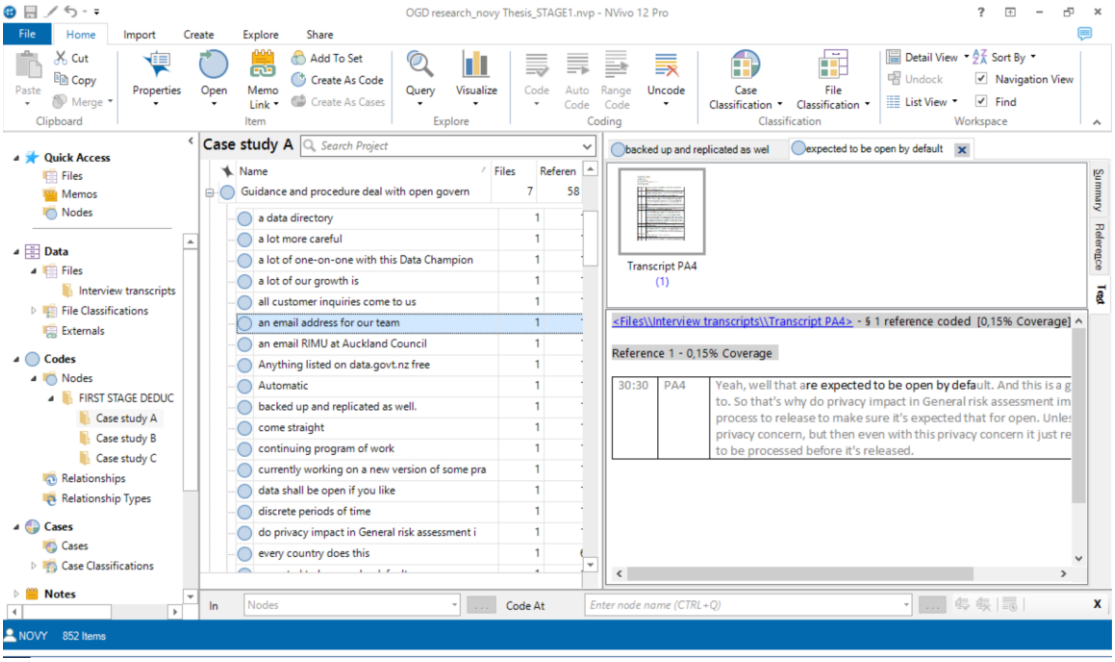


Figure 5-7 Screenshot of Detailed view for category ‘Guidance and procedure deal with open government”

By segmenting the transcript file into free nodes to store coding, NVivo enables this study to process qualitative data methodically. The codes function as "sticky notes," pointing to a specific subject. They may, however, be readily retrieved, organised, and edited as well as deleted, altered or merged with another node at any point in time (Jackson & Bazeley, 2019). A code as a node was generated once a part of a transcript had been excerpted manually.

5.3.4. Second cycle: Inductive coding analysis

Inductive analysis is an emerging strategy in which the researcher reads the data and allows for the emergence of codes/concepts that may be revealed (Allan Afuah, 2014) by participants during interviews. The semi-structured open-ended concept adopted in it is a more analytic "bottom-up" approach. Pattern coding was utilised to simplify categories for codes that appeared significantly from the first cycle's In Vivo Coding. The Saldana (2016) approach to relationship identification was used in this cycle. Pattern coding was applied for creating meta-codes that allow for the identification of similarly coded data via grouping and the generation of meaningful themes.

I dig through the data in each category that I produced during the first round of deductive analysis, developing and applying codes as I go (Galletta, 2013). Figure 5-8 shows a

screen capture of a cluster of categories by word similarity. This NVIVO cluster analysis tool enables me to triangulate the coding process by presenting a complete picture of categories (Myers, 2013). While cluster analysis is an efficient tool for examining data, any apparent relationships should be studied further using coding queries or matrix coding queries. Before examining the data that was coded and categorised as the result of the first cycle, this NVivo Cluster analysis provides initial guidance to apply pattern coding to revise the coding work into case study's meaningful themes that are both clear and relevant (Stake, 2006). NVivo's text query tools assist coding analysis by generating word trees (dendrograms) of related codes and words from text query results (Siccama & Penna, 2008). The dendrogram was introduced as part of a hierarchical cluster of similar-meaning phrases. This cluster analysis chose Pearson's correlation coefficient as the similarity metric for calculating correlation across items (Jackson & Bazeley, 2019).

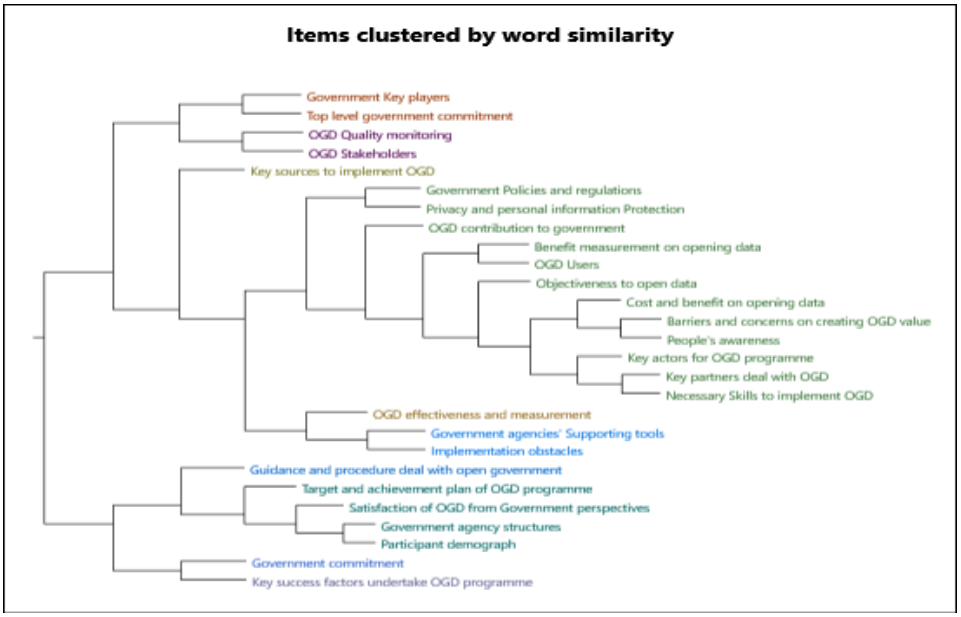


Figure 5-8 A screen capture of a cluster of categories by word similarity

The cluster of codes suggests that the keywords *Government key players* and *Top level government commitment* are close to the terms *OGD quality monitoring* and *OGD stakeholders*, indicating a close association. In the opposite branch of this dendrogram, adjacent terms such as *Government agency structures*, *Participant demography*, and *Satisfaction of OGD from government perspectives* are linked. On the other hand, this cluster implies that *Government policies & regulations* and *Privacy and personal information protection* were considered much differently than *Government agencies'*

supporting tools and *Implementation obstacles*. The objective of cluster analysis is to break down massive, complex nodes into smaller, more manageable clusters. Cluster analysis simplifies multidimensional scaling graphs by displaying data in two dimensions.

I then explored linkages between and within data sources using pattern coding. This strategy compresses the codes generated during the inductive approach to reduce complicated analytic concepts. This enables me to distil the data into meaningful themes. The outcome of this second cycle for case study A was to develop themes and codes as the result of reading through the data and codes using an inductive approach.

Iteratively, pattern coding was used to group and regroup, produce new codes and categories, and simplify cluster analysis. Pattern coding is applied to a set of codes by looking for relationships. Most In Vivo coding resulted in the first cycle re-coding with pattern coding for simplification.

For instance, similar In Vivo codes below (Figure 5-9) from the first cycle under the category “Barrier and concerns on publishing OGD” were combined to determine their similarities and develop Pattern code. This collection of In Vivo codes emerged from participant feedbacks in response to a question to find out what barriers exist and whether there are any concerns about publishing OGD. Several concepts were then generated for the Pattern code. Following the researcher's assessment of that data, the final Pattern code generated and chosen for the identical In Vivo codes was TECHNOLOGY PRESSURE ON PUBLISHING OGD.

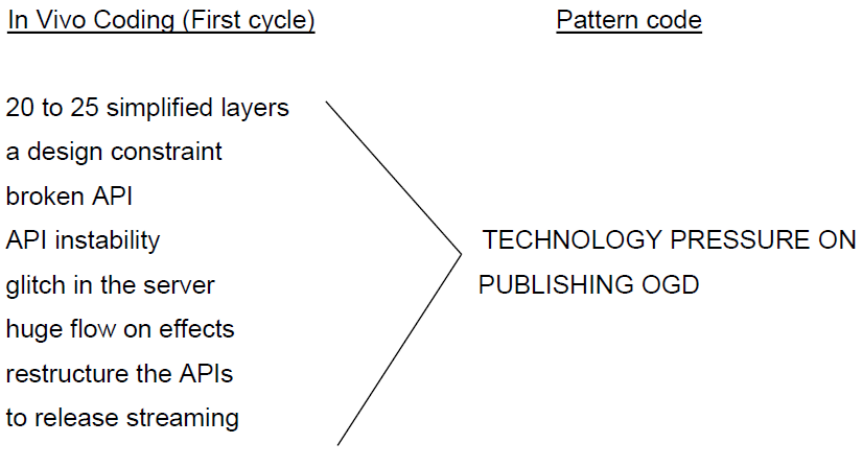


Figure 5-9 A sample of re-coding In Vivo coding with pattern code for case study A

A sample of the second cycle's code list is summarised in Table 5.1. Due to the large number of codes, presenting them in the table was challenging. The sample coding hierarchy of the second inductive analysis with NVivo for the case study A is available in Appendix F.

Table 5.1 Second cycle of Inductive coding – A way of grouping with Pattern code

SECOND CYCLE OF INDUCTIVE CODING ANALYSIS				
CATEGORY (Pattern code)	**SUB CATEGORY (Deductive First cycle)**	**SUPER CODE (Pattern code)**	**NUMBER OF CODED TRANSCRIPTS**	**NUMBER OF CODES**
OPENING GOOD QUALITY DATA	Privacy and personal information Protection	BUILT IN ETHICS NATIONAL DATA STANDARD	3	6
		CAN NOT DETERMINE WHEN DATA MISUSE	4	4
		FOLLOW PRIVACY LAW COMMISSION AND STANDARD	4	9
		MOST DATA UNDER A CREATIVE COMMON LICENSE	2	4
		NO PRIVACY DATA RELEASE FOR PUBLISHING	4	5
		PERFORM PRIVACY IMPACT ASSESSMENT BEFORE RELEASED	3	7
		VERY LITTLE DATA ACTUALLY SECRET AND PRIVACY	2	2
	OGD Quality monitoring	BY ASSESS THE DATA BEFORE PUBLISHED AND RISK AVERSION	1	3
		BY FOLLOWING OGD STANDARD PROCEDURE AND GUIDANCE	0	0
		BY HANDLING USER FEEDBACKS	2	4
		BY IMPROVING DATA QUALITY	2	3
		BY MAINTAINING DATA SYSTEM BASED ON PROCEDURE	1	4
	Satisfaction of OGD from Government perspectives	NOT BAD NOT GREAT	3	8
		NOT SATISFIED FOR SOME PART BUT SATISFIED FOR OTHERS	2	2
		NOT SURE IF I CAN ANSWER	1	1
		SATISFIED	1	2
		UNSATISFIED	1	1
		VERY SATISFIED	4	7
OGD BARRIERS,ISSUES AND CHALLENGES	Barriers and concerns on publishing OGD	EXTERNAL PRESSURES IN PUBLISHING OGD	3	3
		IMPEDIMENTS ON OGD QUALITY	6	29
		IMPEDIMENTS WITHIN ORGANISATIONS	6	26
		NO SIGNIFICANT BARRIERS	2	4
		TECHNOLOGY PRESSURE ON PUBLISHING OGD	3	9
	Implementation obstacles	CAPABILITY AND SKILL LIMITATION	3	7
		ORGANISATION CULTURE CONCERN	2	2
		PROVIDER LEGAL CONSTRAINTS	3	7
		TECHNICAL ISSUES RELATING WITH PUBLISHING DATA	4	23
DRIVING FACTORS OF OGD INNOVATION	Cost and benefit on opening data	ALLOCATED COST FOR OGD IMPLEMENTATION	4	19
		BENEFITS FOR GOVERNMENT ITSELF	3	8
		KNOWLEDGE GENERATION	2	3
		POTENTIAL ECONOMIC BENEFITS FOR USERS	3	4
		SOCIAL BENEFITS FOR USERS	2	4
	OGD effectiveness and measurement	NO MEASUREMENT FOR OGD EFFECTIVENESS	2	5
	Key success factors undertake OGD programme	A SYSTEM-WIDE RESPONSE	1	2
		ACHIEVABLE GOVERNMENT PLANS AND OBJECTIVES	2	3
		CITIZENS INVOLVEMENT AND PARTICIPATION	1	1
		ONGOING OFFICIAL'S CULTURAL CHANGE	2	2
		WORKING TOGETHER IN PARTNERSHIP	2	3
	Key sources to implement OGD	COMBINING RIGHT SET OF SKILLS AND KNOWLEDGE	2	5
		INTEGRATED BIG DATA ANALYTIC TOOLS	2	6
		ROBUST AND RELIABLE DATASETS	1	3
		SUFFICIENT INFRASTRUCTURES	2	5
	People's awareness	ACTIVELY APPROACH PUBLIC	2	3
		CHECK WEBISTE TRAFFIC	0	0
		CITY DWELLER MORE AWARE THAN NON CITY	2	4
		CONDUCT EDUCATION AND TRAINING PROGRAMME REGULARLY	2	2
		DEPEND ON AS-NEEDED BASIS	0	0
		DIFFICULT TO ANSWER	1	1
		ENHANCE CITIZEN'S DATA LITERACY	1	1
		IMPROVE COMMUNITY ENGAGEMENT	1	3
		KEEP PUBLISHING DATA	2	4
		LEAVES A LOT TO BE DESIRED FOR EXISTING AND POTENTIAL USERS	1	1
		NOT SURE IT HAS BEEN DONE	4	5
		THROUGH WEBSITE, MEDIA AND ADVERTISING	1	5
	Benefit measurement on opening data	DIFFICULT TO MEASURE OGD BENEFITS	2	2
		NOT CONDUCTED OGD MEASUREMENT	3	3
		SELF-ASSESSMENT BY DATA PROVIDERS	3	4
		USER-CENTERED MEASUREMENT	3	12
	OGD contribution to government	COMMUNICATE AND SHARE THE RESEARCH	1	4
		CONTRIBUTE TO NEW ZEALAND'S ECONOMIC, SOCIAL, AND ENVIRONMENTAL PROGRE	4	9
		EASE POLICY MAKING PROCESSES	2	2
		IMPROVE ADMINISTRATIVE PROCESSES	3	3
		IMPROVE DATA RELATED CAPACITY	3	3
		USE DATA AS A STRATEGIC ASSET FOR MAORI	2	3
		USE THE DATASET WHEN MODIFYING GOVERNMENT OWN TOOLS.	1	1

The pattern codes used (Table 5.1) similarly acquire data—coded portions from the first cycle of In Vivo coding. This process supported the researcher via NVivo searches, queries, and diagrams. The second cycle codes were analysed for similarity and assigned various Pattern codes. Utilise pattern codes to generate statements that

represent a theme, an activity pattern, a set of relationships, or a theoretical construct based on the data. (Saldaña, 2016).

As illustrated in Table 5.1, Super codes were created as a result of an analytical procedure related to and beneficial for Pattern codes. The procedure for creating each category is similar to creating a super code. Once a set of super codes within a sub-category had been identified and decoded using the pattern codes, the remaining sub-categories within the category were searched for super codes that could be later incorporated into the emerging theme; the step was repeated with the remaining categories. In order to develop the theme, it was necessary to review the meanings linked to each topic once more, and transcripts were used to cite participant statements. For accuracy, the remaining data were also analysed to confirm that the selection was correct. The new theme was given a name, described, and shown with statistical evidence, among other things.

Additionally, the method was used to verify the coding and make any required adjustments. Those tasks included rectifying incorrectly recorded codes and editing for grammar and clarity. Figure 5-10 illustrates how codes and categories from the first cycle were re-coded into super code, edited, and regrouped in the second cycle.

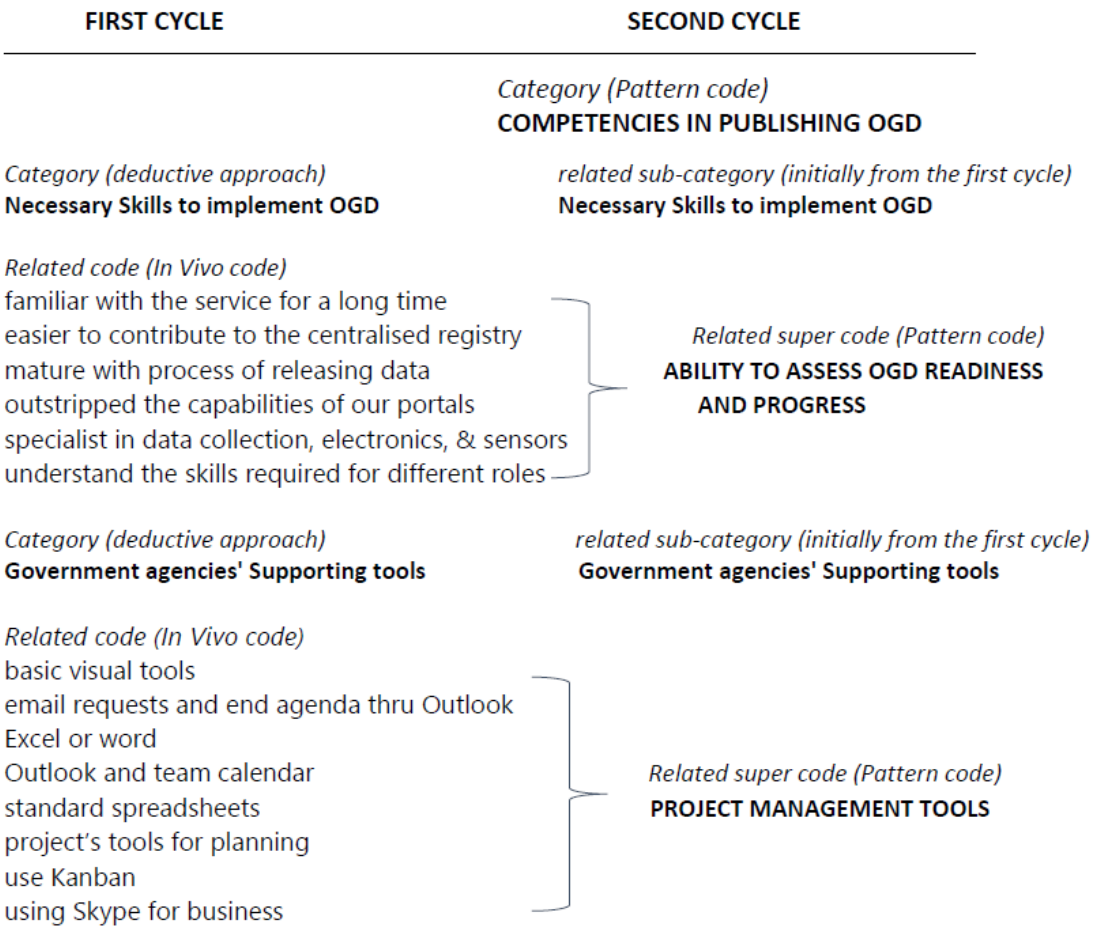


Figure 5-10 A sample of how the first-cycle coding was re-coded in the second cycle

5.3.5. Identifying Emerging Themes of the Case Study A

Themes were developed from analytic reflection on each case study; themes are a collection of extended phrases that describe the entire coding process and the units of analysis (Saldaña, 2016; Turner, 2022). An appropriate hierarchy was adopted in this qualitative coding by undertaking a two-cycle analysis. In an iterative process, coding results were tabulated so that research questions could be answered accurately.

At this point in the study, three emerging themes were identified:

Theme 1A – Competencies and Process-driven abilities in publishing OGD
Theme 2A – Government capacities to undertake OGD activities
Theme 3A – Value created through OGD innovation

In the first and second cycles, deductive and inductive analyses were examined systematically using In Vivo and Pattern coding. I encountered a group of different codes

that might be read as a unified theme. Typically, emergent themes were constructed from coded categories. A theme is a collection of discernments centred on a central topic or idea. Themes are more expansive than categories, as researchers frequently combine several categories into themes(Vanover et al., 2022). This case study looked at how six categories, twenty-seven subcategories, and 157 super codes might work together to determine the themes.

5.3.5.1. Theme 1A "COMPETENCIES AND PROCESS-DRIVEN ABILITIES IN PUBLISHING DATA"

First, the theme 1A "Competencies and Process-driven abilities in publishing data" was revealed after examining categories COMPETENCIES IN PUBLISHING OGD and DRIVING FACTORS OF OGD INNOVATION. Each category linked to sub-categories and super codes were selected and coded using the pattern codes; the process was then repeated for any additional subcategories that may be used to elaborate on the emergent theme.

Reading those two categories and their associated sub-categories and super codes revealed an emerging theme concerning developing a set of skills and competencies required of government officials who work with government data. Additionally, it defines the process that the government must follow when publishing data to verify its quality and value. Competencies are defined as the knowledge, advanced skills/abilities, behaviours, and attitudes that enable an individual to accomplish a certain activity or role (Ona & Concepcion, 2018). OGD is powered by a number of different abilities needed to make open data available. The OGD programme makes government information more accessible to the public than ever before, with several government agencies disclosing massive volumes of previously unavailable data. However, these data releases have come at a cost, as OGD making the data more available also exposed previously sensitive government information. These changes have led to a rise in the skills needed to work with OGD, as agencies are increasingly exposed to the process-driven nature of publishing open government data.

Tables 5.2 and 5.3 shows the coding results of two categories that were formed from super codes that excerpted participants' perspectives related to how government agencies acquired the abilities to impart their expertise and what factors enabled them to function effectively in an open government setting.

Table 5.2 The coding result of category “COMPETENCIES IN PUBLISHING OGD”

CATEGORY	SUB-CATEGORIES	SUPER CODES
CATEGORY 'COMPETENCIES IN PUBLISHING OGD'	Government agencies' Supporting tools	DATABASE AND OPEN SOURCE TOOLS
		DESIGN AND PLANNING TOOLS
		DO NOT HAVE SPECIAL TOOLS FOR OGD
		PROJECT MANAGEMENT TOOLS
		SPECIAL SOFTWARE PACKAGE FOR DATA TOOLS
	Government commitment	HIGH COMMITMENT
		MODERATE COMMITMENT
		UNSURE
	Necessary Skills to implement OGD	ABILITY TO ASSESS OGD READINESS AND PROGRESS
		ABILITY TO BUILD GOOD RELATIONSHIP WITH OGD ACTORS
		AWARENESS OF THE NATURE AND VALUE OF OGD
		OUTREACH AND COMMUNICATION SKILL WITH USERS
		SKILLS TO EFFECTIVELY EXPLOIT OGD'S POTENTIAL VALUE
		SKILLS TO EVALUATE DATA QUALITY AND SUITABILITY FOR USE
	Objectiveness to open data	ASSIST IN IMPROVING GOVERNMENT EFFICIENCY
		DO NOT HAVE OBJECTIVES
		EASIER DATA DISCOVERY
		ENGAGE GOVERNMENT WITH CITIZENS
		ENHANCING GOVERNMENT TRANSPARENCY AND ACCOUNTABILITY
		GOVERNMENT DATA FUNDED BY TAXPAYERS
		INCREASING INNOVATION AND PARTICIPATION
		RAISE AGENCY PERFORMANCE AND PROFILE
		REVEAL OGD BENEFIT FOR GOVERNMENT AND CITIZENS
		SUPPORT GOVERNMENT DIRECTION
	Top level government commitment	COMMITMENT VARIES
		HIGH COMMITMENT
		MOSTLY COMMIT

Table 5.3 The coding result of the category “DRIVING FACTORS OF OGD INNOVATION”

CATEGORY	SUB-CATEGORIES	SUPER CODES
CATEGORY 'DRIVING FACTORS OF OGD INNOVATION'	Benefit measurement on opening data	DIFFICULT TO MEASURE OGD BENEFITS
		NOT CONDUCTED OGD MEASUREMENT
		SELF-ASSESSMENT BY DATA PROVIDERS
		USER-CENTERED MEASUREMENT
	Cost and benefit on opening data	ALLOCATED COST FOR OGD IMPLEMENTATION
		BENEFITS FOR GOVERNMENT ITSELF
		KNOWLEDGE GENERATION
		POTENTIAL ECONOMIC BENEFITS FOR USERS
		SOCIAL BENEFITS FOR USERS
	Key sources to implement OGD	COMBINING RIGHT SET OF SKILLS AND KNOWLEDGE
		INTEGRATED BIG DATA ANALYTIC TOOLS
		ROBUST AND RELIABLE DATASETS
		SUFFICIENT INFRASTRUCTURES
	Key success factors undertake OGD programme	A SYSTEM-WIDE RESPONSE
		ACHIEVABLE GOVERNMENT PLANS AND OBJECTIVES
		CITIZENS INVOLVEMENT AND PARTICIPATION
		ONGOING OFFICIAL'S CULTURAL CHANGE
		WORKING TOGETHER IN PARTNERSHIP
	OGD contribution to government	COMMUNICATE AND SHARE THE RESEARCH
		CONTRIBUTE TO NEW ZEALAND'S ECONOMIC, SOCIAL, AND ENVIRONMENTAL PROGRESS
		EASE POLICY MAKING PROCESSES
		IMPROVE ADMINISTRATIVE PROCESSES
		IMPROVE DATA RELATED CAPACITY
		USE DATA AS A STRATEGIC ASSET FOR MAORI
		USE THE DATASET WHEN MODIFYING GOVERNMENT OWN TOOLS.
	OGD effectiveness and measurement	NO MEASUREMENT FOR OGD EFFECTIVENESS
	People's awareness	ACTIVELY APPROACH PUBLIC
		CHECK WEBISTE TRAFFIC
		CITY DWELLER MORE AWARE THAN NON CITY
		CONDUCT EDUCATION AND TRAINING PROGRAMME REGULARLY
		DEPEND ON AS-NEEDED BASIS
		DIFFICULT TO ANSWER
		ENHANCE CITIZEN'S DATA LITERACY
		IMPROVE COMMUNITY ENGAGEMENT
		KEEP PUBLISHING DATA
		LEAVES A LOT TO BE DESIRED FOR EXISTING AND POTENTIAL USERS
		NOT SURE IT HAS BEEN DONE
		THROUGH WEBSITE, MEDIA AND ADVERTISING

The two categories of this theme were studied through sample transcripts of interviews with participants who represented government agencies. Each group of interviews contributed to the establishment of categories and subcategories within the broader subject of open data. The samples emphasised the abilities required to produce value from OGD, the drivers that have fuelled data-driven service innovation, and the main

factors that support working with OGD. This subsection thoroughly illustrated the theme development process by inserting the full narrative quotes to explain how the theme emerged from those two categories' coding results in the second cycle.

Competencies in publishing OGD. The following excerpts from interview transcripts explained that the government is committed to improving its data publishing process across diverse skills, though it can be complicated. This included discussing the skills, knowledge, and tools required to improve government services. People who work for the government have to deal with two significant changes: information and communication technology and the trend toward OGD. Information and communication technologies have transformed the communication process from a one-way, top-down approach to an interactive, multi-directional one. Government agencies should be provided with adequate resources and tools and be equipped with the necessary competencies.

Under the sub-category *Government agencies supporting tools*, the participants indicated that dealing with OGD necessitates the use of appropriate supporting tools. Their holistic responses to whether the agency employs any tools to collaborate with OGD differed because of their involvement in various roles throughout the conceptualisation and implementation processes and types of agencies. Participants who started dealing with OGD in the implementation stage in technical and IT departments explained the specific tools for database, open-source and field applications needed:

> *"… most of our data is geospatial. So, this also sort of tools that we're used to manipulating the data we created….A lot of our publishing channels like going from database management into our open data, the platform is usually open source-based so Azure Postgres database is and then transported using open source technology."* (PAC9, 45:57)

> *"We also have Field app we use on our devices as well. So, they can plan their day, where they're going to visit as well. So, that will capture them that, and so they can take off as they go as their positions, different locations and taken samples or inspection on it..."* (PAB8, 27:51)

Participants who doing their roles in OGD conceptualisation, management and planning expressed:

"I've used basic visual tools to draw a visual version of an open data framework. Very interested in ecosystem mapping but waiting until I have free time. I've also used some service design paradigms when designing open data processes." (PA2, C.2 text)

"...The project department here, has project's tools for planning." (PA10, 29:39)

"We use Kanban. Sometimes for sharing, sometimes it's just present on the wall. We are not actively seeking for the software to help us. (PA4, 23:50)

For planning work, we do plan our work, but it's just captured everything and like Excel or word or some of that the team plans. But then they do some planning thru Outlook and team calendar through that..." (PAB8, 30:11)

Additionally, participants highlighted how their respective agencies publish big datasets such as infographics and observational data. The datasets nature necessitated the usage of specialised tools and software.

It's called intra Maps. So it's a product that we license from TechnologyOne. It's basically what you see in most local government Council GIS viewers. (PAC9, 02:53)

"How we handled it? well, there's a large amount of software used in the organization for handling data. So there's software which is written that understands the codes which are described in the W-mode technical regulations so that we can encode and decode and store data according to what regulations say." (PA10, 38:03)

"Yeah, so each [system's name] is recorded locally, and information is then sent to a Telemetry software package that's in the Cloud Server…" (PAB8, 31:50)

Other feedback was provided by a participant who indicated that the agency might not use OGD-specific tools because they began opening huge volumes of datasets years before the New Zealand government released the open data portal data.govt.nz in 2009. They simplified procedures considerably when they proactively published so much big data before data governance became a familiar concept.

So, which I wouldn't say is generally done very well... And we're behind in that because start a publishing data so early, and we did it in a very quick and proactive way, but it meant that we have a rather simplistic process that data owner manager publisher to a platform path, it's quiet simple and worked well for a very long time and would normally start… We don't have a lot of good tools to view out data process…" (PAC9, 45:57)

Seven super codes under the sub-category *Necessary skills to implement OGD* indicate participants' various skills and competencies. The super codes were categorised according to the similarity of In Vivo codes (the result of the first cycle's coding). The competencies and skills were defined as the capacity to analyse OGD readiness and progress, the ability to evaluate OGD quality and suitability, the ability to exploit data's potential value successfully, and an awareness of the nature and value of OGD, skills in outreach and contact with users, as well as the capacity to develop positive relationships with OGD actors. As participants commented on how they were expected to be proactive to create, manage and release data evaluation:

But before I began the role, I was a very regular user of the [the organisation name] data service and very aware of their operations. I was sort of one of their key customers. So being very familiar with the service for a long time." (PAC9, 00:26)

"That's what I think one of the challenges on that journey and says, we've become more mature with the process of releasing data, we've outstripped the capabilities of our portals. So now I'm having to build new ones." (PA1, 07:53)

Further, some participants created a good relationship with users by attending community activities to socialise and inform the public about OGD. They were exposed to the experiences of others who have used OGD to improve their communities and solve problems.

"I think I am the only of one of the original organizers that still involved in. But I'm more likely the ground at these days. I don't really know. It takes communities in [the city name] who do these things" (PA1, 07:28)

"as part of that Community we bought things like GovHack to New Zealand." (PA1, 06:12)

"… but now because it's available we can say, we can email, we said, please use the website and please the Environment [the city name], download your

data and we may even provide a web and web link to website but then specifically to that data set. So, it makes it easier for them to use." (PAB8, 43:23)

In terms of experiences to improve government performance and understanding of what OGD can do and how it can benefit the public, some participants profoundly understood that OGD is a mechanism for increasing citizen access to government services, which improves responsiveness and accountability:

"So, my experience would be sitting up or be providing our environmental data to [people who live in the city] and New Zealanders through the various method. ..So, all of our environment data is accessible through that. Providing data to the Land, Air, Water Aotearoa (LAWA)- is the National initiative and then sort of whoever needed. So, it's making all those different connections." (PAB8, 03:11)

"So we've had [The organisation name] occasionally asked to explain what it's open data policy is, and what we consider to be open data and what not and I've had quite a lot to do with that." (PA10, 03:18)

Under the sub-category *Government commitment*, all participants responded to whether the central government supports the implementation of OGD in their respective government agencies or not. The majority of respondents believed that the New Zealand government demonstrates a high level of commitment:

"The central government has been wonderful…they've been very generous with their time. Have you spoken to a man named [another official name]? … He's been very generous in helping us on our journey, and he helps a lot of the local governments and the government departments to work together. The central government signed up to the Open Data Charter." (PA1, 16:18)

"Central government agencies are required (mandated) to follow the Declaration mentioned above…also signed up to the OGP – which is _not_ about open data, and which doesn't necessarily have any actions, per National Action Plan, about open data. … NZ central govt is also signed up to the ODC, but this is a set of guiding principles" (PA, B.2 text)

"…we work very closely with them... is definitely supported and encouraged to release as much open data as it made in very good progress in this area." (PAC9, 39:57)

Some participants highlighted moderate commitment as for example:

> *"They've been talking with us about it. But I haven't followed up on it… I know what their commitment is. They've just been sidetracked on other things… And they certainly make it as easy as possible for their data to be available to us, and they are always encouraging us."* (PAC7, 21:50)

> *"..held (often loosely) to the commitments the OGP national action plan."* (PA2, B.2 text)

Just one participant was unsure about how the commitment was applied:

> *"I'm not sure if I can answer that. I'm not sure any particular action being taken at the moment in response to the StatNZ guidelines."* (PA10, 28:00)

Furthermore, this theme was also based participants' perceptions of how their respective government agency's top management demonstrated their commitment to facilitating OGD implementation in their organisation. The majority of respondents stated that their own agency's leader placed a high value on the OGD program:

> *"…So there were a few key member of the organization that really bought into the idea of open data."* (PAC9, 08:02)

> *"Very good. So historically I've said from the Chief Executives Office and the imperative to open data is come from the very top."* (PA1, 14:23)

Other feedbacks mentioned that the leaders' commitments vary by organisation and individual:

> *"…well that varies from organisation to organisation and individual to individual but they had been directed by cabinet through the open and transparent government."* (PA4, 16:28)

According to participant statements that were grouped in sub-category *Objectives to open data*, firstly, they have adequate understanding that government data is publicly funded:

> *to make that data accessible to the public because it is ultimately publicly funded, and that's where possible to make… I thought it was important that our evidence is publicly available*…" (PAC7, 01:45, 02:48)

Secondly, they noted the potential impact of OGD on their programmes and services as they are also users of data published by other agencies. Moreover, they reflected on how open data assist them in achieving performance goals and increasing their profile.

> *"…it does prove that we are the experts in those areas as well, by making it available and to a high quality and the high standard… proof that we could do a job do it well, and when other people use that data then they say that as well. They collected such data, and we are about making it more available; absolutely, it does raise our profile*." (PAB8, 40:16)

Driving factors of OGD innovation. This corresponding category, including seven associated sub-categories and 38 super codes, served as a base assumption to form the theme "Competencies and process-driven abilities in publishing data". This category indicates that, even though the OGD programme has been implemented, determining the expected potential value is problematic because that relies on several factors. Indeed, the chances for innovation do not continually expand consistently and steadily. The theme was formed by the statements of the participants as shown in Table 5.3 through the coding results.

Based on feedback from participants included in the sub-category *Benefit measurement in opening data*, most of them explain that it was difficult to measure the benefit because people use it but do not inform government agencies as the provider of OGD:

> "*Well, this very difficult question. We're about to be back on our research to try finding that ourselves, but it's difficult because people use it and don't tell you. So, the only measurement we have is more decentralised, so we know who goes to data.govt.nz."* (PA4, 09:47)

Most of applicants cannot measure benefits gained by users because most of the benefits are long-term and entirely depend on users:

> *"I suppose we've got hits to our websites. …but now we don't fully measure benefits, and that would be very difficult because a lot of the benefits are long-term."* (PAC7, 16:26)

> *"Completely depends on the users, and one can't necessarily measure direct benefits to users."* (PA2, C.8)

Several participants reveal that they conduct an assessment by identifying how many visitors hit the open data portal to track OGD progress. The number represents how many times users had clicked to download datasets:

> *" the only measurement we have is, well, it's more decentralised, so we know who goes to data.govt.nz. That's the only good idea to find that data. It's no measurement of how much they access, or how often they access the data because the data is that the source agency."* (PA4, 09:47)

However, this measurement is only to know the production of datasets but cannot identify the benefit that users experienced:

> *"To know how much data is downloaded, you have to talk to every agency on what the statistic are. But even then knowing as been downloaded still gives you no confirmation that it's used or how it's used and on what benefits come over. So, the only way we have so far is to get stories about how people have ever used data from those. You know, those you'll find on data.gov.nz/showcase/. That's some brief case studies around the impact of open data being reused." (*(PA4, 09:47)

In addition, the participant highlighted about effectiveness by publishing their data through open data portal:

> "*We don't… it's just part of us being transparent and doing our jobs. Because it's been entirely operationalized."* (PA1, 24:41)

Another approach is by getting the stories as case studies from a participant and conducting events such as open data meet-ups, conferences, GovHack and community gatherings.

> *"so we've given those stories really by networking. So being out to conferences, having open data meetups. By creating a freeload Community gatherings in talking to people that we, sorry serendipitously whoop by chance or by stories."* (PA4, 12:11)

Other excerpted transcripts under the sub-category *Cost and benefits by data opening data* highlighted datasets that were not totally free. The cost is within the marginal-cost pricing, the price of making the data accessible, rather than as a profit.

“There's some sheets data which is sold but the basis of that isn't profit… So that data is sold because we have to defray the cost of the process.” (PA1, 04:58)

In critical feedback, a participant stated that opening data is not free for the government. Direct costs associated with data publication, sharing, maintenance, and updates were incurred for availability datasets. Prompting governments to seek support from third-party companies for hosting, standardisation, and analytical tools for data inspection:

no data is free. All data is paid for somehow, and so if data are made available to the New Zealand public, someone has to pay for that. And so, for example, if an organisation chose to make new datasets available on its website public, it would have to decide whether the public benefits of doing this, would balance by saying the loss of profitability for sharing data that might previously being proprietary. (PA10, 30:31)

Participants’ perspectives shed light on the challenges and opportunities for OGD in the community engagement space. Specifically, the participant discussed the costs and fees associated with making government data available and the awareness of open government data among community members.

“There's some datasets which is sold, but the basis of that isn't profit. What happens is that we treat data as waste. So once we have extracted what the value from that data, so say I need some data for City Planning, what’s should be done with city planning, that data is basically no longer required. So it's free to people and something like raising data where you've got companies like say homes.co.nz or OneRoof.. for these are all companies we help to get started…. So that data is sold because we have to defray the cost of the process”. (PA1, 04:58)

“Probably not. It's probably on an as-needed basis. Most of the population don't need to access that. I mean it's maybe it's something central government needs to obviously have far better tailor communication the same applies to us” (PA7, 14:44)

According to a participant, publicly sharing data - geospatial data, and demographic data in particular - can lead to the higher costs and complications compared with publishing other types of datasets:

" And we have to purchase things like the business demographic data. …for example, we provide the uploading Consent data, so they use it as part of the GDP calculations, but we pay them to get it back from them. …so we have to pay economic Consultants infometric to provide us with GDP data… So open data, Open Access is very variable. It's not easy to ask except for Stats New Zealand and because we know them " (PAC7, 11:45)

One participant expressed the view of the government that by making data available for usage and re-use, it may disclose the data's potential value.

"..well informed. That's partially due to the location for government here and also because we have tick industries, our citizens usually data literate... The best way to increase the use of open data is to release open data." (PA1,10:07)

"no data is free. All data is paid for somehow, and so if data are made available to the New Zealand public, someone has to pay for that… In other words, there might be a benefit to individuals using data that was previously not available. But the cost is to the taxpayer, for doing so." (PA10, 30:31)

"…means is a lot of people come to our website and then we can monetize the back for the advertising purposes." (PA6, 28:22)

Participants cited time savings for users as examples of indirect economic benefits and increased efficiency in governmental services:

"…our website is one of the most visited websites in New Zealand and that was suggest to me that we deliver significant value to the New Zealand public" (PA10, 23:43)

Figure 5-11 visualises a conceptual framework of theme 1A in NVivo mind map. This is to present how the theme was derived from in-depth content analysis to categories "COMPETENCIES IN PUBLISHING OGD" and "DRIVING FACTORS OF OGD INNOVATION" with their sub-categories.

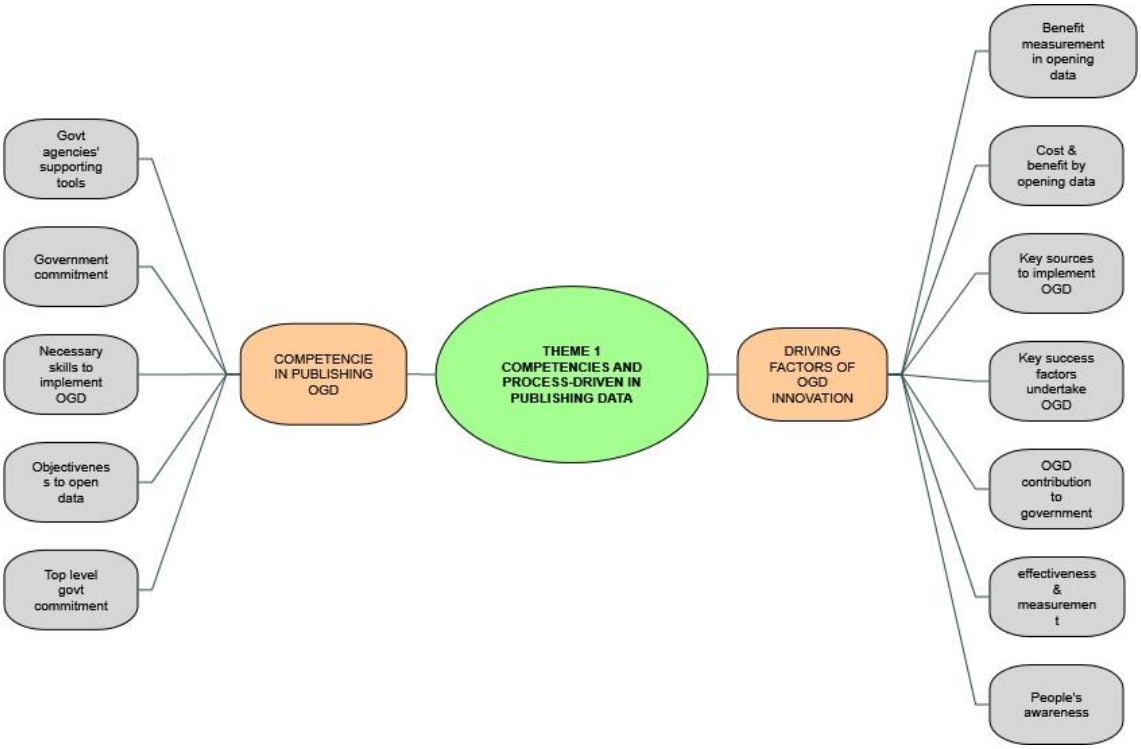


Figure 5-11 A conceptual framework of theme 1A-case study A (with NVivo Mind map)

Finally, illustrated by supported narrative above, a concept of theme 1A "COMPETENCIES AND PROCESS-DRIVEN ABILITIES IN PUBLISHING DATA' is summarised as: **A set of skills, knowledge, and attitudes is required of government officials who work with OGD. It drives the process strictly and consistently doing the OGD activities to enhance the data quality and value.**

5.3.5.2. Theme 2A "GOVERNMENT CAPACITIES TO UNDERTAKE OGD ACTIVITIES"

When all the categories were examined to find meaningful themes, the second theme emerged from two categories: "GOVERNMENT LEADERSHIP AND CULTURE" and "OGD BARRIERS, ISSUES AND CHALLENGINGS". This happened after I focused on their coding clusters, reviewed their subcategories, checked super codes, and ran through any initial codes to get a, including re-reading the excerpted transcripts that provided relatable context as the reason for building this theme. Tables 5.4 and 5.5 show the coding map for categories "GOVERNMENT LEADERSHIP AND CULTURE" and "OGD BARRIERS, ISSUES AND CHALLENGES".

Table 5.4 The coding map of the category “GOVERNMENT LEADERSHIP AND CULTURE”

CATEGORY	SUB-CATEGORIES	SUPER CODES
GOVERNMENT LEADERSHIP AND CULTURE	Guidance and procedure deal with open government	IMPLEMENT DATA GRANULARITY STANDARD
		NO SPECIFIC PROCEDURE RELATED TO OGD
		STANDARD FOR DATA PUBLICATION
		APPLY PRIVACY DATA STANDARD ASSESSMENT
		USE STANDARD FOR IT TASKS
		KEEP UPDATE ON SPECIFIC GUIDANCE
		GUIDANCE RELATED TO HANDLE INTERACTION WITH USERS
		APPLY INTERNATIONAL GUIDANCE
		MAKE INTERNAL AGENCY STANDARD
	Target and achievement plan of OGD programme	ADOPT A SET OF OGD STANDARDS
		VERIFY OGD IS GENUINELY OPEN
		CONSULT DATA USERS AND PRIORITISE THEIR NEEDS
		DEEPEN OPEN DATA PRACTISE
		SYNC OPEN DATA, PRIVACY, AND INFORMATION EFFORTS
		NO NECESSARILY HAVE TARGET
	Government Policies and regulations	NEW ZEALAND GOVERNMENT DATA POLICIES
		ADOPTED INTERNATIONAL POLICIES
		NOT AWARE ABOUT OGD POLICIES
		STANDARD AGREEMENT WITH THIRD PARTIES
		GOVERNMENT AGENCIES REGULATIONS
	Government agency structures	NO SPECIFIC STRUCTURES FOR OGD
		FORMAL STRUCTURE FOR OGD IMPLEMENTATION
		INFORMAL OR TASK FORCE STRUCTURE FOR OGD IMPLEMENTATION

Table 5.5 The coding map of the category “OGD BARRIERS, ISSUES AND CHALLENGES”

CATEGORY	SUB-CATEGORIES	SUPER CODES
OGD BARRIERS,ISSUES AND CHALLENGES	Barriers and concerns by publishing OGD	EXTERNAL PRESSURES IN PUBLISHING OGD
		IMPEDIMENTS ON OGD QUALITY
		IMPEDIMENTS WITHIN ORGANISATIONS
		NO SIGNIFICANT BARRIERS
		TECHNOLOGY PRESSURE ON PUBLISHING OGD
	Implementation obstacles	CAPABILITY AND SKILL LIMITATION
		ORGANISATION CULTURE CONCERN
		PROVIDER LEGAL CONSTRAINTS
		TECHNICAL ISSUES RELATING WITH PUBLISHING DATA

For this theme, the researcher considered two categories: GOVERNMENT LEADERSHIP & CULTURE and OGD BARRIERS, ISSUES AND CHALENGES which formed emerging theme “GOVERNMENT CAPACITIES TO UNDERTAKE OGD

ACTIVITIES". The following narratives convey the essence of how theme 2A emerged, with linked transcripts of two categories and what component of the code each theme captures.

Government leadership and culture. This relevant category, with its subcategories and super codes, served as the premise upon which the theme "Government capacities to undertake OGD activities" was based. This category describes that the government must lead by an example by implementing OGD with guidance, regulation, structure, and standards. This will call for a capable leadership and a culture shift. While culture change is not complete across government agencies, a transformation is happening as they consider data as vital public assets whose release can drive innovation, increase knowledge, and create new value. As shown in table 5.4, this category was broken down into four sub-categories: *Guidance and procedure deal with open government*, *Target and achievement plan of OGD programme, Government policies and regulations*, and *Government agency structures*.

Based on participant's transcripts, this sub-category *Guidance and procedure deal with open government* elaborates that the central government, especially StatNZ, was mandated to lead the OGD programme by preparing guidance and procedure to produce and publish data and engage with the government agencies in implementing the OGD programme.

There are several guidelines to conduct the New Zealand OGD programme, for example, the Open Data Charter. According to a participant, The Open Data Charter is an international standard for transparency in government data that assists New Zealand Government in building capability and releasing value for their constituents. It encourages the implementation of open data principles and best practices.

> *" that's the international Open Data Charter. So that's not New Zealand-based, international. Yeah. So New Zealand has signed up to the international Open Data Charter along with a number of other governments around the world and is also endorsed. And I play an active role in their by co-chairing a implementation working group which is the purpose of either building guidance or helping the sharing of knowledge around how you actually put Charter principles into action."* (PA4: 13:55)

"*We're also signed up to the OGP – which is _not_ about open data, and which doesn't necessarily have any actions, per National Action Plan… NZ central government is also signed up to the ODC, but this is a set of guiding principles"* (PA2, 10:20)

In addition, the participant emphasized the need for a culture shift across government agencies to translate principles into reality by identifying individuals who can accomplish tasks practically:

"…And as I said as much about culture change as anything else. When it comes doing action within the agency at a practical level then they work with people at that level. So they find people to make it happen." (PA4,14:57)

Below is the participant's response when asked whether OGD is an example of the effective implementation of the government's ICT strategy.

"Yeah, we certainly owned that particular action. The strategy is also quite old now and I think in general affairs are currently working on a Digital strategy I guess it still applies but no one refers to it anymore." (PA4, 17:33)

When being asked about a new release framework of Data and Statistical Capability Framework (DSCF), a participant explained that DSCF is a conceptual framework that explains the data and analytic capabilities needed by the central government, local government or NGOs that maintain and interact with government-held data[26].

" So this is currently being developed. And not by the open data program that it's more broadly looking at and supporting the role of Chief Command Data Steward to look the capability across government. So the idea is to help

[26] https://www.stats.govt.nz/assets/Uploads/Data-leadership-fact-sheets/Fact-sheet-data-and-statistical-capability-framework-july-2019.pdf last accessed January 2022

people understand the skills that are required for different roles and gathering data. And how to write them and how to enhance them." (PA4, 18:15)

In another perspective, the participant addressed the implementation of the OGD's guidance and procedures to publish their data into open data portal, data.govt.nz.

"…these two paths to data.gov catalog and then stick the content, guidance, policies and insightful… they come on big platform is where we put the content and then the listing of datasets happens through the catalog as just blend it as one thing" (PA4, 05:50)

Participant PA8 shared that New Zealand GOAL were written to guide the OGD implementation and more people and organisations could use and reuse the datasets. According to the information in the open data portal[27], The New Zealand Government Open Access and Licensing framework (NZGOAL) is a set of guidelines government agencies must follow before releasing non-copyright protected information for reuse. It recommends using statements for non-copyrighted content and Creative Commons licenses for copyrighted government works for reuse.

"…main document that would drive our open data release would be the document name New Zealand GOAL" (PA8, 31:22)

When another participant from the central government asked about guidance that works to implement the OGD program for government agencies, the participant replied that the 'real guidance" for officials dealing with publishing data is by practising and conducting workshops and discussions with the data champions to socialise the guidelines.

" It's been various versions over the years, but I'm currently working on a new version of some practical guidance to releasing data, open data released checklist. So there's no open data framework bit stay. In my view

[27] https://www.data.govt.nz/toolkit/policies/nzgoal/ the latest access on January 2022

that doesn't actually help anybody do it. It's probably gone for the practical how-to guidance. We also do a lot of one-on-one with this Data Champion and run workshops to get more groups of people together." (PA4, 21:59)

The sub-category *Target and achievement plan of OGD programme* describes the participant's feedback regarding the New Zealand government's efforts to meet their target and goal and implement their OGD achievement plan. The government has started a plan and outlined a strategy for accomplishing this target.

One participant from a public agency that published most of their big data, shared their target to release open building outlines dataset with main objective to adopt a set of OGD standard.

> *"So most of those 2,000 data sets that we published were out of our topographic mapping team or the property system. You know something that we were already doing there's now bits of work going on with [the organisation name] that are responding to customer needs directly. So, things like building outlines."* (PAC9, 14:22)

Furthermore, another participant discussed their plan to deepen open data practices through fostering interoperability among government organisations.

> *"We should probably get some better oversight and start to develop some interoperability between these datasets and between wider government."* (PAC9, 45:47)

According to a central government participant (PA4), one of their goals to prioritise user needs was the process of talking to procurement professionals explicitly about their request for procurement data.

> "*So we're currently trying to get better access to procurement data and the company better access to the company's register, F&B, animation and prominent… so we've helped raise awareness and the amongst procurement professionals across government that they need to get data explicitly for the contracts when we have outsourcing service.* "(PA4, 35:26)

Government policies and regulations. This sub-category examines the information retrieved from participants regarding different policies and regulations made by the central government to monitor the implementation of OGD. The coding analysis has

extracted the feedback from the different participants of the central and local government about the context, objectives, progress and outcomes of the policies and regulations.

The participant affiliated with a central government revealed that the government has not adopted special regulations or policies to identify which data types are public, private, or sensitive. To release data to adopt open by default, they did a privacy impact assessment in general.

> *"Well, it's up to each agency. Obviously, part of the process of releases doing things like privacy impact assessments in general risk assessments… well that are expected to be open by default."* (PA4, 29:58)

In addition, the participant stated a significant amount of guidance about data governance and data lifecycle management were released and prepared by the top levels of the central government's wider group on the OGD initiative, including plan, gathering, short-term storage, analyse, publishing, and preserving.

> *"So, at a very high level with its great with the Data and Information Management Principles come in. And there is also lots of other guidance around data governance, data management from a V8 like from Department of Internal Affairs or from internationally. Our wider group is also pushing out a framework, operational data framework. Which will be hopefully released and more user-friendly form. Yeah,we are not actively doing in this because we're rolling up. "* (PA4, 31:21)

The participant from a local council indicated that they do not regulate the usage of their open data since it is not their responsibility because data licencing allows anyone to reuse data under the Creative Commons licence, which is freely available.

> *"So, licensing we use a creative use the Creative Commons ones. .. You just have to attribute where the data to come from. Yeah, to be honest, we don't govern the use of our data. It's none of our business. People can use it for whatever they want to over. If it's illegal, the police will come and arrest them."* (PA1, 13:12)

This sub-category *Government agency structure* describes how the organisational structure of government agencies has been altered to accommodate the Open Government Data program. This is provided by explaining the agencies' current mandate

and functions and its connection with the organisation's aims and objectives to conduct OGD programme.

Participants highlighted that understanding the potential associated with OGD can help government agencies carry out their responsibilities.

> *" years after the Open Government Data program within a wider team of data leadership and capability in [The organisation name] . And department of [department's name] was involved because they managed that the data catalog of NZ. So they keep it running and they were also the host of Common Web Platform. So these two paths to data.gov catalog and then stick the content, guidance, policies and insightful. And so they come on big platform is where we put the content and then the listing of datasets happens through the catalog as just blend it as one thing."* (PA4: 05:45)

New Zealand has a whole variety of councils. Participant affiliated with local council revealed that the council has totally different structure with other city councils.

> "*So one of the things to bear in mind as we have a different structure from [another smart city's name]. We have a whole variety of councils, which cover [the city name] not just one like [city's name] does …Totally different."* (PA1, 03:11 & 03:30)

Another participant noted that different with central government, the local agency did not form a special role related to OGD implementation. The participant works involved in publishing and managing monitoring and research data.

> *"It doesn't have a specific role in that except that all our work involves research analysis and monitoring." (PA7, 04:23)*

Another participant from the state-owned enterprise informed that their role related to open data have been included as part of core government infrastructure. The role of open data stated in the agreement between agency and ministry of transport.

> *"the provision of [The organisation name] regarded as a function that the government contract to [The organisation name] to perform. And so, this is effectively a commercial Arrangement between the government and [The organisation name]."* (PA10, 03:58)

OGD barriers, issues, and challenges. This category was derived from two sub-categories that developed participants' experiences linked to barriers and concerns by publishing OGD and implementation obstacles. The sub-categories as shown in table 5.5 are: *Barriers and concerns by publishing OGD* and *Implementation obstacles.* When it comes to publishing open government data, this is one of the most effective ways to capitalise on the potential benefits of data. However, many challenges are faced before the data is published and throughout the data value chain. Several participants stated that they frequently encounter a variety of problems and roadblocks.

The sub-category *Barriers and concerns by publishing OGD* pointed out the barriers and concerns were faced by the participants, such as technology pressures, OGD quality issues and internal and external agency barriers. One participant from central government discussed his/her experiences publishing government data, dealing with impediments inside the agency or between other agencies:

> *: "…releasing open data publicly, it's more about privacy, risk, money, resources and executive support and backing. Quality can be a barrier, but doesn't have to be" (PA2, 11:43)*

Additionally, the participant explained that the key concern is the need to maintain better coordination within and across the agencies involved in the release of the data.

> *"as would better coordination. I'm not sure you can solve these things, but we could continue to address them and address them better".* (PA2, text B.3)

Participants shared their experiences publishing government data, dealing with external challenges and pressures such as working with third parties:

> *"...* **.** *Another issue is data which has been locked down by commercial vendors contracted by central / local govt – for example, the centreline (CoreLogic)" (PA2, 15:22)*

> *"And if we don't, we can just talk to vendors or suppliers and look at to a right software and it's just ask them to do some work for us and they can provide in different formats."* (PAB8, 25:40)

Some participants stated that the most significant challenges they faced in disseminating government data were the lack of data quality and the pressure from technology. Others, on the other hand, did not encounter any significant obstacles.

The participant discussed the concerns about malicious data. People exploiting data to cause harm in some way, marketing to people in an unethical manner, or even robbing people's homes are examples of data misuse.

> *"So, in terms of malicious reuse of data when it's not malicious data itself, well, the first thing is Creative Commons license. So, if they provide a Creative Commons license, they are moving themselves from reliability, so that the unanimous of reuse is on the user. So, it doesn't stop somebody doing it, but, it is also if you can see ways quite clearly how it could be used. You can communicate that it's not acceptable to do that, but I think it also be giving somebody an idea that didn't previously have. So, it really actively just encouraging agencies to license, also to promote good ways data that can be used."* (PA4, 20:09)

> *"The only people we would look, frankly, it's a lot of trouble to negotiate data sharing and it's very costly."* (PA4, 36:37)

> *"One long-standing problem that we heard about lots as that we don't offer an ESRI's Risk Service. …ESRI's Arcmap, sort of probably the most popular proprietary piece of software in geospatial or GIS and we don't offer an API that feeds directly into that software. So, we get a lot of complaints about that. "* (PAC9, 20:57)

The central government and local council participants described their experiences with data quality barriers. Data quality is one of the challenges for agencies in opening their data but lack the resources to address the issues it presents:

> *"So, barriers to release streaming. Anxiety over privacy, concerns on malicious reuse."* (PA4, 19:09)

> "*So when you're dealing with some of those more sensitive data sets, normally I take the position that data is processed into information, the lens you use is up to you when it comes to some of those cultural data. so the lens is actually the important part."* (PA1, 17:18)

> *"Sometimes the resolution of it is not good enough to use for us. So, it's at a national level, but we can't get to the city scale insights out of it. That can become useful, can become difficult sometimes. I'm interested in a particular*

thing. And for some reason it's missing from the datasets where it should be in." (PA1, 39:37)

Another barrier faced by the participants was technology pressure. The central and local government participants also encountered technological pressure while publishing government data, such as Application Programming Interfaces (APIs) with an outdated architecture, broken APIs, complex database levels, and diverse raw data formats:

"The other difficulty is so we released a great deal of open sensing data that a couple of years ago as the trial and part of the trial was pressed to learn how to structure the API is necessary to deliver it. And of course at the end of the trial once we've learned some stuff we decided would restructure the APIs which just annoying everybody because they built under the old structure." (PA1, 41:09)

"…that's technical like around an API being broken or a glitch in the server so bug which there's a lot of we get 20,000 customers a week going through the service." (PAC9, 29:24)

"we also publish three hundred five tables which I couldn't even begin to tell you … but then coming off that there's maybe 20 to 25 simplified layers" (PA9, 08:02)

"So, things like sensor data which come and basically more like real time and the three-dimensional datasets are proving a particular challenge to release, maybe because of the storage and different formats." (PA1, 08:57)

This sub-category *Implementation obstacles* related to implementation obstacles faced by all of government agencies ranging from capability and skill limitation, organisation culture concern, provider legal constraint and technical issue. According to one of participants that most concern are capability and skill limitation:

"we're not necessarily control of that user experience side of our product, which is can be very frustrating to be honest, but koordinates.com, we works as a partnership. So we they're very proactive about helping us in that respect." (PAC, 31:22)

According to participant from local council, cultural barrier for shifting to data open might be solved with engaging with key users of their data such as researchers and academics:

"So, if our scientists do produce journal articles, so they may be cited X number of times, but that's not going to help a small community in South [the city name] who need information on their community. So it isn't it. It's that tension around Open Access." (PAC7, 34:25)

The participant from the central government talked about the importance of organisations' culture in cultivating the OGD initiative, describing how multiple approaches should be adopted to follow the guidance:

"There's a conflict of belief within [the organisation name] about whether or not we should do that. My personal belief is that if there's enough users wanting a certain format, you should work outside those Open Standards or that it's okay to work outside those Open Standards… it should be opened first by default and then proprietary building on top of that." (PAC9, 31:22)

In addition, this participant highlighted about legal constraints when starting publishing data years before OGD programme released.

"so initially when we first started on the open data journey, it was a lot of blind faith. So there were a few key member of the organization that really bought into the idea of open data, probably through their close relationship with open source software and the idea that these two things are quite well combined and there are a few real champions within the organization that were great at selling the idea." (PAC9, 08:02)

The participant then added concern about data governance as the agency started opening early before the OGD initiative was launched:

"I would say that's probably one of the areas that [the organisation name] has the most work to do in data governance. And we're behind in that because start a publishing data so early…" (PAC9, 45:47)

Another constraint revealed by the participant that when it comes to the OGD user experience, one aspect may appear trivial at first glance. Then they got support from a software developer to solve the issue.

"It's a bit more difficult when you use software as a service, we're not necessarily control of that user experience side of our product, which is can

be very frustrating to be honest, but koordinates.com, we works as a partnership." (PAC9, 31:22)

One of participants highlighted one legal issue raised with a key partner as a vendor to support centreline data to be opened:

"Another issue is data which has been locked down by commercial vendors contracted by central / local govt – for example, the centreline (CoreLogic)" (PA2, Text D.4)

Under this sub-category *Implementation obstacles*, technical issues were the most significant problems shared by participants. Ranging from complicated demand such as to build a new storage and open portal for big data and sensing data:

"Three dimensional and since the data is the most troublesome to deal with. The biggest problems we'd see around how you hold formats-bear in mind that three-dimensional data has six times the volume of conventional two-dimensional data. So how you deal with it's quite important. The sensing data has an interesting one because we normally get at them to five-minute blocks. Our portals were never designed to be able to deal with that. So we're having to create new storage and portal options." (PA1, 34:11)

The participant from the local government experienced complicated method to integrated source of open data that manually recorded in different locations:

"Yeah, so each station is recorded locally, and information is sent to a [special term] software package that's in the Cloud Server, yes. And then because that's just the connection to the field and depending on what kind of data is all going to a specialised database…and then process it and archived, quality coded and admitted data for intern comments and information, then go back up to the web portal" (PAB8, 31:50)

Another issue when publishing big-geospatial data in discrete periods impacted on the storage shared by one participant:

"And that is where a lot of our growth is and the amount of storage, we have to use in our services gets heated up and that area land and elevation area. ... Point that out." (PAC9, 06:41)

The NVivo mind map in Figure 5-12 shows the conceptual framework for theme 2A. The theme was formed using a content analysis of the categories "GOVERNMENT LEADERSHIP AND CULTURE" and "OGD BARRIERS, ISSUES & CHALLENGES" and their associated sub-categories and codes.

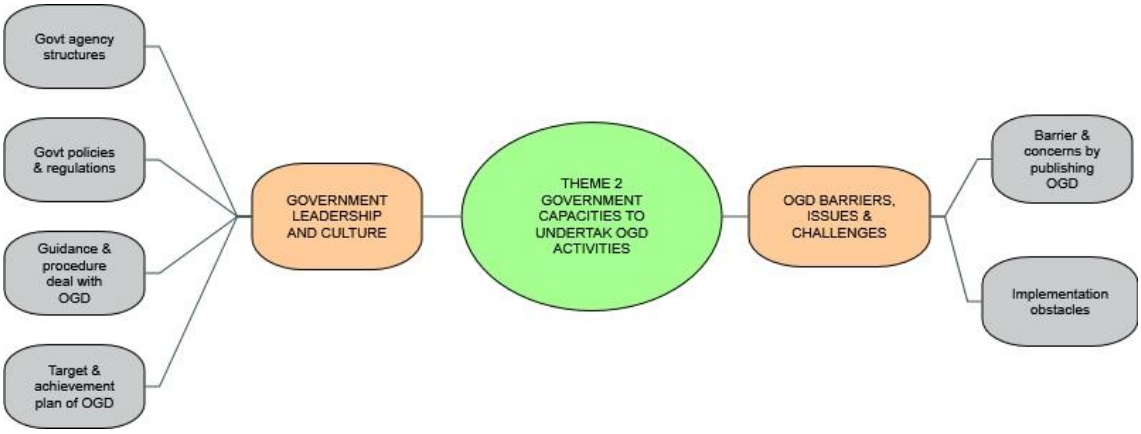


Figure 5-12 A conceptual framework of theme 2A-case study A (in NVivo Mind map)

In summary, narrated by the relevant data above, the concept of Theme 2A "GOVERNMENT CAPACITIES TO UNDERTAKE OGD ACTIVITIES' is **the government's ability to implement OGD through rules, regulations, structures, and standards supported by strong and capable leadership and culture shift. Over the years, the capability has enabled the government to overcome barriers and challenges related to OGD implementation.**

5.3.5.3. Theme "VALUE CREATED THROUGH OGD INNOVATION"

The last theme of case study A was formed from 59 super codes (pattern coding) in nine sub-categories under the two categories "OGD VALUE-CREATING ROLES" and "OPENING GOOD QUALITY DATA." This section discusses the sub-categories with their coding, quotes the relevant transcripts, and explains how the theme was constructed from the coding map of these categories. Table 5.6 and 5.7 illustrate the coding map for " OGD VALUE-CREATING ROLES" and "OPENING GOOD QUALITY DATA" categories.

Table 5.6 The coding map of the category “ OGD VALUE-CREATING ROLES"

CATEGORY	SUB-CATEGORIES	SUPER CODES
OGD VALUE CREATING ROLES	Government Key players	a developer background
		a few real champions within the organization
		Chief Data Steward
		Chief Executives
		Data Champion Network
		Internal Affairs
		Ministry of Transport
		They know every single sign asset
	Key actors for OGD programme	OGD ADVOCATE
		OGD CURATOR
		OGD OWNER
		OGD PRODUCER
		OGD PUBLISHER
		SERVICE DESIGNER
	Key partners deal with OGD	COMMUNITIES AND CITIZEN
		DIFFERENT DEPARTMENT'S OFFICIALS
		NON-PROFIT ORGANISATIONS
		OFFICIAL LEADERS FOR OGD
		OGD CHAMPION
		OTHER COUNTRIES' OFFICIALS FOR OGD
		OTHER GOVERNMENT AGENCIES
		SOFTWARE DEVELOPER COMPANIES
		UNIVERSITIES AND BUSINESS
		WEB APPLICATION DEVELOPERS
	OGD Stakeholders	CENTRAL AND LOCAL GOVERNMENTS
		DATA CAPTURED COMPANIES
		LIDAR MAPPING FIRMS
		THE AERIAL PHOTOGRAPHER
	OGD Users	ACADEMIC AND MEDIA SECTORS
		CITIZENS
		DO NOT KNOW THE USERS
		INTERNATIONAL USER
		NGO AND COMMUNITIES
		OTHER GOVERNMENT AGENCIES
		PRIVATE COMPANIES
	Participant demograph	CURRENT DUTIES
		CURRENT ROLE
		SECTOR REPRESENTATION
		UNDERSTANDING ABOUT OGD

Table 5.7 The coding map of the category “OPENING GOOD QUALITY DATA”

CATEGORY	SUB-CATEGORIES	SUPER CODES
OPENING GOOD QUALITY DATA	OGD Quality monitoring	BY ASSESS THE DATA BEFORE PUBLISHED AND RISK AVERSION
		BY FOLLOWING OGD STANDARD PROCEDURE AND GUIDANCE
		BY HANDLING USER FEEDBACKS
		BY IMPROVING DATA QUALITY
		BY MAINTAINING DATA SYSTEM BASED ON PROCEDURE
	Privacy and personal information Protection	BUILT IN ETHICS NATIONAL DATA
		CAN NOT DETERMINE WHEN DATA MISUSE
		FOLLOW PRIVACY LAW COMMISSION AND STANDARD
		MOST DATA UNDER A CREATIVE COMMON LICENSE
		NO PRIVACY DATA RELEASE FOR PUBLISHING
		PERFORM PRIVACY IMPACT ASSESSMENT BEFORE RELEASED
		VERY LITTLE DATA ACTUALLY SECRET AND PRIVACY
	Satisfaction of OGD from Government perspectives	NOT BAD NOT GREAT
		NOT SATISFIED FOR SOME PART BUT SATISFIED FOR OTHERS
		NOT SURE IF I CAN ANSWER
		SATISFIED
		UNSATISFIED
		VERY SATISFIED

OGD value-creating roles. OGD value-creating roles defines as roles in the OGD effort that focus on developing, exploiting, and providing OGD value via a data process to bring social and economic benefit are considered value-producing roles (Mokobombang, Gutierrez, & Petrova, 2020). This category was created as a merged of six sub-categories as described in table 5.6. When participants asked about key actors for providing open data, their replies vary concerning the participants’ affiliated with different types of government agencies.

Department of Internal affairs conducts roles as the OGD publisher as they ran the open data portal data.govt.nz.

> *“So data.gov is ran by Internal Affairs and there we list all of our data sets. We have our own data portal...”* (PA1, 16:18)

After grouping the key actors discussed by participants, value-creating roles of the actors for OGD programme within central government and agencies vary from OGD advocate, curator, owner, producer, publisher and service designer.

> "*we have government actors and we have Civil Society actors. … a forum of people known as the Open Government Ninjas and that a group of both highly technical and very vocal towards having open and transparent government*. " (PA4, 08:0"9)

> *"The data manager is the doer, so the person who updates the data set and then pushes it up into the data service and makes it available to customers."* (PAC9, 08:02)

According to one participant, the data owner is accountable for open data's strategy and operation. A data owner sometimes may also be a data provider.

> OGD owner *"and the data owner is the custodian, the person who needs to be responsible for their Strategic ideas and make sure that they're meeting the needs of industry and government."* (PAC9, 08:02)

Participants provided feedbacks about Data champion role. This role lead the release of open data to support the shifting culture across government officials and act as a key point of contact for other government agencies and external users:

> *" so I guess this connects back to your question about key players. We have a network called the Data Champion Network. So those are people appointed by Chief Data Steward, Liz McPherson, rights to Chief Executives to ask them to appoint the data champion. Who is ideally a senior manager with knowledge of the organization and they are our window into that organization and also a champion for the culture change. So they don't need to necessarily be a data person at all. They just understand the benefit."* (PA4,14:57)

On the other hand, the government of New Zealand selected government functional leads tasked with developing and enhancing a specific area across the government. The roles are assigned to chief executives. For example, Chief of Data Steward responsible to encourage data use within government agencies to provide better service to the public.

"*Government CIO-Government Chief Information Officer role is just established. …created two roles instead side-by –side, Chief Data Steward and Chief Digital Officer. So the Chief Digital Officer is the Chief Executive Engineer Officer, and GCDS here as the state"* (PA4, 07:16)

Furthermore, based on the participants information, the key partners that dealing with OGD were categorised as hacker groups, communities and citizens, open data meetups, Open Data Programme, friends and networks that their roles were defined as OGD intermediaries:

"…And then we have our meetup communities in Wellington, Christchurch and Auckland. And relationships who built and maintained through networking." (PA4, 33:29)

"…then you've got the hacker groups." (PA1, 30:14)

"The Open Data Programme, various personal friends and networks, open data meetups (various)…" (PA2, text D.1)

"…Open Data Ninjas, more universities and business, ecommerce, Data Champions across government" (PA4, 33:29)

Other participants shared key actors such *as* department officials, non-profit organisations, official leader of OGD programme, OGD champion, other countries official for OGD, software developer companies, academics, profit/business companies and Web developers. Their roles were identified as OGD intermediaries, OGD champion, OGD consumer and OGD infomediaries, respectively.

"there's sort of distributed responsibility throughout the organisation for people that the subject matter experts to know their data, to know the industries that they affected and to know their key stakeholders and to know the value that their data can deliver to them and to decide what data needs to be released" (PA8, 06:41)

"We had third party only because the council had parties with the amalgamation. To bring in, you know, seven or eight different IT systems into one… so we work with our IT Department" (PA7, 36:07)

According to the participants, OGD users range widely, from entrepreneurs, engineers, architects, and enterprises to research institutes and universities. They also highlighted that open data enables different types of communities, non-governmental organisations, and civic involvement. One participant indicated that users also obtained data from the open portal within its agencies and ministries and usage across agencies.

> *"… we have entrepreneurs creating new products and services, like Startup companies, researchers*." (PA4, 24:28)

> *"So, that shows for example engineering and architecture is really one of our biggest users. We've dived into that a bit deeper and it's not actually fair to say that they would be our most important customers because they do discrete projects."* (PAC9, 24:42)

> *"…many of the Ministries and other government departments use that data made decision making. We have Community groups making submissions to council. There are several businesses that use our data and making their products or did demonstrate. And then you've got oddly, our open data is used within the city government itself. And then it's also used in collaboration with our regional partners."* (PA1, 22:12)

> *" we've got businesses making better decisions. So analysing data, we've got Charities using it for evidence for change, advocating for change. We get education institute using it for teaching. We got the media using it for data journalism and visualisations. And we've also got Consultants using it for all sorts of reasons for economic, for free consultancy. Just getting return sites that helping customers. We've got software Developers using [the organisation name] information data, for example, to create applications, for lawyers to do conveyancing."* (PA4, 27:35)

One of the significant aspects of open data is that it is global in scope, as it is accessible and used by anybody with an internet connection. One participant disclosed the proportion of their users by country of residence, demonstrating how global their users are. Most of their data usage originates in New Zealand, while Australia and the United States account for 8% of their usage. The United Kingdom, India, China, Canada, Germany, Japan, and France all have a low level of open data usage.

"85% of our usage is in New Zealand, 4% Australia, 4% the United States below 1% United Kingdom. Just below United Kingdom as India and then you've got a very small percentages like below 0.3% China, Canada, Germany, Japan France." (PA9, 24:42)

Opening good quality data. As shown in Table 5.7, the coding map developed this category referred to three sub-categories: *OGD quality monitoring*, *Privacy and personal information protection* and *Satisfaction of OGD from government perspectives*. The assessment was then broadened to discuss how this theme emerged from this category.

OGD quality monitoring. This sub-category describes participants rated the quality of government information and discussed an aspect of government information related to relationships. They noted how OGD portals employ site analytics to collect vital information about who visits their websites, which data sets are downloaded, and how frequently those data sets are downloaded. One participant discussed how to publish datasets on open data portals.

"data quality doesn't concern me terribly much. The data was good enough to make a decision from normally. So that should be good enough to release" (PA1, 17:18)

"So in that respect we're publishing non-complete data, but we felt it was much better to get out as a pilot, get customer feedback, adapt our schema as we go based on that feedback and ideally come out with a better product that suits the needs of our customers" (PA8, 14:22)

"Hackaton wiking where there was much frustration about the availability of data. So, no. I'm not satisfied with the level of data that's available. There's much more stuff will come."(PA4; 04:37)

One of participants identified that adhering to data standards, such as robust and reliable data, is an important aspect to monitor data quality:

"So, it's a really quick because really clean robust datasets, you know. It will need some those things for long-term trends for climate change… Yes, and consistent to standard. I'm not sure if you aware." (PA8, 46:42)

Another participant from the central government highlighted that data assessment before being published can help avoid the risk of delivering low-quality datasets.

> "*We've got a lot of data sets in which as you described a sort of verging on that Big Data, side of the spectrum like our property data"* (PA9, 08:02)

One participant from the local government shared that to monitor the quality of data with handling respond to user feedback, such as providing a contact email for the public was important to ensuring the best use of OGD and to improving the experience of the public when accessing government data:

"*we've got an email address for our team and that's also on the [city] council website" (PA8, 11:58)*

Under the sub-category *Privacy and personal information protection*, several participants discussed their approaches to preserve privacy and personal information from the risk of being published. The participant from a local council highlighted prior release data the agency conducted a privacy assessment:

> *"Most of the government's we have is around how we release the data in the first place and making sure that it's had privacy assessments that we've proactively taking care of any cultural issues that may be in the data."* (PA1, 13:12)

The participant from the central government made a similar statement, stating that the privacy impact assessment was undertaken to support high-quality datasets:

> "*that are expected to be open by default, this is a good reason not to. That's why do privacy impact in General risk assessment impact as part of the process to release to make sure it's expected that for open*" (PA4,30:30)

Furthermore, the participant from the central government explained that it is not the government's responsibility how users utilise the open data. Currently they adopted Creative Common license. They hope can migrate to Creative common Attribution licence (CC BY) that released by Open Knowledge and Open definition. CC BY is the Creative Commons Attribution licence permits the re-distribution and re-use of a licenced

work, provided that the original creator is properly credited in the process[28]. Governments relies on this standard as the fundamental rule to make data open:

> *"licensing we use a creative use the Creative Commons ones. We try to use CC BY as soon as possible. Yeah, so you're free to reuse it whatever way you want. You just have to attribute where the data to come from. Yeah, to be honest, we don't govern the use of our data. It's none of our business."* (PA1, 13:12)

The subcategory *Satisfaction of OGD from government perspectives* described how to satisfy government agencies with OGD, considering that the government agencies are also users. The government agencies provide information on how to get datasets and tools to make the information more understandable, such as infographics. Despite the fact that their open data platforms encourage the public to ask for datasets and give their feedback, more proactive procedures are needed to let citizens be co-creators or administrators of these platforms. One participant from the central government noted that OGD availability was not bad, nor exceptional, but less for local council progress:

> " *I think we're doing OK, not bad, not great, in terms of the amount of available open data, at least from central government, but we've a long way to go in terms of local open data availability… In all cases, we've also got a fair way to go in terms of data standards, formats and interoperability.* (PA2, 04:05)

Another participant shared that he/she very satisfied with the data:

> *"very satisfied."* (PB6, 19:45)

Figure 5-13 displays a conceptual framework for theme 3A that was developed using NVivo mind mapping with content analysis of the categories "OGD VALUE-CREATING ROLES" and "OPENING GOOD QUALITY DATA" with their associated subcategories

[28] https://opendefinition.org/licenses/cc-by/ last accessed December 2021

and codes. The framework condensed thematic coding into consolidated representations to simplify the case study analysis.

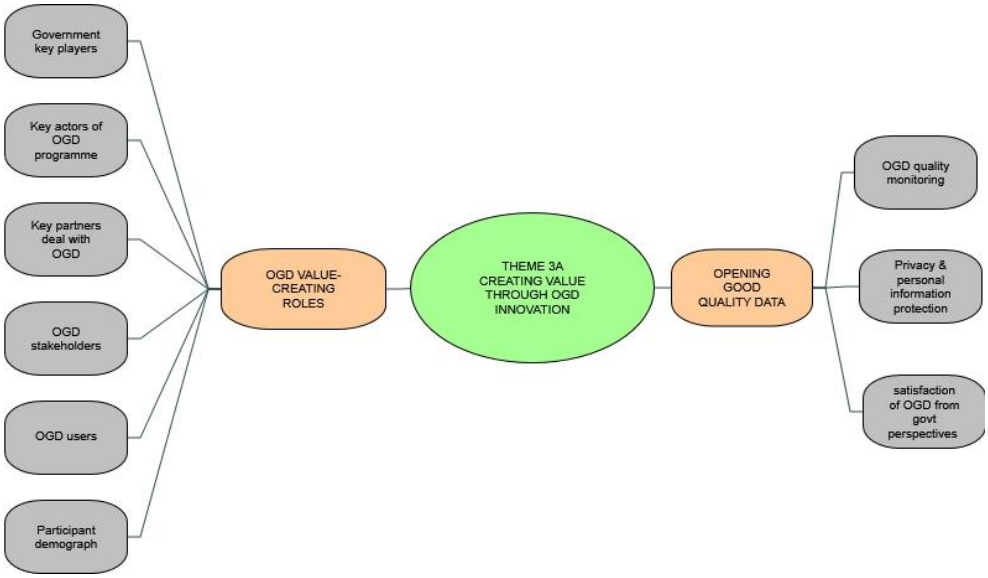


Figure 5-13 A conceptual framework of theme 3A - case study A (in NVivo Mind map)

Summarising the relevant facts presented above, the concept of Theme 3A "CREATING VALUE THROUGH OGD INNOVATION" is **provides insights into the value created by opening good quality data to the public, such as the potential for citizen-driven data innovation, and the value-creating roles that can be developed to enable the public to use and generate data value.**

5.3.6. Thematic map Case study A

Following the thematic coding as the foundation to elaborate the three themes, Figure 5-14 presents the thematic map for the case study A that investigates the participants affiliated with New Zealand government agencies. The thematic map provides rich data visualisation across large amounts of coding information. It illustrates patterns and relationships among disparate themes, categories and sub-categories to understand the case study's findings.

The three themes support this study to understand the pattern, in-depth information resulted from the thematic coding analysis in each case study to provide a starting point for the multiple case study analysis. The first theme, theme 1A, highlights the point that to engage with OGD, government officials need to have the right skills, knowledge, commitment, attitudes and supporting tools. They need to be able to procure, comprehend, manage, and create datasets to be opened through an open data portal

and agency's websites. The OGD implementation was designed to improve data quality and value by precisely and consistently driving the process with internal and external factors such as cost and benefit assessment, actor collaboration and people's awareness.

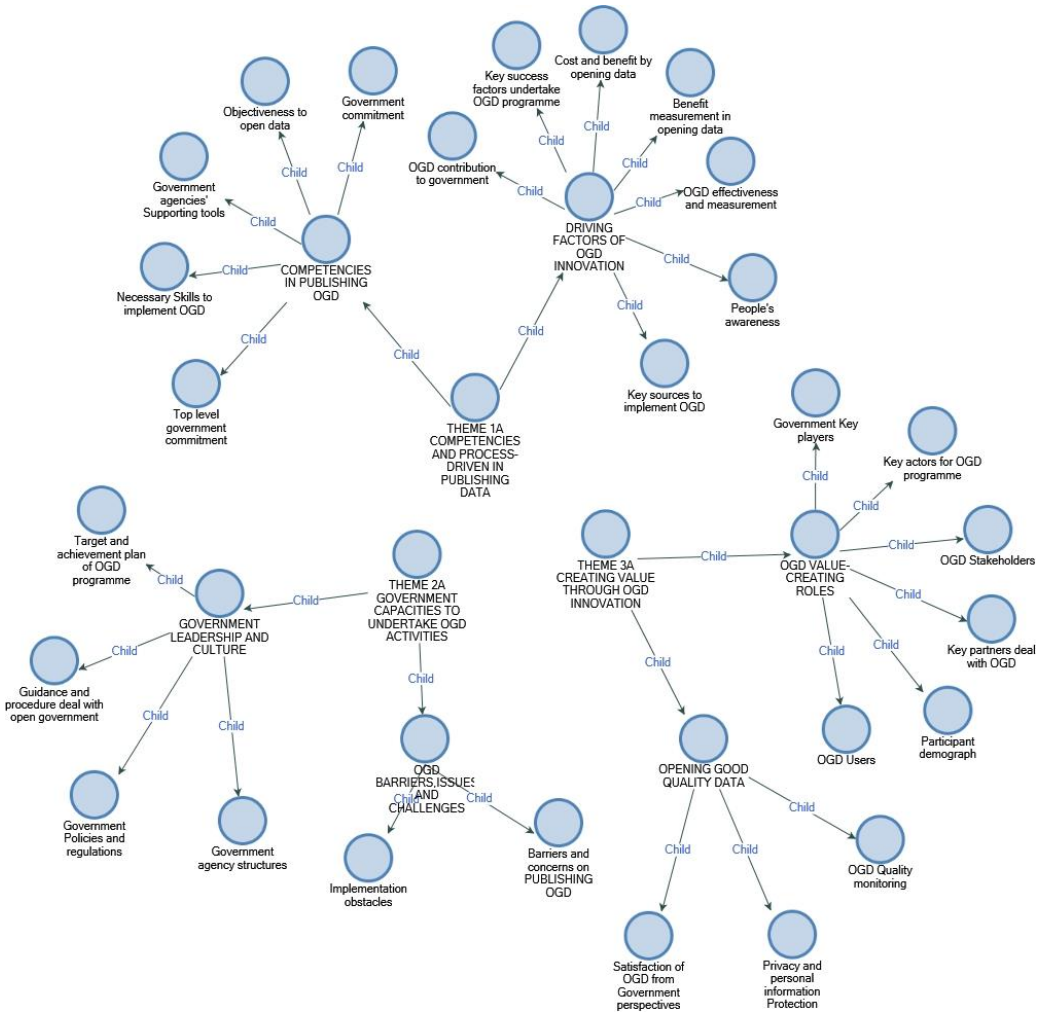


Figure 5-14 Thematic map of case study A – government agencies

From theme 2A coding cluster, an understanding gained after participants experienced dealing with OGD for years that strong leadership and a cultural shift have strengthened the government's ability to implement OGD. This has helped the government overcome many problems especially impediments in implementation and publishing that stem from the OGD programme.

The third theme, theme 3A, clarifies that the fundamental actions of the OGD programme are when government agencies contribute to the value created by making high-quality data accessible to the public. They exploit the potential benefits of citizen-driven data

innovations and then execute the value-creating roles necessary to enable users to capture and gain the advantages of OGD value.

In conclusion, by integrating three themes with coding hierarchies, the thematic map elaborates the government capabilities, official competencies, and OGD value as the three primary elements -organisation, people, and data- in implementing a sustainable OGD programme.

5.4. Case study B: Data-driven organisations in New Zealand

Specifically, the purpose of case study B is to investigate the participants from data-driven organisations (DDOs) located in two cities in New Zealand who have experienced using government-held information. This case study, similar to case study A, which looks at patterns in interview transcripts and takes place in a setting where each participant has experiences and gives an in-depth look at how OGD was used; Each participant's involvement helped the investigation for each case study.

5.4.1. Snapshot of Data-driven organisations in New Zealand

Despite potential benefits for businesses, consumers, governments, and taxpayers, New Zealand is just beginning to emerge in data-driven innovation, according to a case study paper by Sapere, COVEC, and Innovation (2015). DDOs adopted data-driven innovation as a data analytic strategy to increase the operational efficiency of businesses, create new products and services, facilitate better investment and strategic decision-making, and boost the effectiveness of government programmes (Sapere et al., 2015). As a DDO that relies on data insight to run its operations, a robust data infrastructure and access to high-quality data are essential to a successful business strategy. Technology and analytics approaches are essential parts of their success. Another document published by Statistic New Zealand (StatsNZ), the central government body responsible for producing statistical information based on censuses and surveys, examined the emerging trend in New Zealand on the potential benefits organisations can derive from a data-driven approach. According to StatsNZ (2015), three reasons organisations adopted a data-driven approach are the potential benefits of data-driven innovation, the decision makers demand for rich information rather than merely statistical or raw data, and the availability of more open datasets than ever before, such as OGD and open data from private companies. It is unconfirmed how many data-driven organisations are listed in New Zealand.

Two DDOs in New Zealand are involved in this case study B. Information about how the organisations capture, use and exploit OGD were taken from the participants during the interview session and the organisation's websites. The names of the organisations and any related information that may be used to determine the participant's and organisations' identities have been kept confidential to protect the them, as described in section 4.3 about the ethical considerations. The first company is a well-established international banking and finance company, and the second is a new entrance data-driven company that provides property data.

5.4.2. Participants of case study B

According to the overview of participant profiles reported in table 4.2 of chapter 4, there are two participants affiliated with DDOs for case study B. Both have been interviewed to acquire more investigation of their roles and firms' experiences in integrating their data with OGD to create new products/services and solve problems. Following is a listing of the participants:

1. Participant PB5 is one of the chiefs in a data-driven company related to property-data provider. The participant is an expert in computational mathematics and a data scientist who joined the company to work on algorithms and consider how to use public data as recommendations. PB5 has dealt with OGD and data-driven initiatives for more than three years. He/she is accountable for the expansion of the company's partnership and data revenue by transforming data into information and driving data-driven commercial outcomes for the company and its partners. The semi-structured and open-ended interview was conducted through Skype on 18 September 2019.

2. As one of the chiefs in an international banking company, participant PB6 is accountable for predicting the economic statistics and insights, as well as providing relevant reviews for traders within the company and clients who are exposed to economic figures for their business. About ten years ago, he/she joined this company to perform responsibilities that included public service and marketing. The participant discovered the most significant economic indicator for New Zealand that derived from integrating OGD with data from third parties and consumer surveys. At the participant's request, the interview was conducted in the participant's office on 16 October 2019.

5.4.3. First cycle: deductive coding analysis of case study B

This first cycle of the initial coding cycle was similar to the analysis of the first cycle for case study A in that a single word, a paragraph, and a page of text was all coded using In Vivo coding until all transcripts were excerpted with as many codes as possible to ensure data saturation before the second stage of the initial coding cycle began. This cycle employed a deductive approach, in which the codes were grouped into context objectives stated in the interview protocol to ensure that they stayed consistent with the study's objectives - to answer four research questions.

When first cycle techniques are used, the objective is to ensure that the data corpus for this case study B is coded until no additional codes can be generated to meet data saturation. This objective is accomplished through the use of thematic analysis. The NVivo query tools, such as text search queries and list and detailed views, are used to support the researcher in looking for patterns in the excerpted transcripts, evaluating the transcripts, and selecting one category match for a code. During the first cycle, the coding process will generate a coding map. The second cycle will examine the coding map more extensively and assign pattern codes after assessing the similarity of codes and reorganising them as necessary to make the cluster more understandable.

In NVivo, all newly created codes were stored in free nodes, similar to the first cycle in case study A. The following example demonstrates how the In Vivo coding system works in practise. A portion of a lengthy statement from the participant's transcript was coded when explaining the desired outcome of participant’s company from integrating OGD with their data. Each code in the right column corresponded to a superscript number in the transcript. The participant's significant terms were not lost, but each meaningful phrase was tagged with more concise words as one code using In Vivo code.

> *For us, [1]aggregating being the [the organisation name], we want to be the home of property data. [2]The home of property data, so that means aggregating all different kinds of relevant property related information and [3]having all in one place easy for people to use. [4]As oppose it to going and getting a spreadsheet here, a spreadsheet there, a database here and joining all together. [5]We're trying to do all that and make it in a way to increase the usage.* (PB5, 17:37)

[1] BE THE HOME OF PROPERTY DATA
[2] AGGREGATE OF RELEVANT PROPERTY DATA
[3] ALL IN ONE PLACE FOR USERS
[4] COMBINE SPREADSHEETS FROM MANY SOURCES
[5] MAKE THAT POSSIBLE TO INCREASE USAGE

Another example of line-by-line tagging for a lengthy response resulted in many In vivo codes, as shown in the following sample. Any rule does not limit the number of codes that should be created in a single sentence because every phrase that stands out should be coded to achieve data saturation. This is an example of a feedback from participant PB6 regarding the company's consideration of the revenue possibilities associated with using OGD to generate economic insights for its clients. This sample illustrates how a response intended to address a question regarding potential benefits could then cover other questions planned to be raised by the interviewer. The codes were divided into three categories: 'possible revenue and benefit', 'direction and framework', and 'service customisation' to accommodate this lengthy response.

[1]Well, as far as there's always that pressure, [2]you know banks are always looking at the costs trying to figure out where are we wasting resources. [3]That's just always the way it goes and so it is extremely difficult to estimate the money value of what we do [4]but also what the insights team does with their reports to customers. [5]We don't charge them for that and I guess [6]it's strengthening the customer relationship that you can't measure that, [7]you can't put a dollar value on it. But I mean [8]we can't charge for our reports because no one else does and that's it. [9]It is expected that it's part of being a good bank and [10]providing good customer service is providing economic insights. [11]And I don't think that will change anytime soon. I mean, you know, [12]this is whole world robots going to take over our jobs, [13]all that data, technology will change the way we do our jobs. [14]But in the end, I'm paid to be opinionated and robots aren't good at being opinionated. [15]So that's our jobs will evolve and change,[16]but I think what we do is personalise the data to make we're storytellers,[17]change the numbers and or story and that's a very human skill in the end. I think, cross finger, we come around. (PA6, 41:21)

[1] PRESSURE FOR REVENUE POSSIBILITIES

[2] COST OF MINIMIZING RESOURCE WASTE

[3] REPORT VALUE IS HARD TO ESTIMATE

[4] HOW TEAM USES THE REPORT

[5] DON'T CHARGE CLIENTS

[6] STRONGER CUSTOMER RELATIONSHIPS

[7] BEYOND DOLLAR VALUE

[8] NO BANKS CHARGE FOR THE REPORTS

[9] PART OF BEING A GOOD BANK

[10] GOOD CUSTOMER SERVICE IS PROVIDING ECONOMIC INSIGHTS

[11] WILL NOT SOON CHANGE

[12] ROBOT WILL TAKE HUMAN JOB

[13] DATA AND TECHNOLOGY WILL CHANGE JOBS

[14] PAID TO BE OPINIATED, ROBOT ARE NOT

[15] HUMAN'S JOBS WILL EVOLVE AND CHANGE

[16] PERSONALISE DATA TO TELL STORIES

[17] CHANGE FIGURES IS A VERY HUMAN SKILL

After the data corpus was coded entirely, it was necessary to conduct a secondary inspection to determine any trends and patterns for categorising the codes. Firstly, I conduct a more in-depth study by identifying the most often used words by participants from DDOs during interviews by run Word frequency query. I chose the most 20 frequent words to identify concept that appears the most frequently. Figure 5-15 shows the word cloud of the most 20 words proceeds in NVivo. It provides an early glimpse into the entire set of codes. Then, three words "data", "good" and "customer" were chosen to be examined for a more in-depth concepts of DDOs related to OGD. In other words, this tool assists in illustrating the big concept of participants' perspectives as users of OGD. Later, these will assist in the identification of possible themes.

Figure 5-15 NVivo word cloud of the most 20 frequent words

Based on the most five words, the text query search was run with both "data" and "good" using the Boolean operator AND with synonym words for "good" such as "well". Any source returned by the text search should have both terms linked when using the AND operator. At this early stage, the query was run to seek ideas or concepts prevalent throughout the transcripts. Figure 5-16 depicts the result preview of the text query search "data" AND "good."

A combination of the keywords "good" and "data" depicts that participants highlight various concepts dealing with data. The textual context covers anything from technical aspects to how (good) data affects their business, using specific terms such as building system, traffic case, and gross domestic product (GDP). The in-depth analysis, which combines re-reading the data and comparing it to the interpretation of the NVivo text search query, is one of the initial steps in the triangulation process that ensures the appropriate coding result and subsequent meaningful themes are discovered.

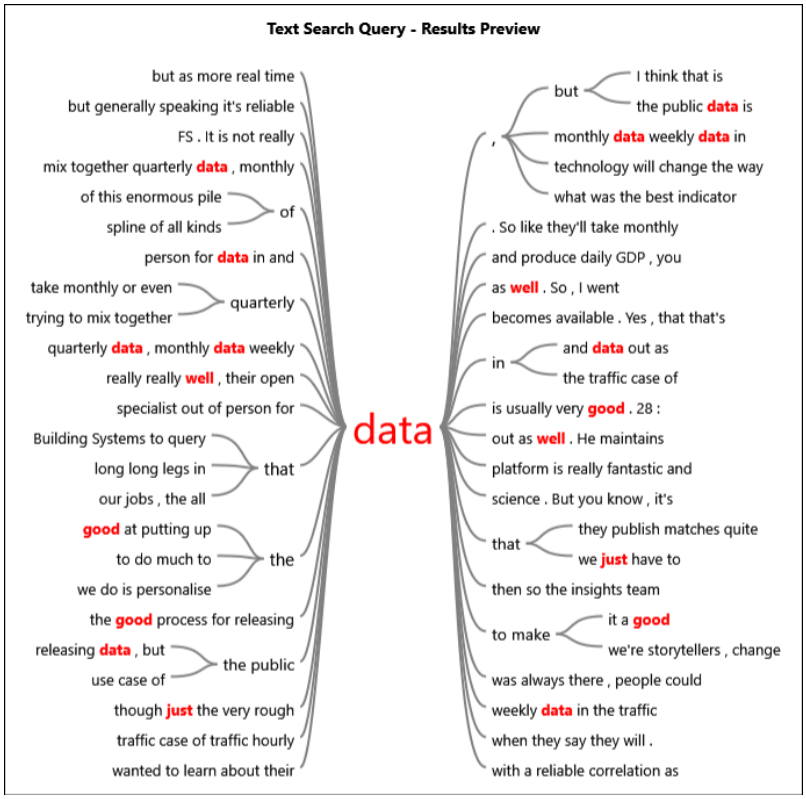


Figure 5-16 NVivo text search query "good" and "data" using Boolean operator AND

The NVivo text query was also run for the keyword “customer”, as visualised in Figure 5-17. Based on the textual content of the transcripts linked to the word “customer”, the prevalent ideas are how DDO participants had positive interactions with their customers and took care of them. The preview suggests that the participants were focused on the needs of their customers, which indicates that they were customer oriented.

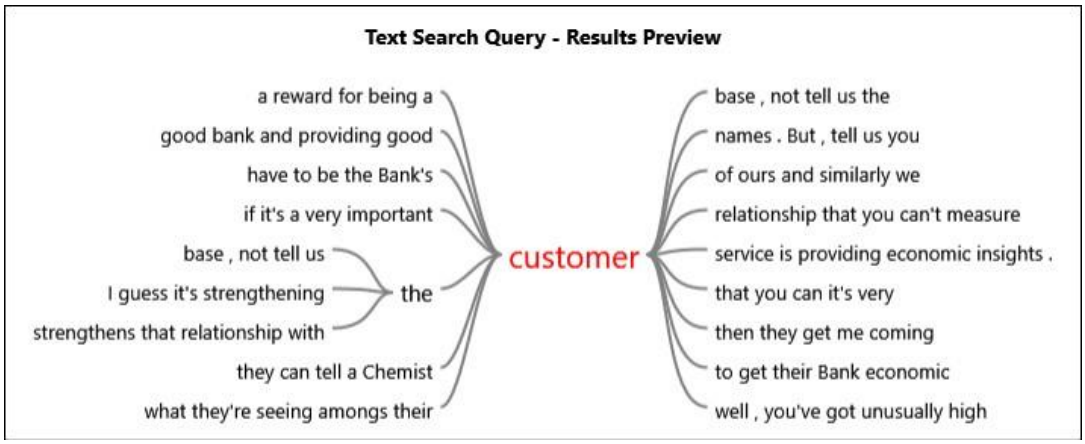


Figure 5-17 NVivo text search query for the word “customer”

Through interrogating data from transcripts in which participants who were affiliated with DDOs expressed their experiences dealing with OGD use, the coding process generated 255 codes. The codes were divided into 26 categories based on the objectives of the context defined in the interview protocol (table 4.1). Using the In Vivo coding technique, a comprehensive sample of the coding map is provided below. Specifically, three categories of the case OGD providers' code were taken from three categories: OGD benefits, Potential revenue and benefits and Inquiries and feedbacks.

FIRST CYCLE OF DEDUCTIVE CODING ANALYSIS:

Initial categorisation with In Vivo/Literal coding

Case study B – DATA-DRIVEN ORGANISATIONS IN NEW ZEALAND

Category 1: OGD benefits

Related codes (In Vivo codes):

[NAME OF SERVICE]-THE MOST IMPORTANT ECONOMIC INDICATOR
BASIC ANALYSIS BEFORE IT
CAPTURES THE CONSUMER ASPECT OF THINGS
COMMERCIAL'S DATA VALUE
DATA WE'VE GOT IS ALWAYS FREE
DISCOVERED THE EXISTED DATA
NO ONE ELSE, BUT ME WITH THE RIGHT ASSUMPTION
PRESENT THEM MY DATA ANALYSIS
PROVIDE THAT FOR FREE
SMALL BUSINESS OWNERS VALUE THAT OPPORTUNITY
THEY TALK ABOUT [NAME OF SERVICE]
VERY IMPORTANT DATA FOR US

Category 2: Potential revenue and benefits

Related codes (In Vivo codes):

ADD VALUE TO THE PRESENTED DATA
ADVERTISING PURPOSES
BUSINESS THAT I STATED AS SALES
DO NOT CHARGE CUSTOMERS
FOR REAL ESTATE AGENTS AND CORPORATE PARTNERSHIPS
MANY BRANDS WANT TO BE ASSOCIATED HOMEOWNERS
MANY PEOPLE VISIT OUR WEBSITE
NOT OFFER REPORT TO GET MONEY
NOT SELL IT, BUT GRAB AND USE IT
OBVIOUSLY PUBLIC DATA
PROVIDING GREAT CUSTOMER SERVICE

STRENGTHENING THE CUSTOMER RELATIONSHIP

SURFACE ALL PUBLIC DATA

THERE'S ALWAYS THAT PRESSURE

TO MONETISE VALUE-ADDED DATA

Category 3: Inquiries and feedbacks

Related codes (In Vivo codes):

ABLE TO DISCUSS IN TERMS OF GENERAL METHODOLOGY

AUSTRALIA HAS LITTLE INTEREST IN SHARING DATA

AUSTRALIA IS NOT CONSISTENCY TO OPEN DATA

CURATED FOR THEIR OWN PURPOSES

DELAY DATA STATNZ FOR UNKNOWN REASONS

EVERY AUSTRALIA'S STATE IS INDEPENDENT DIFFERENT WITH NZ

HAVE MORE REQUESTS

HAVE SOME INTERESTING FIRM LEVEL DATA

IDE DATABASE IS NOT VERY TIMELY

IN AUSTRALIA, SOME DATA ARE FREE, WHILE OTHERS NEED A FEE

NEGOTIATED TERMS EASILY TO USE

NO IMMEDIATE VALUE OF DATA

NZ GOVERNMENT IS MORE HELPFUL

PROBLEMS OF DATA MIGRATION

QUITE ROBUST DISCUSSIONS WITH THE TEAM

REQUEST WHEN NEED DATASETS

SOMETIMES I'VE CONTACTED THEM

STATNZ FOR SHARING DATA IS PRETTY OLD BUT RELIABLE

STATSNZ CONTINUALLY EVOLVE AND ASK FOR FEEDBACK

TRANSPARENT WITH INFORMATION

VERY GOOD AT OPEN COMMUNICATION

Appendix E contains a sample of the use of NVivo for the thematic analysis of the case study's initial deductive cycle. The first cycle resulted in an initial coding cluster by adopting thematic analysis. Throughout this cycle, the data was represented by a small set of theory-driven codes that were extensively defined. It is necessary to complete this cycle to generate the initial code from scratch. All data should be coded and then grouped

under different categories. After going over the data again and running NVivo tools for queries, a coding map was made for the first round of analysis.

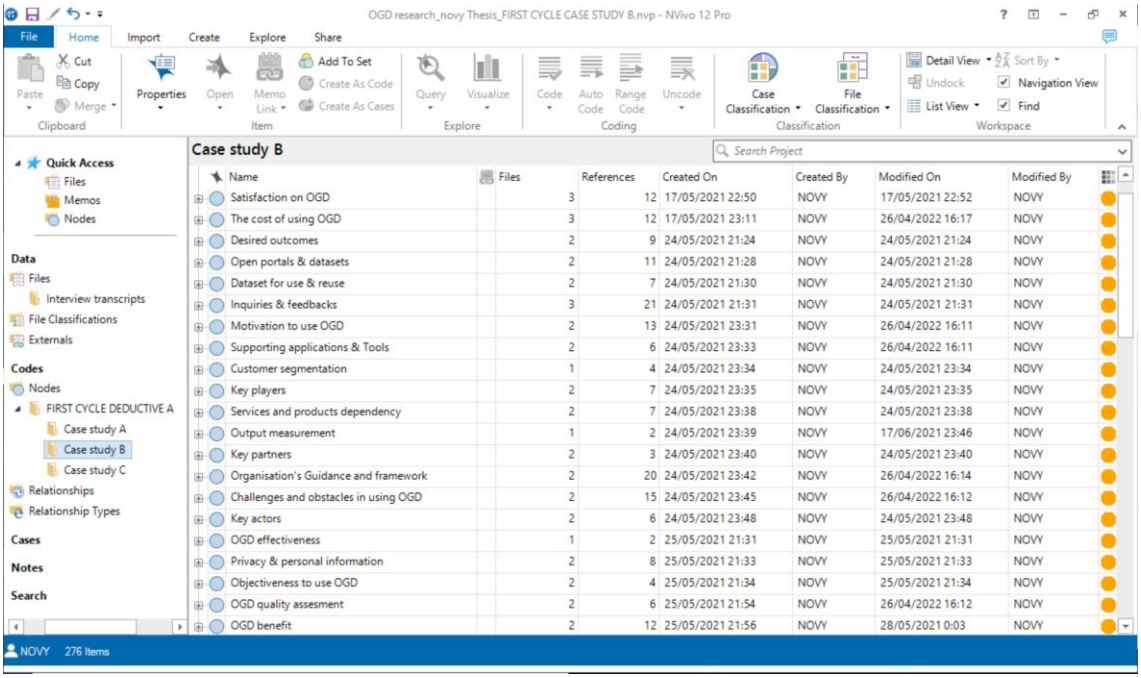


Figure 5-18 The excerpt of a list of categories as seen in NVivo List view for the case study B

Figure 5-18 depicts the list view of the 26 categories that resulted from case study B during the first cycle, as a result of collecting and organising coding in NVivo. Each category in the list view has several files and references that indicate how the category extracted the transcript documents and how many codes were generated for each category. This information outlines each participant's contribution to answering the questions as tabulated in Table 4.1. All participants from DDOs actively responded comprehensively to all questions raised during the interview sessions. It visualises in files and references excerpted for all categories.

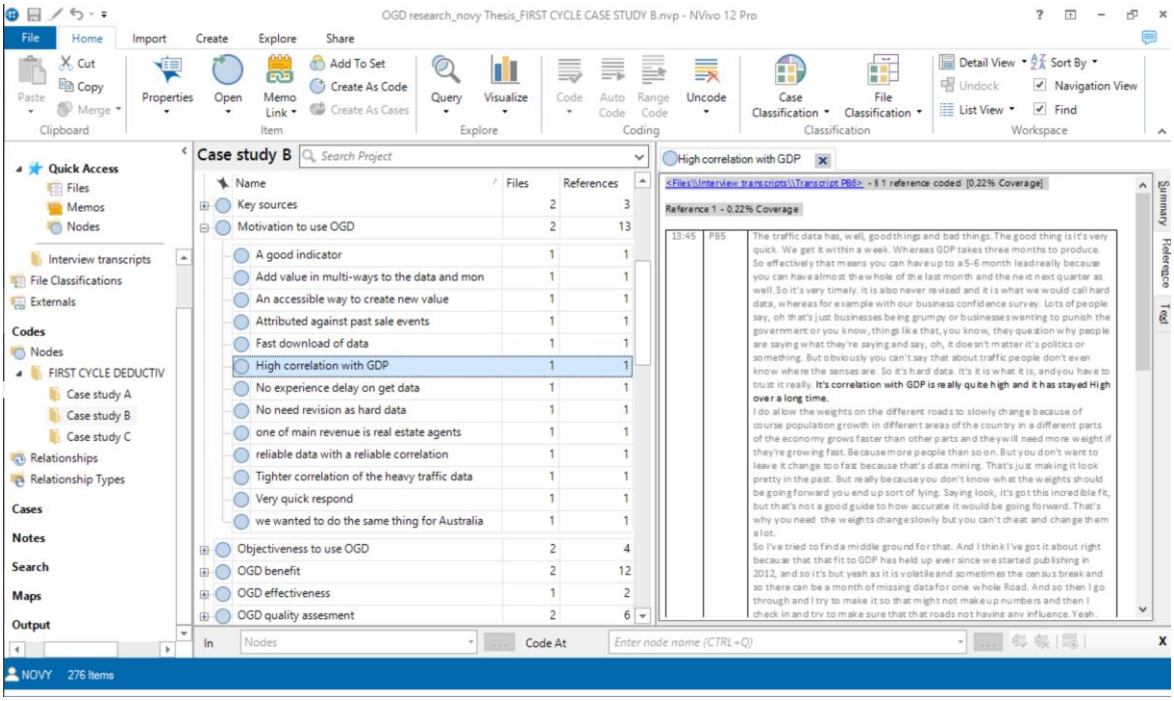


Figure 5-19 A screenshot of NVivo displaying Node used within the case study B

Figure 5.19 illustrates how a part of the participant's interview transcript was coded and then categorised using deductive analysis approach, similar to case study A. The screenshot describes how code *High correlation with GDP* under category 'Motivation to use OGD' was coded from the highlighted text of the transcript.

During the interviews, the rate at which participants responded to questions fluctuated. Some questions elicited detailed comments from participants, while others got short responses. Figure 5-20 depicts examples of the participants' involvement during interviews: creating a comparison map of nodes coded from interview transcripts. Those two diagrams compare the categories 'Data integration' with 'Open portals & agency's websites', and categories 'OGD benefits' with 'Potential revenue and benefits'.

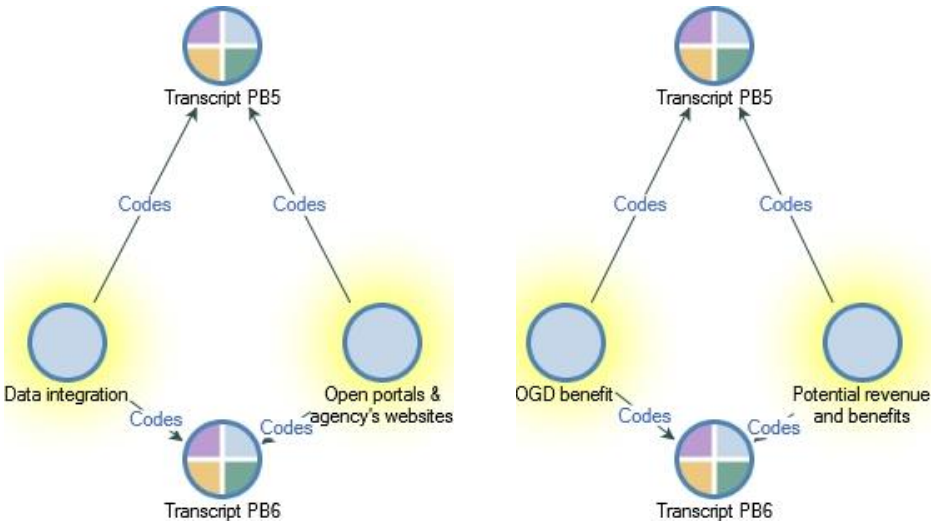


Figure 5-20 A screen capture of NVivo Diagrams to compare four categories of case study B

The thematic coding hierarchy was helpful to the researcher in staying focused on the research topic during the first cycle. The first-cycle thematic analysis helped simplify the qualitative data by coding the primary data to conduct further analysis in the second cycle. This is a process of identifying data patterns and organising them to make them easier to understand and draw conclusions from. The second cycle will refine and re-code the initial coding hierarchy with an inductive analysis approach.

5.4.4. Second cycle: Inductive coding approach

As in case study A, pattern coding was used in this second cycle to simplify categories for codes that differed considerably from the first cycle coding. I conducted an in-depth analysis of the first-coding cycle using NVivo cluster analysis to determine context similarity or assess if any group or category had an inconsistent meaning. The cluster analysis is a powerful technique for exploring large amounts of data and finding groups of similar things. It works by splitting the coding resulting from the first cycle into small groups, called clusters, and then looking to see if any clusters are similar. This is done by creating a graph called a dendrogram, which shows the relationships between the clusters. The most similar clusters are closer together on the dendrogram, while the most different clusters are spaced apart on the dendrogram (Jackson & Bazeley, 2019). Figure 5-21 is a screen capture of a horizontal dendrogram that was built by coding similarity. Similar to case study A, the Pearson correlation factor was chosen as the similarity metric.

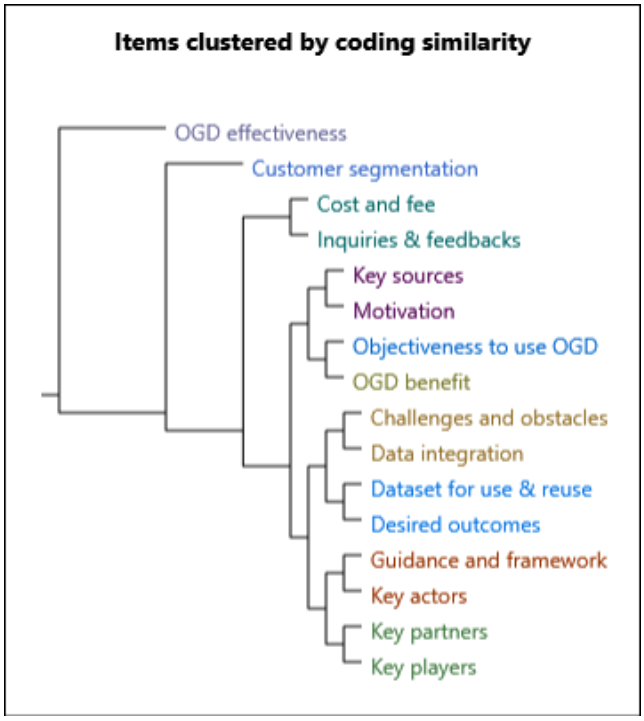


Figure 5-21 NVivo cluster analysis-dendrogram of the first-cycle coding case study B

This cluster indicates that the terms *Key sources* and *Motivation* are placed near the terms *Objectives to use OGD* and *OGD benefits*, indicating that they are closely related. In the other branch of this dendrogram, terms such as *Guidance and framework*, *Key actors, Key partners* and *Key players* are interconnected since they are located adjacent to one another. On the other hand, this cluster indicates that the terms *Key sources* and *Motivation* were written about significantly differently than the terms *Guidance and framework*, *Key actors, Key partners* and *Key players*. This cluster analysis provides a valuable alternative to the complexity of comprehending multidimensional scaling graphs by presenting data in clearly defined clusters in two-dimensional space, so providing a visual tool for interpretation that is both rapid and simple.

In this study, visualising the coding cluster as shown in Figure 5-21 that reflects connections between categories and codes is essential. It provides a visual tool for speedy and simple interpretation of multidimensional diagrams. However, visualisation alone is insufficient to provide a comprehensive analysis, it works as the supporting tool analysis to define following re-coding process with the pattern coding.

Pattern coding is applied iteratively to aggregate and regroup data, create new codes and categories, and simplify cluster analysis by reducing the number of steps. Some

revision made by regroup the codes, separated one category into two, revised the code and category names.

Most In Vivo coding resulted in the first cycle being re-coded with pattern coding for simplicity in this second cycle. For example, due to their similarities, Figure 5-22 shows a sample of re-coding process for the In Vivo codes in the first cycle's sub-category "Motivation to use OGD" were combined to form the pattern codes. Following the completion of the content analysis of that data, the pattern code that was developed for the corresponding In Vivo codes was EARLY AND REGULARLY DATA.

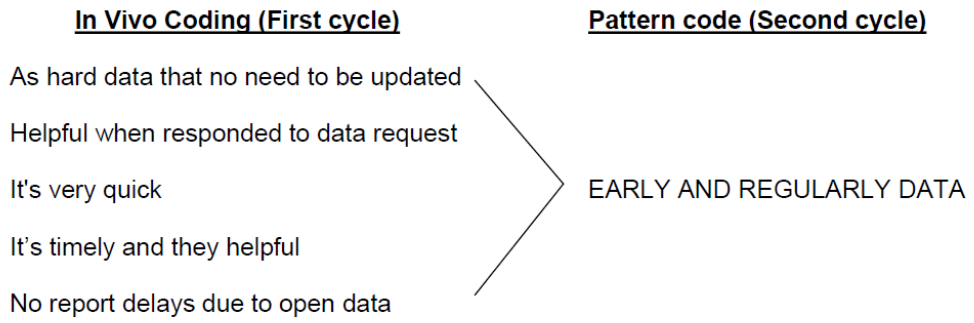


Figure 5-22 A sample of re-coding In Vivo coding with pattern code for case study B

Thematic analysis with pattern coding consolidated the first cycle's coding clusters into a meaningful, simplified coding map resulted in the second cycle. From 26 to eight categories, from 255 In Vivo codes to 230 super codes, and from a two-layer to a three-layer coding hierarchy, the complexity of transcript data is progressively reduced to understandable codes. As a result, the investigation of themes for this case study B became simpler. Table 5.8 illustrates a sample of the clusters from the second cycle.

Table 5.8 shows how super codes evolved from a related analytical tool to Pattern codes. Create each category same way to develop a super code by following the same methods. Each sub-super category's codes were found and decoded using the pattern codes. Then the remaining sub-categories within a category were examined for super codes that may subsequently be included in the emerging themes. The sample coding map of the second inductive analysis using NVivo for the case study B is available in Appendix F.

Table 5.8 A coding map of the second cycle of Inductive coding case study B

SECOND CYCLE OF INDUCTIVE CODING ANALYSIS				
CATEGORY (Pattern code)	**SUB CATEGORY (Deductive First cycle)**	**SUPER CODE (Pattern code)**	**NUMBER OF CODED TRANSCRIPTS**	**NUMBER OF CODES**
BUILD INNOVATION THROUGH OGD VALUE	Potential revenue and benefits	ADVERTISING-RELATED POTENTIAL REVENUE	1	1
		DEVELOP PROPERTY-SEARCH SERVICE	1	3
		RELIABLE OGD SUPPORT CUSTOMERS FOR BETTER DECISSION-MAKING	2	3
		SALES-DRIVEN INNOVATION TO CREATE REVENUE	1	3
		STRENGTHEN CUSTOMER RELATIONSHIPS	1	4
	OGD benefit	ALLOW ORGANISATION GIVE ACCURATE INSIGHT TO ITS CUSTOMERS	1	2
		AS THE MAIN DATA FOR THE MOST IMPORTANT ECONOMY INDICATOR	1	2
		COMMERCIAL'S DATA VALUE	1	1
		CREATE PLATFORM FOR INNOVATIVE SERVICE	2	2
		ENHANCE ORGANISATION'S CAPABILITY AND PERFORMANCE	1	2
		ENHANCE USER'S DATA LITERACY	1	1
		SMALL BUSINESS VALUE THE OPPORTUNITY	1	2
EFFORTS TO UNLOCK OGD POTENTIAL	Customer segmentation	FREE CUSTOMERS	1	1
		HOUSE OWNERS OR LANDLORDS	1	1
		NO CUSTOMER SEGMENTATION	1	1
		PAID CUSTOMERS	1	1
		RESEARCHING PROPERTIES	1	1
	Desired outcomes	AGGREGATE OGD WITH OTHER DATA	1	1
		ALL DATA IN ONE SPOT FOR EASY ACCESS	1	3
		COMBINE OGD WITH PROPERTY DATA TO CREATE REVENUE	1	2
		DERIVE NEW SERVICES WITH VALUE FROM OGD	1	2
	Motivation to use OGD	CORRELATION WITH GDP IS HIGH	1	2
		EARLY RESPOND AND REGULARLY DATA	1	5
		EASILY ACCESIBLE DATA	2	2
		OFFER A DATA-BASED SERVICE TO CUSTOMER	1	3
		UNRESTRICTED DATASETS TO CAPTURE POTENTIAL ECONOMIC VALUE	1	3
	Objectiveness to use OGD	FREE GOVERNMENT DATA	3	5
		TO ADD DATA VALUE IN DIFFERENT WAYS	1	1
		TO SIMPLIFY COMPANY'S INSIGHT TO CUSTOMERS	1	1
		TO USE TRAFFIC DATA FOR ECONOMY INDICATOR	1	2
ENABLING FACTORS TO CAPTURE OGD VALUE	feedbacks to government	COMPARING NZ OGD PROGRAMME WITH OTHER COUNTRIES	1	5
		GOOD OPEN COMMUNICATION	1	2
		GOVERNMENT LEARNT THE DATA TO MEASURE OGD	1	1
		NO IMMEDIATE VALUE OF DATA	2	2
		RELIANCE DATASETS ABOUT STATISTICS	1	2
		TRANSPARENT WITH INFORMATION	1	2
	Inquiries related to OGD	DIRECT CONTACT DUE ABNORMAL DATA PATTERN	1	1
		INQUIRY ON CURATED COUNCIL DATA	1	1
		REQUEST DATASETS	2	3
	Measure the output of OGD	DATA CONSISTENCY	1	1
		PROVIDE VERY STRONG PATTERN OF TRAFFIC DATA	1	1
		TIMELINESS DATA	1	1
	Satisfaction on OGD	NOT BAD NOT GREAT	1	1
		SATISFY	3	3
		SOME PART SATISFY, THE OTHER NOT SATISFY	1	2
		VERY SATISFY	2	6

Additionally, the approach was used to verify and correct any errors in the coding. Those alterations include the separation of the sub-category *Inquiries and feedbacks* into two new sub-categories, *Inquiries related to OGD* and *Feedbacks to government*. After a comprehensive analysis, adjustments were made to adapt to the varying context meanings of the codes contained in the initial category "inquiries and feedback" Another revision was done by eliminating the sub-category *OGD effectiveness* as relevant codes overlapped with those in the sibling category "Measure the OGD output". As a result, the codes connected with the deleted one were transferred to the destination one. Following re-reading content analysis, several codes under "measure the OGD output" were more appropriate when transferred to a different sub-category *OGD benefits*. The

following example of adjustment demonstrates how to alter assembly codes using pattern code.

FIRST CYCLE	SECOND CYCLE
	Category (Pattern code) **ENABLING FACTORS TO CAPTURE OGD VALUE** *related sub-category*
Category (deductive approach) **Inquiries and feedbacks** 21 In Vivo codes	**Inquiries related to OGD** 6 new pattern codes to group 16 In Vivo codes **Feedbacks to government** 3 new pattern codes to group 5 In Vivo codes

5.4.5. Identifying Emerging Themes of the Case Study B

Conducting a two-cycle analysis established an adequate hierarchy for case study B, as explained comprehensively in sections 5.3 and 5.4. The iterative coding skill was adopted to ensure that the findings needed to develop themes then answer the study's research questions.

It was required to construct themes to go over the meanings connected with each super code and category again, using transcripts to reference participant responses. The remaining data were also evaluated to confirm that the selection was accurate. Four themes for case study B were elaborated by applying the same procedure as in case study A. The pattern code was used to investigate the coding cluster and its data. During this time of investigation, the following themes for case study B emerged:

Theme 1B - Competencies and data-driven culture in using OGD

Theme 2B - Organisation capacities to drive OGD innovation

Theme 3B - Capturing OGD Value for business and service innovation

Theme 4B - OGD collaboration and partnership

Each theme will be elaborated upon in the following sections, with comprehensive narratives explained by supporting sources such as excerpted portions of transcripts, super codes and categories.

5.4.5.1. Theme 1B "COMPETENCIES AND DATA-DRIVEN CULTURE IN USING OGD"

Theme 1B, "Competencies and data-driven culture in using OGD" emerged from two categories ICT LITERACY SKILL IN USING OGD and OGD VALUE-CAPTURED ROLES. This theme, which focused on perceptions of the competencies required to use OGD based on the data-driven culture adopted by businesses, was composed of eight sub-categories and 55 super codes in two categories.

Tables 5.9 and 5.10 depict the coding clusters of two categories that were formed from sub-categories and super codes that excerpted participants' perspectives on how DDOs acquired the skills and knowledge to obtain, analyse, and incorporate OGD into their organisation's strategic plan. Companies that have adopted a data-driven culture can make contributions and reap the benefits of open government data (OGD).

Table 5.9 The coding map of the category ICT LITERACY SKILLS IN USING OGD

CATEGORY	SUB-CATEGORIES	SUPER CODES
ICT LITERACY SKILLS IN USING OGD	Data integration	AGGREGATE OGD WITH INTERNAL DATA
		COMBINE OGD WITH OTHER GOVERNMENT DATA
		DATA IMPORT ENGINE
		DISCOVERY RELEVANT OPEN DATA
		INTEGRATE ALL DATA USING POSTGRES DATABASE
		INTEGRATE INTO ANALYTICS FORM
		INTEGRATE OGD WITH NON-GOVERNMENT DATA
	Key sources	ONLINE DATABASE SYSTEM
		PROPERTY DATA RECORD
		SKILLED HUMAN
	Open portals & agency's websites	ACCESS TO THE CORE PROPERTY DATA
		ACCESS TO THE ONLINE TRAFFIC
		HAVE API's TO ACCESS THE DATASETS AT OPEN PORTAL
		LINZ DATA SERVICE
	Tools	CODING TO AUTOMATE FS PROCESSING
		EXCEL-BASED FOR BASIC STATISTIC
		POSTGRES DATABASE
		R STATISTIC ANALYSIS
		MOVE TO NEW SOFTWARE PLATFORM TO REPLACE EXCEL

Table 5.10 The coding map of the category OGD VALUE-CAPTURED ROLES

CATEGORY	SUB-CATEGORIES	SUPER CODES
OGD VALUE - CAPTURING ROLES	Key actors	A DATA TEAM
		AGRICULTURE ECONOMIST
		IT TEAM
		SPECIALIST DATA IN ECONOMIST
	Key partners	INTEGRATION WITH DIFFERENT PROVIDERS
		NZTA
		STATNZ
		WEB DEVELOPERS
	Key players	AGRICULTURAL ECONOMIST
		CHIEF OF DATA
		DIFFERENT DATA PROVIDERS
		FOUNDER
		LINZ
		OPEN DATA MEETUP
		STATSNZ
	Participant demograph	PARTICIPANTS' BACKGROUND
		PARTICIPANTS' CURRENT DUTY
		PARTICIPANTS' CURRENT ROLES
		UNDERSTANDING ABOUT OGD

The following part of this section will illustrate how the theme emerged by including detailed narrative quotes from the coding results of the second cycle. Each excerpted transcript was followed by the participant code and the time code was corresponding to the response (minute: second).

ICT literacy skills in using OGD. A user engaged in data visualisation may require a different set of skills than a user developing an application that utilises government data to increase the efficiency of OGD programme. However, each user of government data requires a unique set of abilities to use OGD.

Under sub-category *Data integration*, the participants indicated that their affiliated organisations employ OGD to develop new goods, services, and solutions. They layered OGD with other data from various sources and in various formats to generate products or value-added services:

> *"..data import engines to receive all these files and reconcile the different formatting issues."* (PB5, 14:18)

> *"..we set up integrations with the different part of providers. We bring their data and store it in our own database."* (PB5, 22:02)

"Well, I combined it with Statistics New Zealand data for GDP." (PA6, 09:02)

Additionally, participants described under sub-category *Key sources* that OGD boosted the relevance and utility of the data within an organisation and their customers:

".... They have a core set of data, which is our most fundamental data is the property records." (PB5, 03:44)

"…the Statistics New Zealand, they've got a couple of portals you can use rather than going through the web pages and download. "(PB6, 11:47)

Human skill was one of the key sources by participant PB6 when he/she stated that the insight produced with OGD analysis, offered expert's opinion, could not be substituted by machine or robot:

"I'm paid to be opinionated and robots aren't good at being opinionated. So, our jobs will evolve and change, but I think, what we do is personalise the data to make we're storytellers, change the numbers and or story and that's a very human skill in the end." (PB6, 41:21)

According to participants, they acquired OGD in various ways, including through an open data portal, direct access to an agency's database, or through APIs to the open data service. Participants were asked to respond to subcategories *Open portal & agency websites* to understand better where and how they obtained the OGD:

"We consume it from the LINZ data service and I have APIs to access that." (PB5, 09:14)

"…basically they just gave me a log in to the online Traffic Management System-TMS," (PA6, 04:52)

OGD provides users access to valuable data. However, users would miss out on its potential unless they have the knowledge to work with it. Transcripts of participant interviews categorised under the sub-category *Tools* examine tools and software available to assist users in extracting, analysing data, and planning their business objectives:

"We do a little bit of R analysis and for stuff that Excel doesn't cope with so well.." (PB6, 36:10)

"We bring their data and store it in our own database. So, with Postgres (PostgreSQL) database to store that and then we've built a website that can shims that data in different ways." (PB5, 22:02)

"For example, I've done some computer coding to help automate our processing of FS. It is not really data science. But you know, it's yeah," (PB6, 44:42)

OGD value-captured roles. This corresponding category including its associated sub-categories and super codes discussed about value – capture roles conducted by DDOs as users, their key partners and players. Government as the OGD providers create potential value by publishing OGD, while DDOs as users capture the value that created by government agencies. According to participants, their key partners are LINZ, NZTA, StatsNZ, web developers, and data providers:

"the Statistics New Zealand, they've got a couple of portals you can use rather than going through the web pages and download." (PB6,11:47)

"once we have that available being at web development exercising with a team of with developers that make the website as you said." (PB5, 22:02)

"*Yeah, the Transport Agency. So, then that's when I discovered that the data existed, and they had been collecting it for 10 years."* (PB6, 03:04)

"But essentially we like I said, we set up Integrations with the different part of providers." (PB5, 22:02)

According to participants, their key players also as actors are economists, company's IT team Chief of data and company's founders. They highlighted that the key actors and players have different roles -governmental organisations, and civic involvement:

"We have a data team who collects all the data and everything for us" (PA6, 23:19)

"we have an agricultural Economist, insights team. So, any data you see that sort of talking about, the average firm that's using our [the organisation name] internal database." (PA6, 25:47)

"We have the IT team that supports, but basically the stuff we do is mostly in Microsoft office plus a few Specialists data programs." (PA6, 37:00)

"There's a couple of us. Yes, I, myself and founders have the relationships with different data providers." (PB5, 23:16)

One participant affiliated with the banking industry highlighted that the participant's roles include both internal and external aspects. A company's credibility would suffer if it only communicated what was best for it. The company has to be credible and trusty:

"… part of my role is partly public service, but partly also really part of the marketing effort. I suppose for the bank in terms of getting the [the organisation name] brand out there and the positive way making us look like we're a bank who knows what's going on.. That's sort of thing. ..because we wouldn't have credibility if we always just said what was best for [the organisation name]. We have to be credible. We have to be believable and so we have quite a lot of freedom to say what we think." (PA6, 00:31)

In this theme 1B, I explored the skills and knowledge required of participants as the users to effectively use OGD and how people affiliated with DDOs should orient themselves to OGD to capture value from it. Figure 5-23 depicts a conceptual framework for theme 1B that was built using NVivo mind mapping of the categories "ICT literacy skills in using OGD" and "OGD value-capturing roles" along with their respective subcategories and codes. This framework provides a high-level overview of theme 1B to serve as a starting point for developing further analysis for case study B and cross-case analysis.

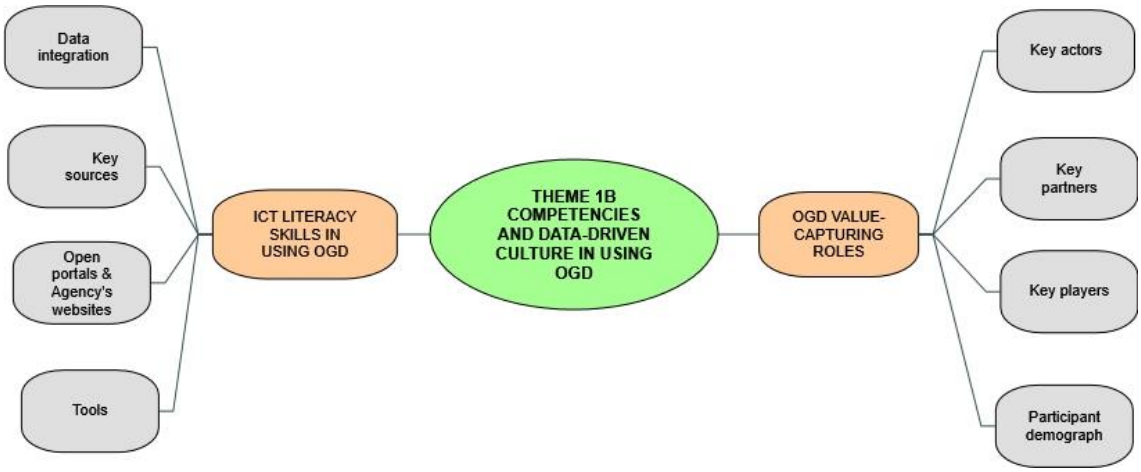


Figure 5-23 A conceptual framework of theme 1B-case study B (with NVivo Mind map)

In summary, a concepts of theme 1B “COMPETENCIES AND DATA-DRIVEN CULTURE IN USING OGD” was summarised as: **a company's abilities, knowledge, and attitude to gather, analyse and apply OGD to their organisation's strategic goal, concerning a data-driven culture to gain OGD benefits.**

5.4.5.2. Theme 2B “ORGANISATION CAPACITIES TO DRIVE OGD INNOVATION”

By reading coded data, 65 super codes associated with seven sub-categories of two categories were discovered, creating a theme about the organisation's strategies and initiatives to use OGD's potential for enhancing the company's innovation. Two category that formed this theme, contained coded data of participant responses supported this theme. According to participants, the first step in exploiting OGD value is the government make it accessible and understandable to the public. OGD is vast and complex, yet it contains an abundance of information that may be used to make informed decisions, allowing DDOs, as users, to take advantage of the availability of analytics tool and business strategy.

Table 5.11 The coding map of the category “EFFORTS TO UNLOCK OGD POTENTIAL”

CATEGORY	SUB-CATEGORIES	SUPER CODES
EFFORTS TO UNLOCK OGD POTENTIAL	Customer segmentation	FREE CUSTOMERS
		HOUSE OWNERS OR LANDLORDS
		NO CUSTOMER SEGMENTATION
		PAID CUSTOMERS
		RESEARCHING PROPERTIES
		REGULAR CUSTOMERS
		WHOLESALE CUSTOMERS
		COMMERCIAL CUSTOMERS
		VERY IMPORTANT CUSTOMERS
	Desired outcomes	AGGREGATE OGD WITH OTHER DATA
		ALL DATA IN ONE SPOT FOR EASY ACCESS
		COMBINE OGD WITH PROPERTY DATA TO CREATE REVENUE
		DERIVE NEW SERVICES WITH VALUE FROM OGD
	Motivation to use OGD	CORRELATION WITH GDP IS HIGH
		EARLY AND REGULARLY DATA
		EASILY ACCESIBLE DATA
		OFFER A DATA-BASED SERVICE TO CUSTOMER
		UNRESTRICTED DATASETS TO CAPTURE POTENTIAL ECONOMIC VALUE
	Objectives to use OGD	FREE GOVERNMENT DATA
		TO ADD DATA VALUE IN DIFFERENT WAYS
		TO SIMPLIFY COMPANY'S INSIGHT TO CUSTOMERS
		TO USE TRAFFIC DATA FOR ECONOMY INDICATOR

Table 5.12 The coding map of the category “ORGANISATION STRATEGY TO EXPLOIT OGD VALUE”

CATEGORY	SUB-CATEGORIES	SUPER CODES
ORGANISATION STRATEGY TO EXPLOIT OGD VALUE	Guidance and framework	BUSINESS RULES
		DATA ARCHITECTURE TO JOIN ALL DATA
		DATA CLEANSING PROCESS
		DATA-DRIVEN STRATEGY
		FINANCIAL REGULATION
		GUIDANCE OF ONLINE SYSTEM BEYOND WEBSITES
		GUIDANCE ON DATA ANALYTICS
		GUIDANCE ON HOW MEASURE PROCESS
		R ANALYTICS FOR STATISTICS
	Service customisation	CAPTURE OGD VALUE IN COST-EFFECTIVE WAYS
		DISCOVER NEW ECONOMIC INDICATOR THROUGH OGD
		PROVIDE CUSTOMER WITH THE BEST ECONOMIC ASSUMPTION
		SERVICE AVAILABLE IN NZ BECAUSE OF DATA MEANINGFULNESS
	Services and products depend on OGD availability	THE BUSINESS SURVEY RUN DEPEND ON DATA AVAILABILITY
		THE SERVICE WAS A GOOD USE CASE OF OGD
		THE SERVICE WAS CREATED BECAUSE OF OGD DATA RELIABLE

Tables 5.11 and 5.12 illustrate the coding clusters of two categories constructed from sub-categories and super codes that summarised participants' viewpoints on how DDOs have put their efforts to unlock the potential of data and improve their decision-making. This has been mainly through adopting digital technologies, such as big data and analytics, and implementing business strategies which have enabled firms to extract more value from the captured data.

The subsequent narratives show how these coding maps and their underlying data led to the emergence of theme 2B, with related transcripts of two categories and which code component each theme captures.

Efforts to unlock OGD value. There are four sub-categories and 22 super codes associated with this category as shown in table 5.11 that pulled participant’s responses about what drive them to use OGD and what outcomes by integrated open data with their internal data.

Referring to the participant input as the underlying data for the sub-category *Customer segmentation*, the property-data provider adopted strategies to attract customers by building innovated platforms fitted with the client’s segmentation:

"Many home owners and researching property. So that's our free customers and then we have the people that we're providing an appetizing service to which are paid customers." (PB5, 21:30)

Differently from the participant from the bank, the firm defined its clients as regular, wholesale, commercial and very important customers. The company offered different approaches to assist them in their business needs:

"For example, we do a morning brief every morning summarize what happened in overseas markets. It's just for customers and then some of our Products can only go to wholesale customers because they contain very technical information about interest rates and exchange rates…. sometimes [company's name], if it's a very important customer then they get me coming along to their board meeting one-on-one, but if the right down to the little commercial customers where maybe I speak to a hundred and fifty of them at a time at a cocktail function or something. " (PA6, 30:52)

Under the sub-category *desired outcomes*, the participants pointed out their company's action to harness OGD for achieving their intended outcomes. The participant from the property-data provider created easy-to-use platform for application/web service to capture more of the property-market share:

"And now trying to think how we can use the public data as advices, how we can derive the new insights using that value of data." (PB5, 01:23)

"We want to be the home of property data, so that means aggregating all different kinds of relevant property related information and having us all in one place easy for people to use." (PB5, 17:37)

"what we're actually doing is adding even more value to the data were already showing… So, it's kind of using the public data and adding to it and trying to monetize it." (PB5, 19:37)

The other participant affiliated with banking industry described how he/she leveraged the OGD by producing economic reports to enhance clients' loyalty:

"We don't charge them for that and I guess it's strengthening the customer relationship that you can't measure that, you can't put a dollar value on it…It

is expected that it's part of being a good bank and providing good customer service is providing economic insights." (PA6, 41:21)

According to the participant response as the source data of sub-*category Motivation to use OGD*, his/her company's motives are to create an advanced platform to provide the highest-quality data to its customers, earn new revenue streams and build a strong brand in property-data industry:

"we can use an easily accessible way to create new value. It's kind of the data's already there, ... It's just finding a way to put a link to share it, in a way that could use it." (PB5, 12:19)

"what we've done is we've brought all the sales in one place, we put them up on the website and then we're sell marketing." (PB5, 18:27)

The participant from the banking industry said the company uses OGD because the datasets are early and regularly available and easily accessible from the open portal or agency's database.

"downloaded all it's quite important often to download that data very fast and analyse it quickly because the Traders want to know ups or downs, it should be by yourself." (PB6, 11:47)

"The traffic data has, well, good things and bad things. The good thing is it's very quick. We get it within a week. Whereas GDP takes three months to produce. So effectively that means you can have up to 5-6 month lead early..." (PB6, 13:45)

From the sub-category *Objectives to Use OGD*, the participants revealed that their firms had captured the OGD value objective of creating a one-stop application for property data and obtaining free accessible datasets:

"we've brought all the sales in one place we put them up on the website and then we're sell marketing." (PB5, 18:27)

"were questioning why a government Department was providing data free to a bank, who really afford to pay for it, but they decided that it was , …open data would be to give it away to anybody who asked for it." (PB6, 12:06)

Organisation strategy to exploit OGD value. There are three sub-categories with 16 super codes form this category as shown in Table 5.12. The category and its underlying data elaborated on how to best leverage OGD within the context of a company's long-term business strategy. The value of OGD has been recognised by companies such as DDOs to provide value-added services to their customers. However, the challenge DDOs have faced is understanding how the value can be extracted from OGD. This sub-category *Guidance and Framework* and super-codes described companies' rules to guide in exploiting the OGD value, such as data management and architecture:

> *"we have basically a number of business rules. Determine how we use the data and we treat them as unexpected events and manage them accordingly."* (PB5, 10:41)

> *"We're a little bit beholding to what data we can get. So, if it's the data provider, they have format that is available, way kind of need to work in their format. But yes, internally, we do have a data architecture considering how they're all joined together…That's always changing and updating."* (PB5, 27:18)

Implementing an adjusted methodology for different aggregate types of OGD by replicating the government's data analysis method:

> "*We survey various process usually on the Internet and try to get a good guess of inflation each month ... But in order to make that good we need to know from Statistics New Zealand, how they measure various process... that it's turned into a really good indicator"* (PB6, 28:53)

And providing protocols for processing all data by integrating database and Excel applications:

> *"we're currently doing a project about deciding sort of software application on a global basis. What software we should be using the some quite cool stuff out there. Now that's kind of a mix between a database and Excel."* (PB6, 36:10)

The following subcategory, *Service customisation*, is supported by four super codes, as shown in Table 5.12. Two companies engaged in this case study B have various

industries and scales and offer different services. The participant from the data provider emphasised that the company may in some cases modify its service:

> "*Not massively, no. New Zealand is a pretty small place. But we can talk about in different cases, you know, maybe some people only want to advertise in certain areas, and we can do that."* (PB5, 21:00)

Another participant who utilised the OGD value by distributing several free economic reports to the public disclosed that the corporation had customised the service because it was normally provided exclusively to its customers. However, the company developed a distinctive strategy for the New Zealand market:

> *"Well some of our reports are free on demand and we put them on the internet. That's actually it's unusual in New Zealand and most countries like in Australia. For example, you have to be the Bank's customer to get their Bank economic reports, but for some reason New Zealand evolved differently and so once everyone else is giving it away*" (PB6, 30:52)

> *"But I mean we can't charge for our reports because no one else does and that's it."* (PB6, 41:21)

In addition, as a means to preserve customer relationships, the participant stated that the economic reports were not only comprised of numerical and statistical data but were also enriched with insights from banking specialists to assist clients in making financial decisions:

> "*what we do is personalise the data to make we're storytellers, change the numbers and or story and that's a very human skill in the end."* (PB6, 41:21)

Furthermore, the participant also invented important economic insights that resulted from analysing OGD of New Zealand traffic and population statistical data:

> "*So, if there are a lot of trucks on the road in January, February, March, then that is good for GDP growth and that first quarter of the year. But the car traffic is even more exciting. The car traffic tells you where the economy will be in half a year's time... So, I think it might be partly because it's very strongly correlated with population growth."* (PB6, 03:26)

The last sub-category, “Service and product depend on OGD availability”, with three underlying super-codes (table 5.12), elaborates the participant feedback about the importance of reliability and availability of OGD to the service and product offering of the market:

> *“We want to step back and compare the experience to line up properly the into what it is now. So I think we're good use case of the public data was always there, people could always get it.”* (PB5, 25:27)

> *“… I just created as the inventor but really I just discovered it. I don't have to do much to the data to make it a good indicator. It just it is. So, yes, I was very excited to just to discover that the car traffic in the truck traffic were very good indicators of how the economy is going.”* (PB6, 03:26)

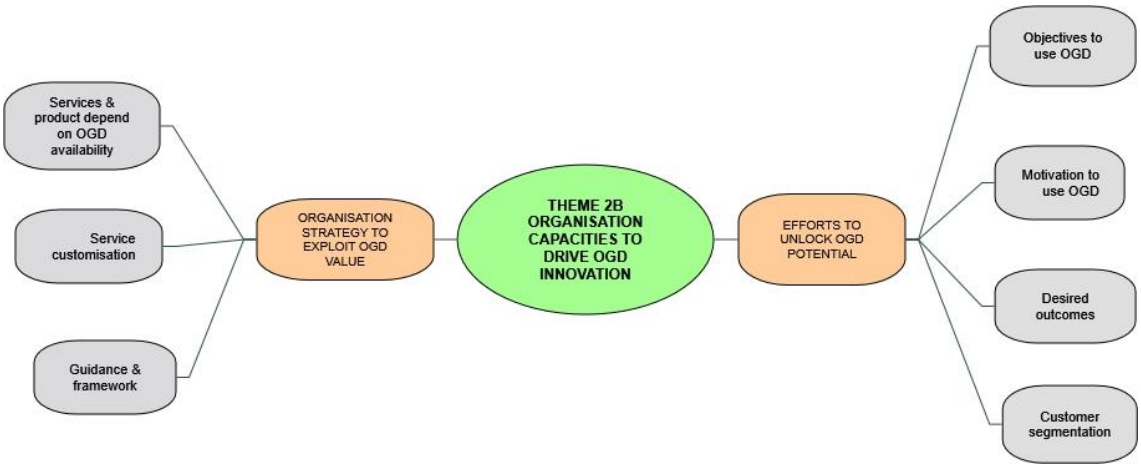


Figure 5-24 A conceptual framework of theme 2B-case study B (with NVivo Mind map)

Theme 2B addressed the organisational capabilities needed to facilitate innovation in OGD. The capabilities require the DDOs to develop strategies that increase their innovation ability, enabling the implementation of the New Zealand OGD. Figure 5-24 displays a conceptual framework for theme 1B constructed with NVivo mind mapping of the categories “ICT literacy skills in using OGD” and “OGD value-capturing roles” as well as their underlying data. This framework gives a high-level overview of theme 2B as a starting point for developing further analysis.

As all the above points have explored, a concepts of theme 2B “ORGANISATION CAPACITIES TO DRIVE OGD INNOVATION” was summed up as **the organisation**

potential to implement innovative strategies by prioritising investments in its core capabilities, such as its people, data, and initiatives to drive innovation.

5.4.5.3. Theme 3B "CAPTURING OGD VALUE FOR BUSINESS AND SERVICE INNOVATION

Theme 3B, "Capturing open government data value for business and service innovation", was created based on two categories, five sub-categories and 25 super-codes. Tables 5.13 and 5.14 show the coding maps of two categories and their underlying data to explore the OGD value data created for businesses and services. The thematic coding analysed how business and service performances have been developed after using OGD. The participants also explained how the companies create even more value and utilise it to create better outcomes.

Table 5.13 The coding map of the category "BUILDING INNOVATION THROUGH OGD VALUE"

CATEGORY	SUB-CATEGORIES	SUPER CODES
BUILD INNOVATION THROUGH OGD VALUE	OGD benefit	ALLOW ORGANISATION GIVE ACCURATE INSIGHT TO ITS CUSTOMERS
		AS THE MAIN DATA FOR THE MOST IMPORTANT ECONOMY INDICATOR
		COMMERCIAL'S DATA VALUE
		CREATE PLATFORM FOR INNOVATIVE SERVICE
		ENHANCE ORGANISATION'S CAPABILITY AND PERFORMANCE
		ENHANCE USER'S DATA LITERACY
		SMALL BUSINESS VALUE THE OPPORTUNITY
	Potential revenue and benefits	ADVERTISING-RELATED POTENTIAL REVENUE
		DEVELOP PROPERTY-SEARCH SERVICE TO CONNECT USER, BUYERS AND BRANDS
		RELIABLE OGD SUPPORT CUSTOMERS FOR BETTER DECISSION-MAKING
		SALES-DRIVEN INNOVATION TO CREATE REVENUE
		STRENGTHEN CUSTOMER RELATIONSHIPS

Table 5.14 The coding map of the category "USING GOOD OGD"

CATEGORY	SUB-CATEGORIES	SUPER CODES
USING GOOD OGD	Customer's Privacy & personal information	CREATIVE COMMONS LICENSE TO ALLOW RE USE
		CUSTOMER'S PERSONAL INFORMATION WAS STORED SECURELY
		PROVIDE CUSTOMER DEMOGRAPHICS
		SHARING ONLY PUBLIC RECORD
	Dataset for use & reuse	DATASETS FROM COUNCIL ABOUT SALES
		DATASETS RELATED TO CITY IMAGERY AND PUBLIC FACILITIES
		DATASETS RELATED TO INVESTMENT
		DATASETS RELATED TO STATISTICS
		DATASETS RELATED TO TOURISM
		DATASETS RELATED TO TRANSPORT
	OGD quality assesment by government	DECLARED THAT THE QUALITY IS NOT IDEAL
		NOT SURE IF GOVERNMENT CONDUCT THE ASSESSMENT
		SHOULD PROVIDE CERTAIN LEVEL OF QUALITY ASSURANCE

Building innovation through OGD value. There are two sub-categories *Potential revenue and benefits* and *OGD benefits* under this category that were created from twelve super codes. According to participant feedback under the subcategory *OGD benefits*, the social and economic benefits of OGD is discussed. One participant mentioned that the affiliated company provided its customers with an economic indicator insight with reliable OGD as one of the data sources:

> *"…generally speaking it's reliable data with a reliable correlation as well. And so particularly the light traffic. So, it was probably the most important indicator that meant that back in December last year. And I said The Reserve Bank was going to cut interest rates. No one else was saying that then and then I was right within six months.."* (PB6, 13:45)

According to the participant from the property-data provider, OGD have commercial worth to monetise. The company offered property sales online and sold real estate agents cross-outside marketing:

> *"Some too well, but a lot don't. Because I see the commercial value of the data,"* (PB5, 03:44)

> *"So we provide that for free. But what we do is look to add value in different ways to the data and monetize that. So, in [the organisation name] case, one of main revenue sources is real estate agents".* (PB5, 18:27)

> *"So, what we've done is we've brought all the sales in one place we put them up on the website and then we're sell marketing, I guess to real estate agent stuff to be attributed cross-outside."* (PB5, 18:27)

The participant revealed that OGD benefits are not mainly revenue and service benefits but also to enhance user's data literacy, the main data for the most important economy indicator and organisation's capability and performance:

> *"Yeah, the Transport Agency. So, then that's when I discovered that the data existed, and they had been collecting it for 10 years. But they were just using it for modelling traffic flows and figuring out where to build roads and that sort of thing."* (PB6, 03:04)

> *"So, the [service's name] was the single most important indicator because it is that hard data ... They normally right, but can we trust it but with the traffic*

data, it doesn't lie. Doesn't know how to lie. It just is what it is. So it's been very important data for us." (PB6, 13:45)

One participant highlighted introducing new services as an example of indirect economic benefits. The participant also cited the spread of connected marketplaces:

"So, I went and I presented, showed them what I was doing with the data which they found very interesting because they were asking though paying an economic consultancy to predict the economy so they could predict traffic. I was like No, you should be using traffic to predict the economy, you've got it round the wrong way". (PA6, 19:45)

Another subcategory, *Potential revenue and benefits*, supported by five super-codes, discussed opportunities for DDOs to investigate some potential revenue and benefits that DDOs have leveraged from OGD, as well as how the government can also take advantage of these opportunities. According to one participant, integrate OGD with other data to produce insight for customer business purposes, contributes to the strengthening of the customer relationship, which is difficult to quantify.

"it is extremely difficult to estimate the money value of what we do but also what the insights team does with their reports to customers. We don't charge them for that and I guess it's strengthening the customer relationship that you can't measure that." (PB6, 41:21)

Furthermore, the participant noted that with reliable data, the company could provide its customers with information to help them make better decisions, such as assisting a prospective buyer in deciding whether to buy a house or not by providing comprehensive information.

"Which is great for the users as well because what we're actually doing is adding even more value to the data were already showing." (PB5, 19:37)

Another participant noted that the layering of OGD with other data to serve as a one-stop solution for information about the property has the potential to generate income for the company. Revenue was not earned through the service's sales but rather through connect users, sellers and buyers for advertising, and brand agreements.

> *"What that means is a lot of people come to our website and then we can monetize the back for the advertising purposes. So it's all based on public data, but that's how we package it up."* (PB5, 28:22)

> *"…there are a lot of brands that want to be associated with those homeowners, that's where we look to build the business around."* (PB5, 20:14)

According to participants, utilising OGD has the potential to generate sales-driven innovation benefits. Connecting individuals seeking to buy or rent a home with real estate brokers, mortgage lenders, and advertisers targeting these markets resulted in innovation:

> *"that's what I hope business is, as what I mentioned sales…Then the other cases we are surfacing all this public data in one place in an easy-to-use way."* (PB5, 28:22)

Using good OGD. This category uses the term "good OGD" to explain the criteria of good open data in section 2.1. According to the Open Data Institute, good open data is defined as data that is linkable and available in a standard format, as well as data that is constantly consistent and readily available throughout time. Thirteen super codes formed three sub-categories cited about privacy and personal information, datasets for use and OGD quality assessment by government.

According to participants, they were concerned about the privacy implications of data. Due to the fact that OGD is public data, they maintained that they were just sharing what was publicly available:

> *"So the good thing about the public data is it's public information, so we stand behind that and we're only sharing what is on what is the public record."* (PB5, 23:52)

When their clients require data, the participant will obtain it from frontline staff without providing any personal information. They may provide demographic information, but not the individual's name or any other identifying information:

> *"data we use at the moment is [the organisation's application] dot. So [the organisation's application] data that we collect from the Frontline staff. So, we asked them to tell us what they're seeing amongs their customer base,*

not tell us the customer names.. So we can give them demographics about their customers that they can't access in the other way." (PB6, 37:37)

Another participant added that personal information about customers was stored securely and was not shared:

"any personal information that customers, users provide to us, as I see stored securely and not shared in any way." (PB5, 23:52)

When participants were asked which datasets they used and which they requested, they listed datasets relating to tourism and investment*:*

"…but also data on anything and everything tourism and investment." (PB6, 09:40)

They used statistic datasets, city imagery and public facilities:

"We use a lot of data from statistics New Zealand," (PB6. 09:40)

"Commute time, modelling around the city or the location of bus stops or location of amenities is all data that local councils have and some form or another" (PB5, 12:19)

The benefits of OGD extend beyond the obvious economic gains associated with reduced data spending and the development of new, creative services and products. On the other hand, without stringent quality standards, might result in poor decisions and even worse outcomes. This study asked participant opinion about OGD quality assessment by government; the responses varied ranging from that the quality is not ideal:

"You know, you could imagine if they can't assure the quality, that's fine. They just needed to say that the quality may not be as good as it's not perfect." (PB5, 15:09)

Or stated that government should provide certain level of quality assurance:

"I think in a perfect world the provider of the data should provide some level of quality assurance." (PB5, 15:09)

Figure 5-25 is a mind map created in NVivo depicting the conceptual framework for theme 3B. This framework aims to demonstrate how the theme was derived from a thorough content analysis of the categories "BUILD INNOVATION THROUGH OGD VALUE" and "USING GOOD OGD" and their sub-categories. The framework illustrates the thematic coding, demonstrating how DDOs have devised strategies to access potential markets and enhance their competitive positioning by stimulating innovation and utilising high-quality OGD.

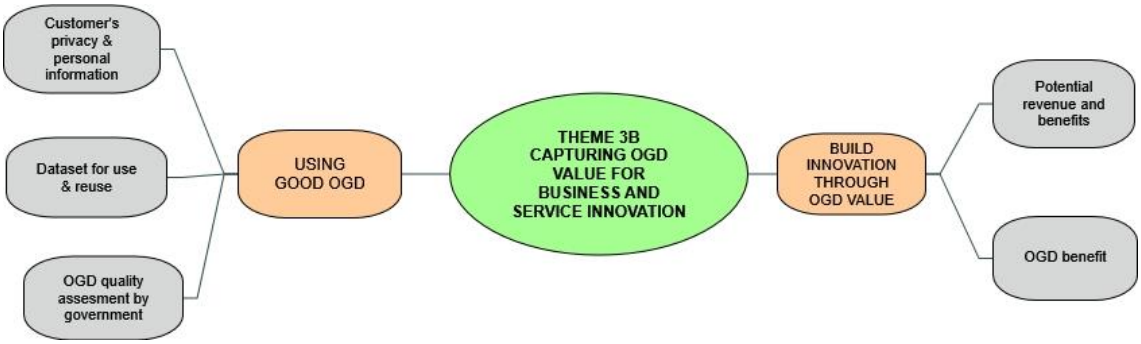


Figure 5-25 A conceptual framework of theme 3B-case study B (NVivo Mind map)

In conclusion, the concept of theme 3B, "CAPTURING OGD VALUE FOR BUSINESS AND SERVICE INNOVATION", was summed up as follows, as supported by the preceding narrative: **One of the most significant impacts of OGD is that it allows for the creation of better products, services, and businesses. The OGD has the potential to generate commercial and social value creation opportunities. However, it also presents problems, such as data quality, which must be carefully considered to realise its full potential.**

5.4.5.4. Theme 4B "OGD COLLABORATION AND PARTNERSHIP"

Theme 4B, "OGD collaboration and partnership", was created based on two categories, six sub-categories and 30 super-codes. Tables 5.15 and 5.16 show the coding maps of two categories and their underlying data. This section discusses how the theme emerged from these coding maps regarding achieving OGD benefits of collaboration across government and DDOs with obstacles and challenges arising from a data-driven culture.

Table 5.15 The coding map of the category “ENABLING FACTORS TO CAPTURE OGD VALUE”

CATEGORY	SUB-CATEGORIES	SUPER CODES
ENABLING FACTORS TO CAPTURE OGD VALUE	Feedback to government	COMPARING NZ OGD PROGRAMME WITH OTHER COUNTRIES
		GOOD OPEN COMMUNICATION
		GOVERNMENT LEARNT THE DATA TO MEASURE OGD
		NO IMMEDIATE VALUE OF DATA
		RELIANCE DATASETS ABOUT STATISTICS
		TRANSPARENT WITH INFORMATION
	Inquiries related to OGD	DIRECT CONTACT DUE ABNORMAL DATA PATTERN
		INQUIRY ON CURATED COUNCIL DATA
		REQUEST DATASETS
	Measure the output of OGD	DATA CONSISTENCY
		PROVIDE VERY STRONG PATTERN OF TRAFFIC DATA
		TIMELINESS DATA
	Satisfaction on OGD	NOT BAD NOT GREAT
		SATISFY
		SOME PART SATISFY, THE OTHER NOT SATISFY
		VERY SATISFY

Table 5.16 The coding map of the category “OGD IMPEDIMENTS AND ISSUES UNDER DATA-DRIVEN CULTURE”

CATEGORY	SUB-CATEGORIES	SUPER CODES
OGD IMPEDIMENTS AND ISSUES UNDER DATA-DRIVEN CULTURE	Challenges and obstacles	COMMUNICATION BARRIERS WITH OGD PROVIDERS
		DATA IMPERMANENCY
		DIFFERENT FORMATTING ISSUES
		DIFFICULTIES TO ACCESS RELEVANT DATA
		EXTRA EFFORT TO PRUNING DATA
		LACK OF DATA ACCURACY
		LACK OF METADATA STANDARD
		SPECIFIC ISSUES WITH SPATIAL BIG DATA
	Cost and fee	CONSIDERABLE COST OF PROPERTY DATA
		COST FOR CONSUMER SURVEY DATA
		COST FOR DATA FROM COUNCIL
		COST TO INTEGRATE OGD WITH OTHER DATA
		EXPENSIVE COST OF SPECIALIS DATA PROGRAM
		FREE FOR OGD

Enabling factors to capture OGD value. Under this category, a set of 16 super codes formed four sub-categories *Feedback to government*, *Inquiries related to OGD*, *Measure the output of OGD*, and *Satisfaction on OGD*.

Under the sub-category *Feedback to government,* the participant provided feedback to the government about their implementation of OGD. The feedback is used to help the government improve the quality and accessibility of the data. According to a participant with the affiliated company has branches in other countries, New Zealand's OGD programme is superior to Australia's. Compared to Australia, the New Zealand government was more consistent and regular in implementing the OGD programme across all agencies. Additionally, not all states in Australia opened their data available for free since some jurisdictions charge a significant fee, while others do not proactively release data:

> *"But the problem with Australia is that every state does it independently and some of them are like New Zealand, they produce the data very fast and it is free, some of them you have to pay for it quite a lot of money and some of the states that only produce the data, they give us six monthly update which is useless for monitoring the economy."* (PB5, 21:05)

> *"It's timely and they helpful and Yeah, whereas the Australian experience was that there was no consistency and how they published it and very little Interest in that making the data available for other purposes."* (PB6, 22:17)

The participant emphasised that New Zealand government agencies was transparent in sharing information regarding OGD's methodology to allow the company to identify the data's significant value:

> *"And they've been very open and sharing information, so that we could replicate their methodology for the inflation gauge, and it's turned into a really good indicator."* (PB6, 28:53)

Another positive feedback was made about the agency's open communication when concerns were raised about data movement, delays, and inaccuracies:

> *"Sometimes I've contacted them and said what's going on with this road? When will it be back? Because I need it. Don't worry we'll send someone immediately. It's been very good at open communication."* (PB6, 21:05)

One participant noted that governments, particularly local councils, should be rewarded to motivate them to share their data that is currently available in a form that the public can use it:

> *" It's kind of the data's already there, It's already being done. It's just finding a way to put a link to share it, in a way that could use it. That's the big question is how to incentivise them to share it, there's no immediate value."* (PB5, 12:19)

According to excerpted transcripts under this sub-category *Inquiries related to OGD*, participants specified their inquiries to capture the OGD value. Curated data would be valuable if published, such as city modelling, information about public facilities, and a prompt response from data publishers when users encounter issues with their downloaded datasets:

> *"Commute time, modelling around the city, the location of bus stops or location of amenities are all data that local councils have … and if curated that for their own reasons and what would be great is to being surface act in a way that we can use an easily accessible way to create new value"* (PB5, 12:19)

Participants requested more datasets to be available at open data portal such as firm level data:

> *" I know they have some interesting firm level data - I think all the IDE database or something, but It's not very timely."* (PB6, 05:45)

The participant from a local council informed that usually link about request to datasets available in open data portal.

> *"So, we have it on the links to our site on the main [The organisation name] page"* (PAB8, 19:36)

This subcategory *Satisfaction on OGD* consists of six super codes with participant responses ranging from indifferent to the high level of satisfaction with government agencies' OGD implementation. Participants rated their satisfaction in using OGD and discussed different OGD achievements between central and local governments. While LINZ did an excellent job maintaining datasets on its open data platform, local

governments that collected LINZ data for decentralisation sold it to other parties for a quite significance amount:

> *"LINZ do this really well, their open data platform is really fantastic and I shared or willingly and they have really good technology to make that accessible which we use. The recent case and that's being decentralized in every local Council has to capture that data themselves following a legislative LINZ data standard…although that is public data as public information, they sold back to different parties for quite a considerable fee. So, we paid public data rather than open data."* (PB5, 03:44)

A part of response taken from interview transcript of a participant from the local council highlighted that government agencies opened their data to promote OGD but in general people still did not aware:

> *"Probably no, as I know. I think in general the people aren't, we try and promote information as much as we can but sometimes people still stumble across and say that they didn't do in aware"* (PAB8, 19:08)

On the other side, great satisfaction was given to agencies who gladly assisted participants and were eager to study their datasets to identify OGD value creation:

> *"They were very enthusiast to help. For them, they wanted to learn about their data as well. So, I went and I presented, showed them what I was doing with the data which they found very interesting."* (PB6, 19:45)

OGD impediments and issues under data-driven culture. This category consists of two sub-categories and 14 super-codes**.** Organisational and personnel issues, such as leadership and governance approaches and issues relating to altering people's cultures, are frequently the most significant impediments.

Under the sub-category *Challenges and obstacles,* the participants from DDOs commented on the challenges and obstacles they faced when using OGD. For example, one participant noted that OGD data often not regularly published. This complicates their efforts to uncover value of data:

> *"So, when there's an obvious crazy spike up or down or some missing data, I put quite a lot of effort into. For example, if it's the Saturday was missing I*

will replace it with the average of the Saturday before and the Saturday after" (PB6, 06:44)

Another participant stated that they need extra effort to pruning data, lack of metadata standard and different formatting issues:

"I could download hourly data for 96 sites around the country that where they continually monitor the traffic data." (PB6, 04:52)

"The RNZ less helpful that sometimes put their data out in a PDF." (PB6, 27:27)

"about data import engines to receive all these files and reconcile the different formatting issues." (PB5, 14:18)

Participants also identified inaccuracies in data and communication hurdles as concerns while utilising OGD. Maintaining good communication is beneficial for OGD collaboration and knowledge sharing.

"You know, sometimes it might be typos on the sale price might have sold for 500,000 but they add an extra zero and say it sold for $5,000,000. Little things like that, but on the whole because it's a standard format that they have to capture..." (PB5, 10:50)

Under sub-category *Cost and fee*, participants feedbacks gathered about cost incurred for using and integrated OGD with other data. The cost associated with using OGD was expected minimal when compared to the value that it provides. One participant noted about cost for data from council:

"they sold back to different parties for quite a considerable fee. So, we paid public data rather than open data." (PB5, 03:44)

Insight for customers that resulted from statistical and analysing of OGD and other data incurred cost for consumer survey data. Participants' mentioned that the company paid for a few questions in the Roy Morgan monthly survey that households asked questions. The survey involved a thousand respondents, so it had to be done very accurately to get enough data for meaningful results. Different participant noted the considerable cost of property data.

"we basically pay for a few questions in their monthly survey that households were they ask other questions as well. So you have the right coverage of the different regions and of the different demographics, old people to young people, in men and women and what not all that sort of stuff that whereas with a business survey." (PB6, 33:16)

On the other hand, there is no charge for downloading datasets from an open data portal. It is entirely free:

"They will give it to anyone who wants it. They don't charge for it, it's free." (PB6, 5:36)

"… It's it is what it is, and you have to trust it really. It's correlation with GDP is really quite high and it has stayed high over a long time… it does capture that sort of consumption side of things as well." (PB5, 18:07)

Figure 5-26 depicts a conceptual framework for theme 4B created with NVivo mind mapping of the categories "Enabling factors to capture OGD value" and "OGD impediments and issues under data-driven culture" and their associated subcategories. This framework provides a high-level overview of theme 4B as a one key point for further case study B analysis. The framework provides a high-level overview of the thematic coding and a key point to build future case study B analysis.

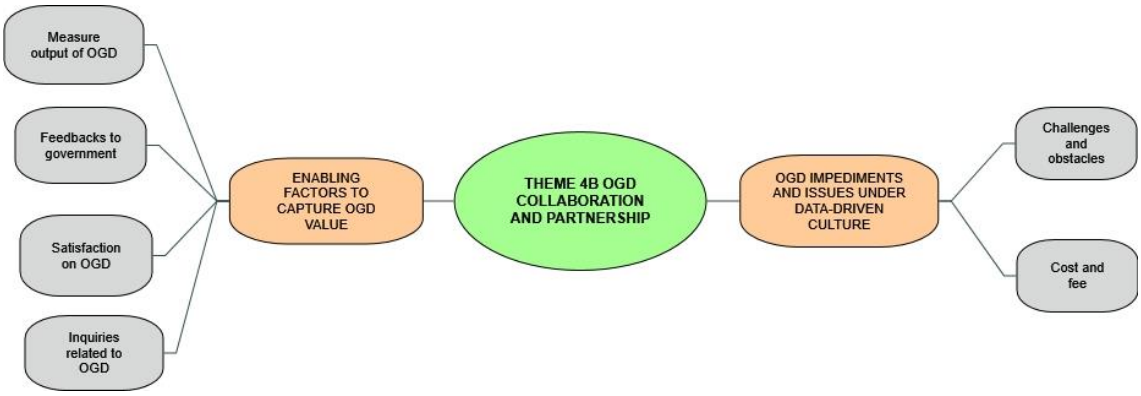


Figure 5-26 A conceptual framework of theme 4B-case study B (with NVivo Mind map)

In summary, a concepts of theme 4B "OGD COLLABORATION AND PARTNERSHIP" was summed up as: **Building partnerships between the government agencies and DDOs to capture the value of OGD and leverage it by resolving the impediments to cultivating a data-driven culture**.

5.4.6. Thematic map of Case study B

Figure 5-27 depicts the thematic map for case study B, which explores the participants linked with DDOs, using the thematic coding as a source to create the four themes. The thematic map gives a comprehensive display of vast quantities of coding data. It highlights patterns and correlations among diverse themes, categories, and subcategories to comprehend the case study's findings.

The four themes help this study's understanding of the pattern from the thematic coding analysis of this case study and serve as a fundamental point for the multiple case study analysis. The first theme, theme 1B, highlights that DDOs need to perform abilities, expertise, and attitude to capture and utilise OGD to its strategic aim for products/services innovation. The categories as the associate items show DDOs need to ensure that they are nurturing the ICT literacy skills to fully capture the OGD benefits and executing the value-capturing roles necessary to gain the advantages of OGD value.

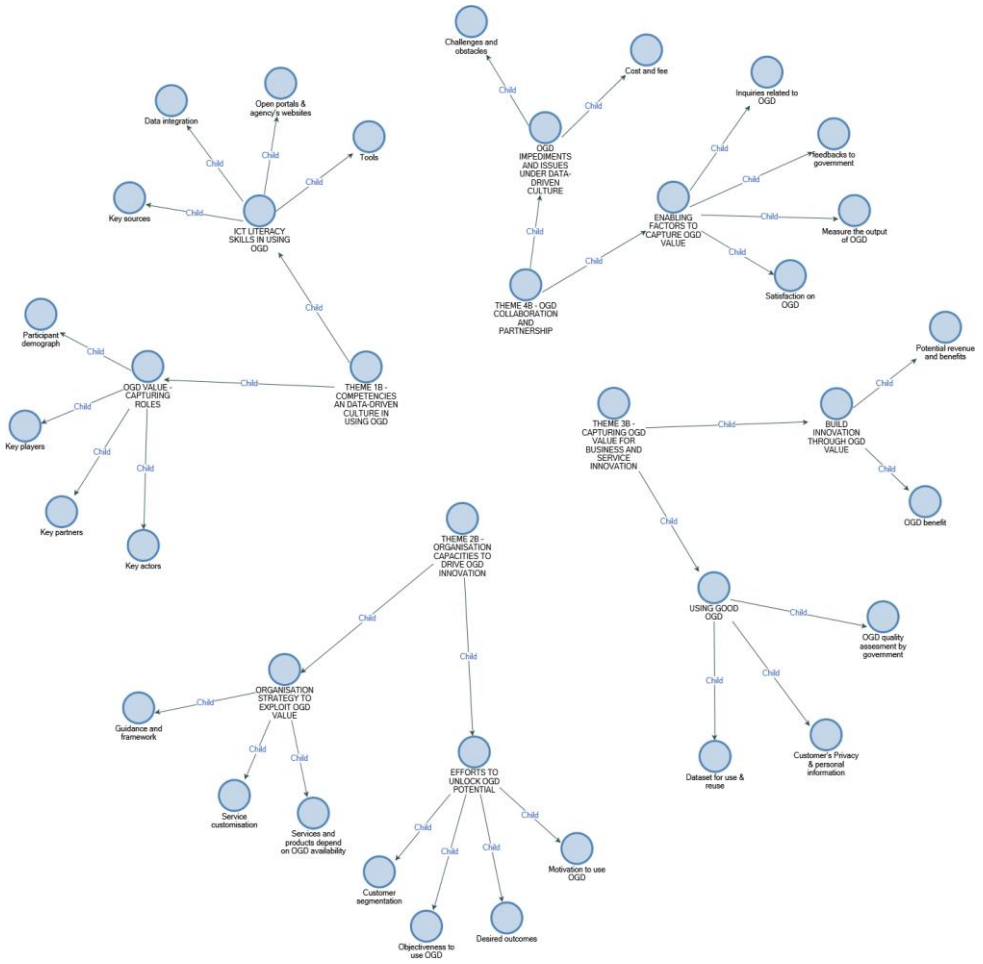


Figure 5-27 Thematic map of case study B – Data-driven organisations

From theme 2B cluster, the organisation's ability to adopt innovative strategies is enhanced by prioritising investments in its key competencies, such as people, data, and innovation-driving activities. This has the potential to transform the way the DDO operates and interacts with its stakeholders, providing them with better and more strategic solutions to exploit OGD value. The third theme, theme 3B, clarifies that one of the most notable effects of OGD is that it enables the creation of better products, services, and enterprises. The OGD can offer commercial and social opportunities for the generation of value. However, it also offers challenges, such as data quality, that must be carefully evaluated to leverage its potential. Theme 4B describes that building relationships between government agencies and DDOs harness the value of OGD by eliminating the obstacles that prevent the cultivation of a data-driven culture.

In conclusion, by integrating four themes with coding hierarchies, the thematic map elaborates the DDO capacities, people's competencies, OGD value and collaboration. The OGD collaboration and partnership facilitate the exchange of open data and resources and empower people, organisations, and communities to build their capacity to create value. The OGD are the new platform for people to create value together.

5.5. Case study C: Information & Technology companies

Specifically, the objective of case study C is to explore IT companies that supported government agencies in publishing OGD. This case study, similar to case study A and B, examines interview transcripts as the primary data, takes place in an environment where each participant has experiences, and provides an in-depth examination of how OGD was opened.

5.5.1. Snapshot of Information & Technology (IT) companies in New Zealand

Information and Technology (IT) companies, such as software developers, support governments in most countries to recognise the potential of blockchain and other distributed ledger technologies to make public digital platforms more transparent and efficient (Kassen, 2022). The developers have created digital ways to accelerate reforms in the open government programme. Referring to business demography statistics

released by StatNZ[29], there are 6,879 enterprises of Information media & Telecommunication industry (ANZSIC06) per February 2021 out of totally 562,520 enterprises in New Zealand. Australia and New Zealand use the Australian and New Zealand Standard Industrial Classification (ANZSIC) 2006 to produce industry statistics.

One of the essential ways OGD can be realised is by creating data utilisation tools that enable users to interact with government data in open and public portals. IT companies, such as software developers, are a type of developer whose task involves designing and building software and data utilisation tools. IT companies play an essential role in encouraging the adoption of OGD and the release of ever-increasing amounts of data to be opened. The IT company involved in this case study C was founded in 2002, and most of its clients are government agencies. It supported the government's projects in designing, delivering, and maintaining large-scale digital services while promoting open-source software, Linked open data and software development. For example, the company assisted a local government in releasing the API manager and making real-time transport information publicly accessible.

5.5.2. Participants of case study C

According to the summary of participant profiles presented in table 4.2 of chapter 4, there are three participants affiliated with DDOs and IT companies for case study C. They were interviewed to understand their roles and the firms' experiences with DDO and OGD utilisation. The following is a list of participants:

1. Participant PC3 is a leader of a software developer in the IT industry. PC3 has dealt with open data and access for nearly five years, including participation in Hackaton 2014 and providing IT support for the open data initiatives of government agencies. He/she is responsible for supporting clients in service innovation and ensuring the company's financial viability. The semi-structured and open-ended interview was

[29] https://www.stats.govt.nz/information-releases/new-zealand-business-demography-statistics-at-february-2021 The latest access on March 2022

performed at the participant's office on 9 September 2019, per the participant's request.

2. The participant PAC7, one of the leaders in public service, background is in sociology then managed the research analysis and monitoring team to make data available to council, decision makers and communities. The participant's transcript was used in case studies A and C. Most of the transcript expounded on participant feedback for case study A, and several responses were extracted as the primary data for case study C. The interview session was held in the participant's office on 16 November 2019.
3. Participant PAC9 is a government agency whose transcript was used in case studies A and C, too. Over a long time, participant PAC9 has dealt with service data organisations. He/she is one of the managers and product owner of open data of a public service. The interview was held on 4 March 2020 through Skype.

5.5.3. First cycle: deductive coding analysis

The first cycle of deductive coding analysis, similar to the previous case studies A and B, was iterative to ensure the data corpus were entirely coded with In Vivo code. All transcripts were tagged until no possible codes to ensure data saturation.

After completing the coding of all transcripts, the identical codes were grouped in one category. This cycle was conducted deductively, as all categories had been specified previously to ensure they aligned with the interview protocol's content objectives for answering the study's research questions. All codes discovered were created in NVivo using the nodes function, incorporating content/references to cases and categories for clustering coding. The following sample from a transcript was coded when the participant explained the quality of data. Each code in the right column corresponds to a transcript's superscript number

"Yeah, quality of data could be also a problem. [1]But until people use it, you don't know if the quality is good or not. [2]So you either use it yourself and you know, whether the quality is good or not, [3]or you make it publicly available so that people use it and then they can provide feedback. And then we can go, Hey, this is not right. You know, instead of trying to focus on making things right before you make it available, [4]if you pass the legal and privacy barrier, you should just make it then people can start giving you feedback." (PC3, 12:07)

[1] LET PEOPLE USE TO KNOW DATA QUALITY

[2] USE IT YOURSELF TO KNOW THE QUALITY

[3] MAKE IT PUBLIC TO GET FEEDBACK

[4] PASS PRIVACY BARRIERS, OPEN AND RECEIVE FEEDBACK

Transcripts as the primary data for this case study C, not only collected from participant affiliated with IT company, but also took parts of transcripts of participant associated with government agencies, PAC7 and PAC9. As indicated in section 4.4.3, PAC7 and PAC9 are participants from government agencies whose transcript was included as data for case studies A and C, as multiple participant responses corresponded to data required for case studies A and C.

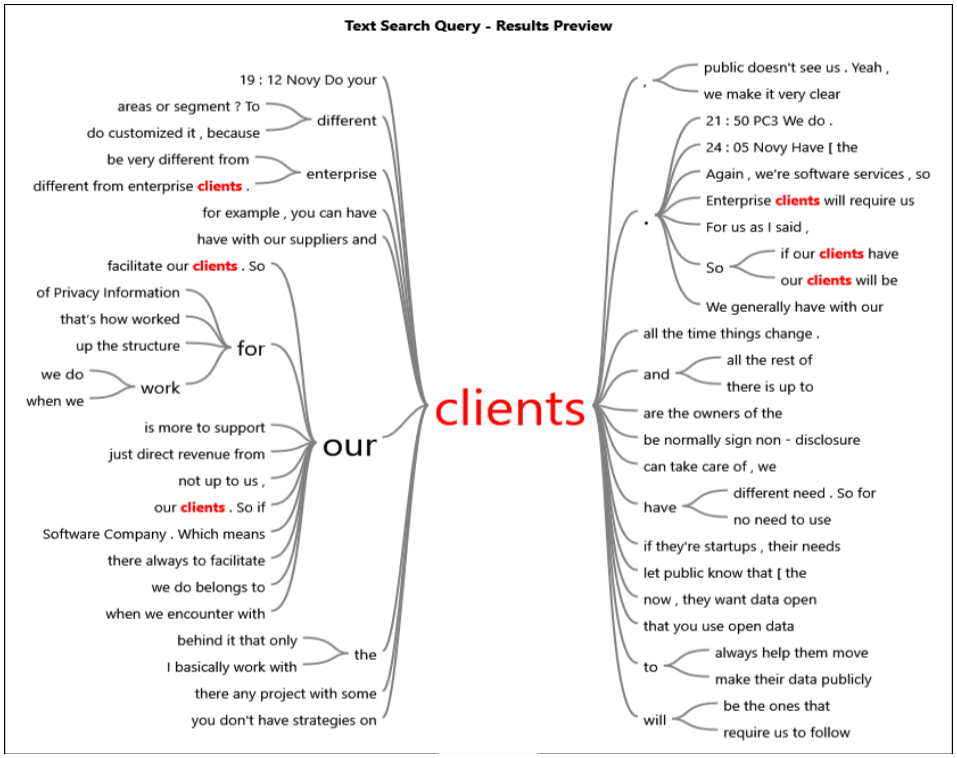
Following the coding completion of the transcripts, an analysis was conducted to determine the pattern and context similarity of the codes to categorise them. Initially, NVivo word frequency assists in determining the most often used terms by participants by allowing them to choose the top 30 most frequently used words. Figure 5-28 illustrates how the word cloud of the top 30 words is used in NVivo to create a large-scale representation of the word patterns.

Figure 5-28 Vivo word cloud of the most 30 frequent words

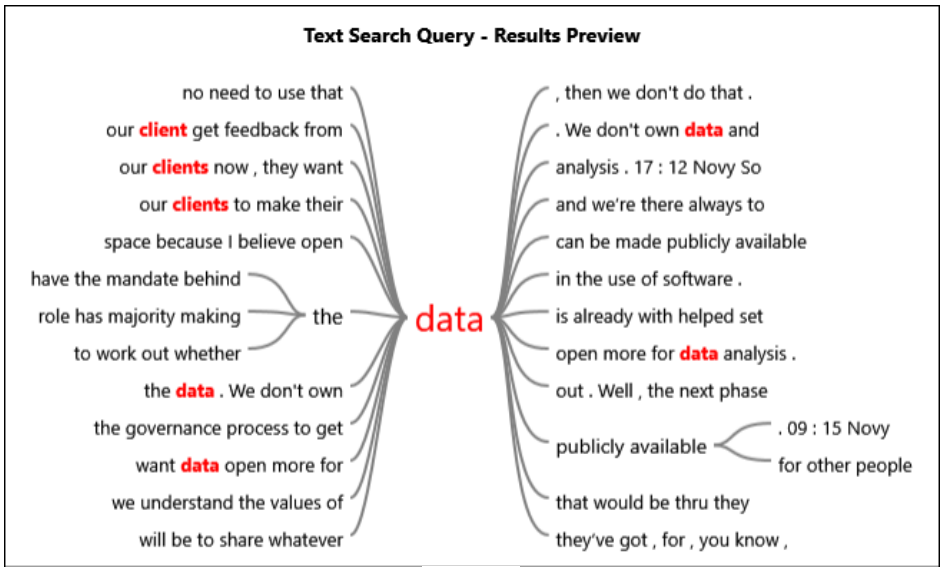
Then, the most-occurrence six keywords were chosen: " clients", “data”, "use", "make," ""publicly," and "available" to identify interrelated phrases and detect specific terms and patterns across data. Alternatively, to put it another way, it helps illustrate how participants' viewpoints on different phrases fit together as a big conceptual picture. Later, these will assist in the identification of possible themes.

The text-based search results for the phrase "clients" and “data” are displayed in Figure 5-29. The first search (a) yields a word tree with the term "clients" highlighted using a text query. Based on the textual content of the transcripts linked to the word “clients”, the prevalent ideas from the linked phrases are how the IT companies treat their clients, such as “facilitate our clients”, “to support our clients” and “work with our clients”. Another preview suggests that the participant’s feedback were focused on their role when dealt

with clients, such as “public doesn’t see us”, “clients are the owner of data” and “we’re software service”.



(a)



(b)

Figure 5-29 NVivo word trees for terms "clients" and "data"

The second search (b) combines the text query with the Boolean AND operator, requiring both "clients" and "data" as a targeted term in the word tree. The lead-up words to the targeted terms and the lead-away words are shown how the clients get benefits from

data, such as “get feedback from data”, “publicly available”, and “open more for data analysis”. Another idea reveals the process of support clients in open data projects, such as “the governance process” and “mandate behind data”, “understand the value of data”. At this first stage, I then used this information to analyse the interview transcripts, allowing me to find patterns that came from the interviews and then further identify the themes.

Figure 5-30 depicts the NVivo text search query for the phrases "data" and "use" with its stemmed format combined with the AND operator. The result in a word tree provides the initial ideas that the participants discussed company’s effort to use data, such as “interested in making useful data”, “no tangible use as just data”, “the use of data” and “bigger drive to get open data”. Another perception gains about in what way IT companies support open data, such as “in the use of software”, “open more for data analysis”, “using Auckland Transport on data” and “data science analysis”.

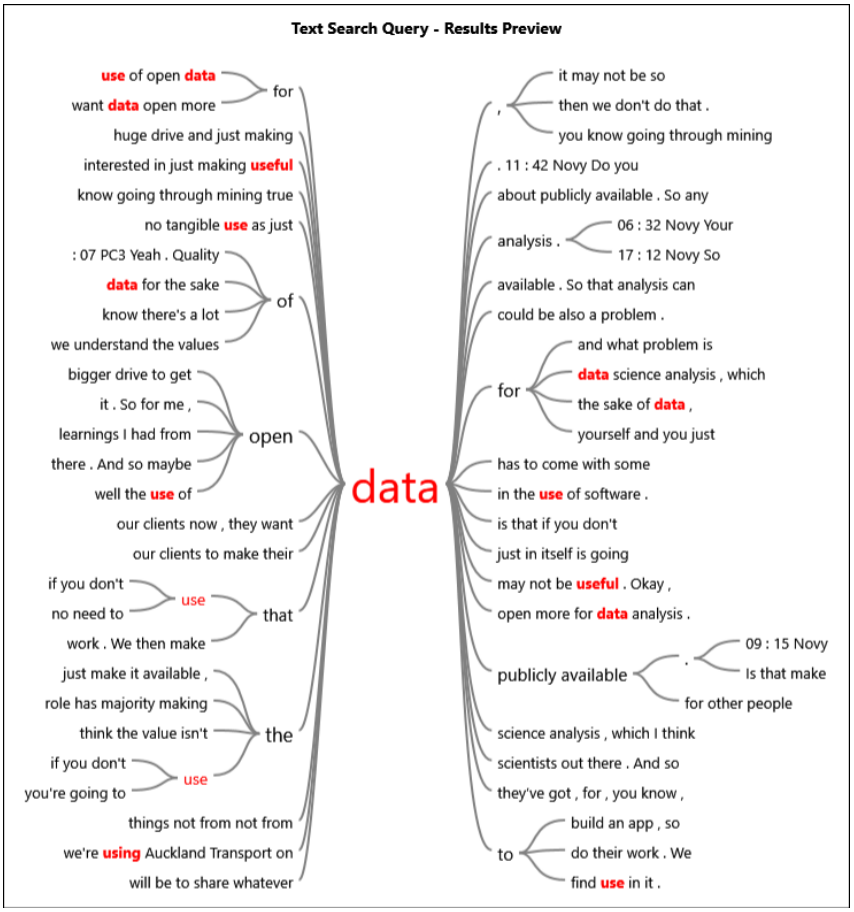


Figure 5-30 NVivo word trees for terms "data" and "use"

A result from the text search query is depicted in Figure 5-31 for terms “data “ and “make” with the stemmed format that linked with the use of AND. The pattern of these terms similar with the result of word trees for terms “data” and “use” as shown in Figure 5-30 role as described participant’s effort to support their clients in opening data. It visualises the lead-up and lead-away words such as “our clients to make their data open”, “role has majority in making the data open” and “huge drive in making data publicly available”.

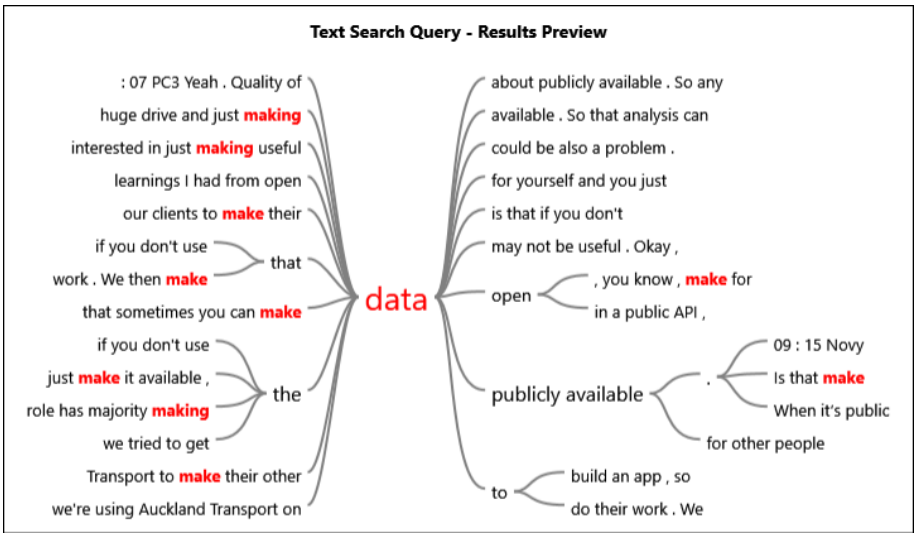


Figure 5-31 NVivo word trees for terms "data" and "make"

In addition, an NVivo text search query was run for a combination of the words, "publicly and "available", using the AND operator, as shown in Figure 5-32. The result acquires an understanding of the participant’s responsibilities in assisting OGD implementation, such as “to make their data publicly available” and “making useful data publicly available.

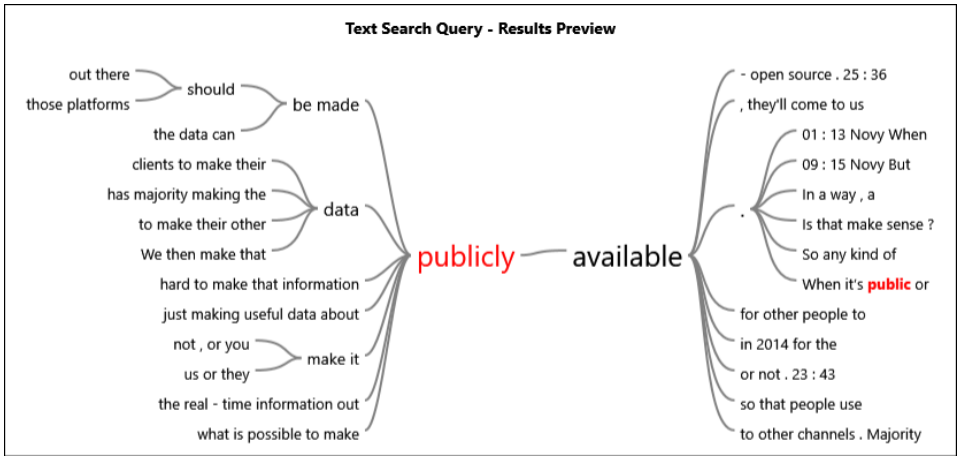


Figure 5-32 NVivo word trees for terms "publicly" and "available"

After going over the data and running NVivo tools for queries, a coding map was created for the first round of analysis. The use of thematic analysis in this cycle resulted in the coding cluster. Transcripts yielded 117 In Vivo codes as a result of participants' perspectives on helping government agencies in OGD programmes. The codes were grouped into 19 categories in this initial cycle according to the objectives listed in table 4.1. Below is a sample of the coding map for four categories: Feedback about OGD programme, Company's guidance and procedures, Challenges and obstacles and Output by supporting OGD implementation.

FIRST CYCLE OF DEDUCTIVE CODING ANALYSIS:
Initial categorisation with In Vivo/Literal coding

Case study C – IT COMPANY

Category 1: Feedback about OGD programme

Related codes (In Vivo codes):

DATA ANALYSIS FEEDBACK
DEVELOPER CENTRIC
GOVERNMENT HELP SEED OPEN INNOVATION
IPS SHOULD BE MADE PUBLIC
PLATFORMS WERE BUILT INTO OPEN SOURCE MODEL
SHOULD USE THE DATA FIRST
USER FEEDBACK THRU SOCIAL MEDIA OR WEBSITE
VERY HELPFUL AND PROACTIVE

Category 2: Company's guidance and procedures

Related codes (In Vivo codes):

ALL WORK OUTCOMES BELONG TO CLIENTS
CLIENTS DECIDE WHICH DATA TO BE OPENED
FOCUS ON OPEN SOURCE
GOVERNANCE OPEN DATA PROCESS
MAINTAIN OWN WEBSITE
OPEN SOURCE GOVENMENT PLATFORMS
PUBLIC DO NOT SEE US
SIGN NON-DISCLOSURE AGREEMENT

Category 3: Challenges and obstacles

Related codes (In Vivo codes):

CONTRACTUAL ISSUES BETWEEN AT AND OPERATORS
LICENSING ISSUES
NOT AWARE OF OTHER PROBLEMS
NOT SCALABLE AND USABLE DATA IN PUBLIC IPs

PRIVACY AND COMMERCIAL CONCERN

Category 4: Output by supporting OGD implementation

Related codes (In Vivo codes):

ASSURE API MANAGER

BUS AND TRAIN REAL-TIME SCHEDULE IN 2015

COMPLY WITH THE PRIVACY INFORMATION

LAUNCHING THE ATLABS PROJECT

PART OF AUCKLAND TRANSPORT OPEN DATA PROJECT

PASSED THE TECHNICAL PLATFORM

RESOLVE THE SOFTWARE ISSUE

SUPPORT AUCKLAND TRANSPORT OPENED THEIR DATA IN 2014

THE REAL-TIME DATA OUT PUBLICLY

USE CASE OF VALUABLE OGD

By utilising thematic analysis, the first cycle produced an initial coding cluster. Throughout this cycle, the data was depicted by a theory-driven set of codes that were comprehensively defined. This cycle must be executed to generate the initial code from scratch. All data should be coded and then categorised into several groups. Following a second review of the data and the execution of NVivo query tools, a coding map was created for the initial round of analysis. Appendix E contains a sample of the use of NVivo for the thematic analysis of the case study's initial deductive cycle.

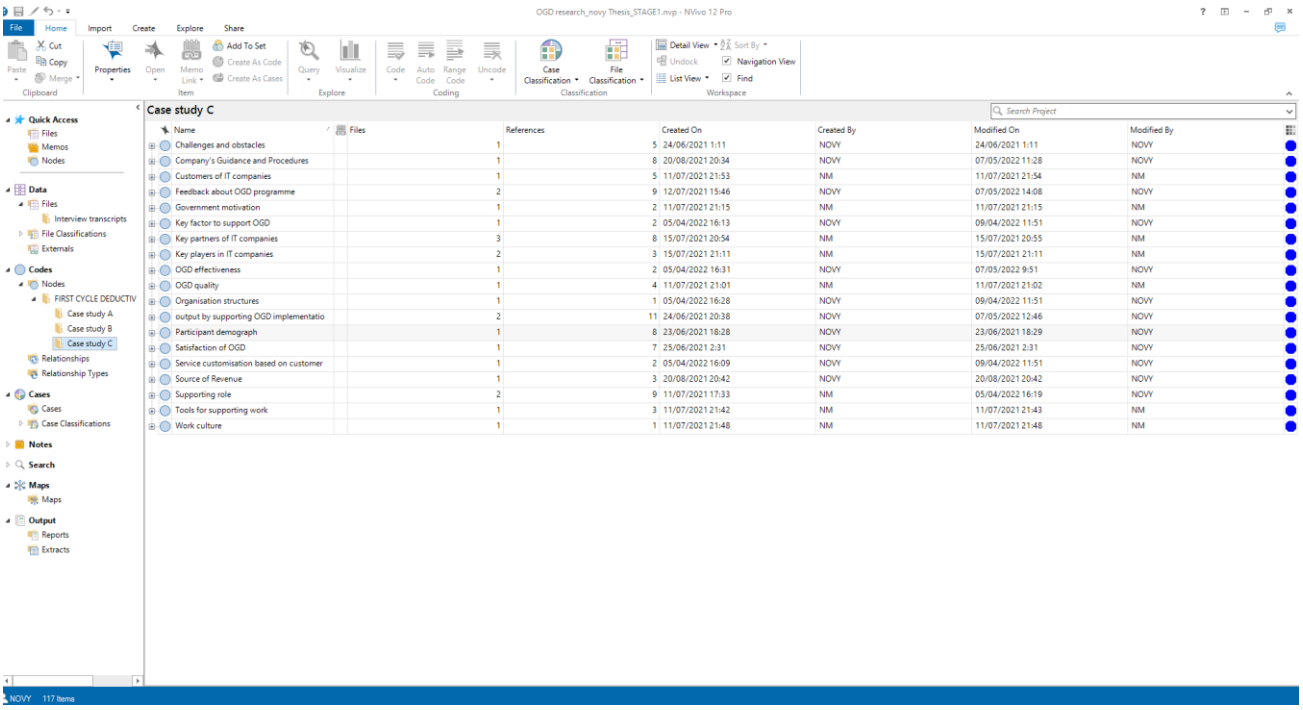


Figure 5-33 The list of categories as seen in NVivo List view for the case study C

Figure 5-33 illustrates a list view of the 19 categories that were generated from case study C during the first cycle. These categories were gathered and organised in the NVivo. The list view is divided into categories, each containing multiple files and references explaining how the category extracted transcribed materials and how many codes were generated for each category. IT company interviewees were all thorough in their responses, demonstrating that they have experience and expertise deal with OGD.

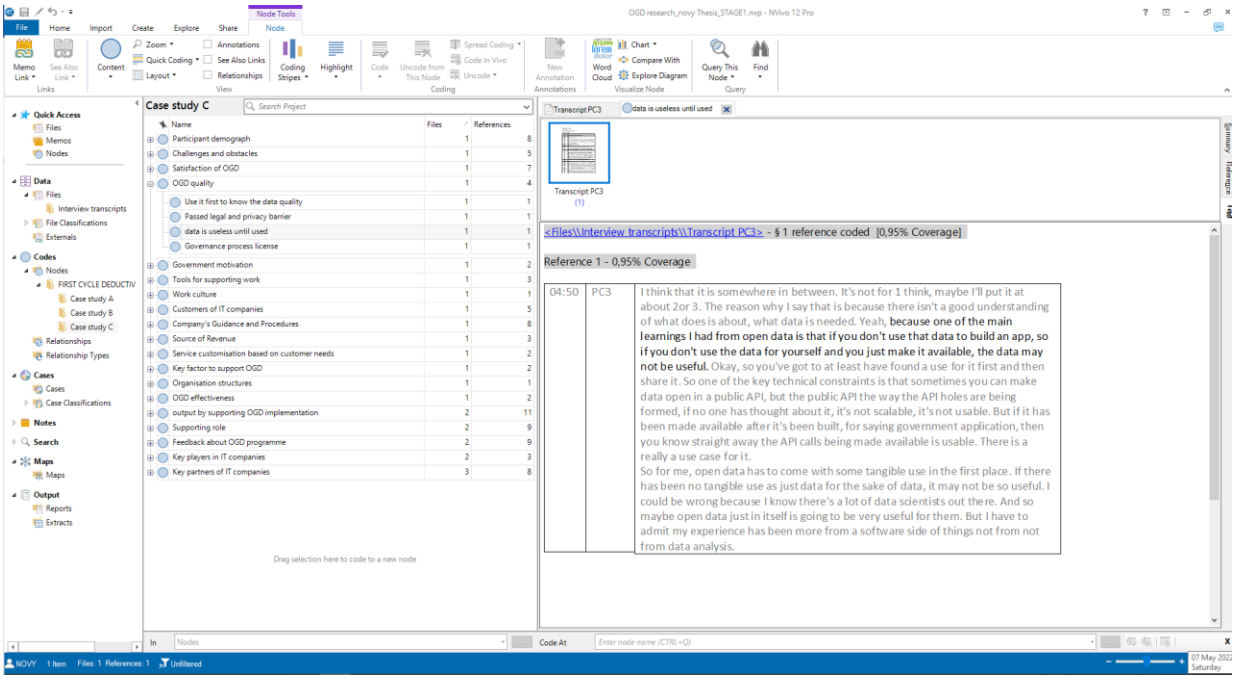


Figure 5-34 Screenshot of NVivo detailed view for category 'OGD quality"

Figure 5.34 depicts how the interview transcript was coded and subsequently categorised using a deductive analysis approach, similar to case study A and B. The screenshot explains how the highlighted phrase of the transcript *data is useless until used* was coded with In Vivo coding then grouped into the category 'OGD quality'.

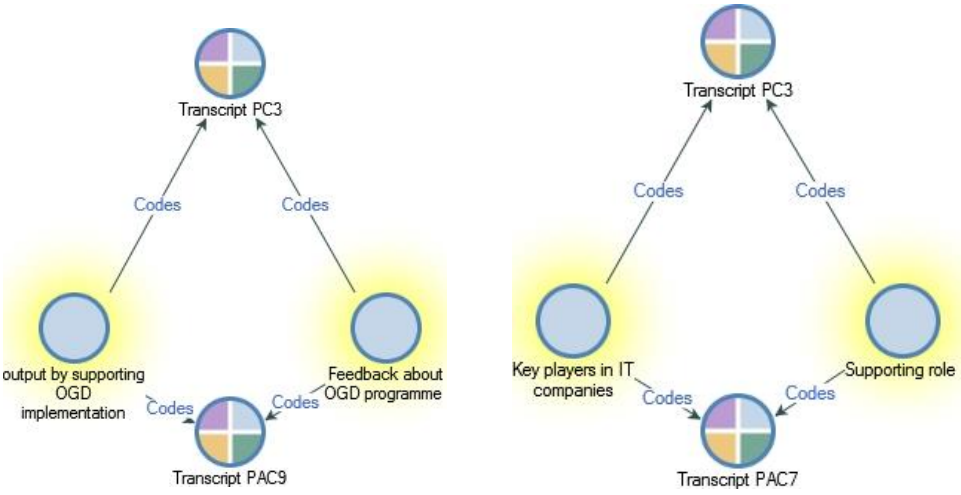


Figure 5-35 Screen capture of NVivo Diagrams to compare two nodes as categories

The participants' engagements during the data gathering are depicted in figure 5-35 presented with a comparison diagram of nodes coded from the interview transcripts. These two diagrams illustrate a comparison between the category 'output by supporting OGD implementation' and 'feedback about OGD programme.' Another diagram compares 'key players in IT companies' and 'supporting roles'. Participant PC3 was involved in both diagrams. While the transcript of participant PAC9 was coded at the nodes 'output by supporting OGD implementation' and 'feedback about OGD programme' and PAC7's transcript was coded at the nodes "'key players in IT companies' and 'supporting roles'.

5.5.4. Second cycle: Inductive coding analysis

Each case study in the multiple case studies must be similar to the others in some characteristics (stake). In this study, the same two-step analysis was used, with In Vivo coding as the first step and pattern coding for creating themes and a set of participants and adapted interview protocols.

The second cycle began with an in-depth examination of the first coding to determine whether any codes needed to be regrouped or whether any categories had inconsistent meanings. Text query capabilities in NVivo assist in in-depth analysis by visualising word trees (dendrograms) of linked codes and words using text query results. The dendrogram was introduced as part of a hierarchical cluster of phrases that were similar in meaning. Figure 5-36 shows a screen capture of a dendrogram that was created using coding similarities. Like case studies A and B, this cluster analysis applied the Pearson correlation coefficient to calculate correlation across items.

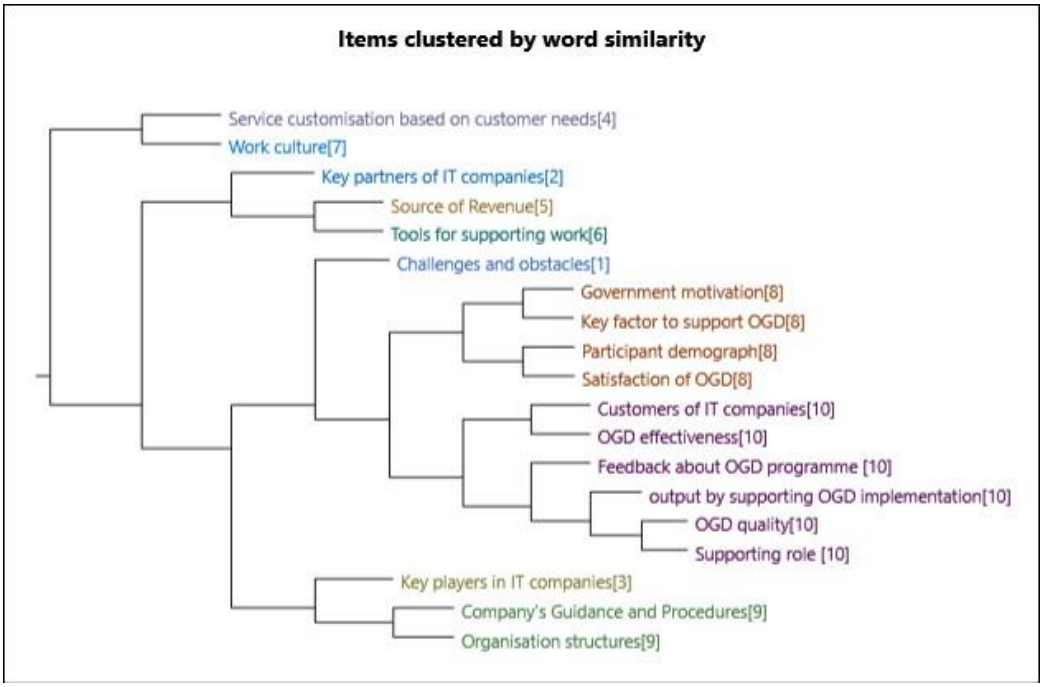


Figure 5-36 a screen capture of a cluster of categories by word similarity

This cluster of codes indicates that the phrases *Government motivation* and *Key factor to support OGD* are close to the terms *Participant demograph* and *Satisfaction of OGD*, showing a close relationship. In the opposite branch of this dendrogram, nearby words such as *Company's Guidance and procedures* and *Organisation structures* are interconnected. On the other side, this cluster indicates that the terms *Source of revenue* and *Tools for supporting work* were discussed significantly different than the terms *IT company customer* and *OGD efficacy*. The goal of cluster analysis is to simplify the large and complex nodes into smaller, more manageable groups. This cluster analysis simplifies multidimensional scaling graphs by showing data in two-dimensional clusters. It offers a visual aid for grouping nodes using the Pattern coding.

As previously explained, this cluster analysis tool serves as a supplementary instrument for data analysis after in-depth learning of the transcripts. Throughout the transcription process and the initial cycle of each case study, I iteratively read and reviewed transcripts. Therefore, following a solid understanding of the data, NVivo cluster analysis supports re-coding using the Pattern codes and finally explore the case study's themes. Figure 5-37 illustrates example of similar In Vivo codes that were assembled together to analyse their commonality then create the Pattern code. For the most part, the coding cluster resulted in the first cycle of re-coding with Pattern coding to simplify the cluster and make it easier to identify themes. For example, a set of In Vivo codes from the first

cycle's sub-category "Supporting roles" were combined to generate the pattern codes because of their similarities. After in-depth coding analysis supporting with NVivo query tools, the Pattern code that was for the relevant In Vivo codes was applied to the category ASSIST CLIENTS IN OPEN DATA.

FIRST CYCLE	SECOND CYCLE
In Vivo codes *Category: Supporting roles*	*Category (Pattern code)*
Use client data to support their work Ideas on using open data Not own the data, clients have the governance	ASSIST CLIENTS IN OPEN DATA
Category: Output by supporting OGD implementation	
Resolved the software issue Passed the technical platform Comply with the Privacy information Assure API Manager	RESOLVED ICT ISSUES
Category: Feedback about OGD programme	
Developer centric APIs should be made public Platforms were built into an open source model	FEEDBACK ABOUT OGD PLATFORM

Figure 5-37 A sample of re-coding In Vivo coding with pattern code for case study C

After conducting two cycles of thematic coding process for case study C, Table 5.17 presents the inductive coding cluster resulted in the second cycle that adopted the Pattern codes to generate super codes, re-coding and re-group the categories. This was accomplished through in-depth analysis supported by NVivo's analytic tools. The sample coding map of the second inductive analysis using NVivo for the case study C is available in Appendix F.

Table 5.17 Second cycle of Inductive coding – A way of grouping with Pattern code in case study C

SECOND CYCLE INDUCTIVE CODING ANALYSIS				
CATEGORY (Pattern code)	**SUB-CATEGORY (Deductive first cycle)**	**SUPER CODE (PATTERN CODE)**	**NUMBER OF CODED TRANSCRIPTS**	**NUMBER OF CODES**
DRIVING FACTORS TO SUPPORT OGD INITIATIVE	Source of Revenue	POTENTIAL MANAGING SERVICE REVENUE	1	1
		DIRECT REVENUE FROM CLIENTS	1	2
	Satisfaction of OGD	VERY SATISFY	1	2
		SATISFY	1	4
		NOT SATISFY	1	1
	Output by supporting OGD implementation	USE CASE OF OGD POTENTIAL VALUE	1	2
		SUCCESFULL REAL-TIME DATA PUBLISHING	1	2
		RESOLVED ICT ISSUES	2	4
		LAUNCHED OPEN DATA PROJECT	1	3
ASSISTING TO PUBLISH GOOD OGD	OGD quality	USE IT TO KNOW THE VALUE	1	2
		PASSED DATA STANDARD	1	2
	Feedback about OGD programme	PROMPT RESPONSE FOR USER'S FEEDBACK	1	3
		FEEDBACKS FOR GOVERNMENT	2	3
		FEEDBACK ABOUT OGD PLATFORM	1	3
	Challenges and obstacles on supporting OGD implementation	TECHNICAL CONSTRAINT	1	1
		NOT AWARE OF OTHER PROBLEMS	1	1
		LICENSING AND PRIVACY ISSUES	1	3
EFFORT TO SUPPORT OGD	OGD effectiveness	NOT CLOSE WITH OGD	1	1
		AUCKLAND CONCENTRIC	1	1
	Key factor to support OGD	DERIVE DATA VALUE OF SOFTWARE	1	2
	Government motivation	MINING DATA VALUE	1	1
		DERIVE BETTER VALUE	1	1
	Customers of IT companies	ORGANISATION WITHOUT SOFTWARE DEVELOPER	1	1
		ORGANISATION WITHOUT IT DEPARTMENT	1	1
		AUCKLAND TRANSPORT	1	2
		AUCKLAND COUNCIL	1	1
COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA	Work culture	CONSTANT CHANGE	1	1
	Organisation structures	EVOLVE INTO OPEN SOURCE	1	1
	Company's Guidance and Procedures	NON-DISCLOSURE AGREEMENT	1	1
		GOVERNANCE OPEN SOURCE	1	4
		ALL WORK OUTCOMES AND DATA BELONG TO CLIENTS	1	3
OGD VALUE CREATING ROLE	Participant demograph	Understanding about OGD	1	3
		Sector representation	1	1
		Current roles	1	1
		Current duties	1	3
	Key players in IT companies	LEADER IN INNOVATION AND REVENUE	2	1
		INTERIM PARTY	1	1
		DATA TEAM	1	1
	Key partners of IT companies	THIRD PARTY PROVIDER	2	4
		OPEN DATA PUBLISHING SERVICES	1	1
		KOORDINATES.COM	2	3
ICT EXPERTISE TO SUPPORT OGD PLATFORM	Tools for supporting work	NO FRAMEWORK	1	1
		LEAN CANVAS	1	2
	Supporting role	TO SUPPORT CLIENTS' PROJECTS	2	3
		SUPPORT ATLABS PROJECT	1	1
		SOFTWARE DEVELOPER	1	1
		OPENING UP DATA	1	1
		ASSIST CLIENTS WITH OPEN DATA	1	3
	Service customisation based on customer needs	SERVICE CUSTOMISATION WITH CLIENT NEEDS	1	1
		DIFFERENT APPROACH FOR START UP	1	1

Due to the extensive amount of codes, this table does not include the In Vivo coding list (from the first cycle) that generated the super codes. The codes for each sub-super category were located and decoded using the pattern codes. The subsequent phase was to examine the remaining subcategories within a category for super codes that may form emerging themes for the case study C.

The creation of super codes and new categories, as indicated in Table 5.17, was the result of the thematic analysis procedure linked to and beneficial to pattern codes. The

process was repeated with the remaining categories once a set of super codes within a sub-category had been identified and decoded using the pattern codes. Then the remaining sub-categories within a category were searched for super codes that could be later incorporated into the emerging theme; this process was repeated with the remaining categories. The following stage is to generate the themes that correspond to this final coding cluster in the second cycle, which will be complemented by analysing the results of the text query tool as seen in Figures 5-30, 5-31 and 5-32 and the Dendrogram cluster of word similarity, as seen in Figures 5-36. The new theme was given a name, described, and explained with corelated codes and transcripts.

5.5.5. Identifying Emerging Themes of the Case Study C

Applying a two-cycle analysis with iterative processes, the hierarchical structure of this qualitative coding was determined to be accurate. The coding results were tabulated and analysed to ensure that the findings were detailed enough to generate themes. By revisiting the meanings associated with each code, super code and category supported by the results of NVivo analytical tools, research questions could be appropriately addressed. The development of the following four themes for case study C was made in the same way as in case studies A and B:

Theme 1C - Competencies to provide IT support for OGD implementation
Theme 2C – Company's capabilities to explore OGD value creation
Theme 3C – Accelerating OGD release to maximise value

Detailed explanations of each theme will be provided in the following sections, with detailed descriptions backed by supporting sources such as excerpted parts of transcripts, categories and sub-categories.

5.5.5.1. Theme 1C "COMPETENCIES TO PROVIDE IT SUPPORT FOR OGD IMPLEMENTATION

Theme 1C, "Competencies to provide IT support for OGD implementation" emerged after learning the pattern of two categories OGD VALUE CREATING ROLE TO SUPPORT GOVERNMENT and ICT EXPERTISE TO SUPPORT OGD PLATFORM. This theme was elaborated as these two categories, and their respective coding hierarchies revealed that ICT skills and knowledge performed by participant-affiliated companies play a significant role in assisting the government with transforming government-held information into open data. The transformation process marked the beginning of OGD's value creation.

The tables 5.18 and 5.19 depict the coding clusters of two categories that were formed from six sub-categories and nineteen super codes that summarised participants' perspectives on how their expertise as a software developer and their role in supporting the value creation of OGD provide crucial support to government agencies deploying OGD implementation.

Table 5.18 The coding map of the category “OGD VALUE CREATING ROLE TO SUPPORT GOVERNMENT”

CATEGORY	SUB-CATEGORIES	SUPER CODES
OGD VALUE CREATING ROLE TO SUPPORT GOVERNMENT	Participant demograph	Understanding about OGD
		SHARED DATA THAT NOT COMMERCIALLY SENSITIVE
		Sector representation
		SOFTWARE DEVELOPER
		Current roles
		five years
		Current duties
		LEADER OF REVENUE AND INNOVATION
	Key players in IT companies	LEADER IN INNOVATION AND REVENUE
		INTERIM PARTY
		DATA TEAM
	Key partners of IT companies	THIRD PARTY PROVIDER
		OPEN DATA PUBLISHING SERVICES
		KOORDINATES.COM

Table 5.19 The coding map of the category “ICT EXPERTISE TO ASSIST OGD PLATFORM”

CATEGORY	SUB-CATEGORIES	SUPER CODES
ICT EXPERTISE TO ASSIST OGD PLATFORM	Tools for supporting work	NO FRAMEWORK
		LEAN CANVAS
	Supporting role	TO SUPPORT CLIENTS' PROJECTS
		SUPPORT ATLABS PROJECT
		SOFTWARE DEVELOPER
		OPENING UP DATA
		ASSIST CLIENTS WITH OPEN DATA
	Service customisation based on customer needs	SERVICE CUSTOMISATION WITH CLIENT NEEDS
		DIFFERENT APPROACH FOR START UP

The following part includes narrative quotations from the second cycle's coding results to show how the theme 1C emerged. Each truncated transcript had the participant code and response time.

OGD value creating role to support government. There are three sub-categories with nineteen super codes under this category, namely *Participant demography, Key partners of IT companies* and *Key players in IT companies*. According to the participant of the software service company, the key players were government agencies' data team and people like the participant who basically work with agencies on the open data projects:

> *"So once they go through that, I think they have their own data team that actually has established the governance process."* (PC3, 09:52)

> *"I think, at the moment, the key players are people like myself…I believe open data is already with helped set up the structure for our clients and there is up to them to go to the governance process to get data out. Well, the next phase for us, like I said, it was basically open sourcing."* (PC3, 15:41)

Another participant, PAC7, representing a local council, highlighted how two software developers were involved in getting the open data platform working despite having a data team:

> *"so we work with our IT Department... But it is this so much having brought all those together. So, we've used two parties as an interim"* (PAC7, 36:07)

Furthermore, the participant informed that the third parties involved for the open data implementation because at that time, the Council became a unitary authority through the amalgamation impacted to merged seven or eight different IT system into one:

> *"Yes. We had third party only because the council had parties with the amalgamation. To bring in, you know, seven or eight different IT systems into one."* (PAC7, 36:07)

A participant from a public service highlighted similar statement that an IT-based service company, such as Koordinates.com is the key partner that assisted the agency in open data publishing.

> "*So, we have a back-end administrator, the interface where we drag and drop data sets and fill out the metadata and can look at analytics. We buy that service from a company called Koordinates.com. So, they are in open data publishing service and you can white label their site. So, we have a ticketing system with them, almost all customer inquiries come to us and we will triage them either to our data managers …"* (PAC9, 29:24)

ICT expertise to support OGD platform. This category with its three sub-categories as shown in table 5.19, namely *Tools for supporting work*, *Supporting roles* and *Service customisation based on customer needs*, and nine super codes elaborated this theme by emphasising an IT-based company's considerable skills and knowledge. The company assists government agencies by transforming government data into open data and converting it into valuable information that can be used and re-used.

Under the subcategory *Tools for supporting work*, the participant from the IT company said that Lean canvas was the primary supporting tool for business and corporate plan management:

> *"we use Lean Canvas. Lean canvas is a very simple one page almost like a business proposal. It's just a one-pager, Lean Canvas is basically from The Lean Startup model. So, because we are software organisation, we believe in work in a very agile manner."* (PC3, 13:55)

According to the participant response under the sub category *Supporting roles*, the company's supporting roles ranging from assisting client's projects, software development and assisting open data implementation:

> "*We were trying to get the initiative called ATLabs off the ground, so you can actually find it as ATLabs."* (PC3, 02:55)
>
> *"We are a services company, so we do work for our clients. So, if our clients have no need to use that data, then we don't do that. I forgot to mention we also did work for Auckland Museum… we actually created their APIs as well."* (PC3, 07:38)
>
> *"So our role has majority making the data publicly available for other people to use. That's been our role."* (PC3, 08:59)
>
> *"We do the website, we do the platform. So, we are the software developer behind them"* (PC3; 20:42)

Concerning their role in assisting the government in publishing open data, the participant mentioned that their service was customised to government agencies and their approach to private firms was different. The information taken from the underlying data of sub-category *Service customisation based on customer needs"*:

"We do customised it, because different clients have different need. So for example, you can have clients if they're startups, their needs are going to be very different from enterprise clients. Enterprise clients will require us to follow more processes, startups will be a bit looser and actually we have to establish the process for them." (PC3, 21:50)

Theme 1C was designed based on the coding cluster and its underlying data. It examines the skills and knowledge required of participants as the main partner of government agencies to publish OGD efficiently, as well as how companies should orient themselves towards OGD to derive value from it. Figure 5-38 displays a conceptual framework for theme 1C constructed with NVivo mind mapping of the categories "OGD value creating role to support government" and "ICT expertise to support OGD platform" and their corresponding subcategories and codes. This framework gives a high-level overview of topic 1C as a starting point for generating further case study C and cross-case analysis.

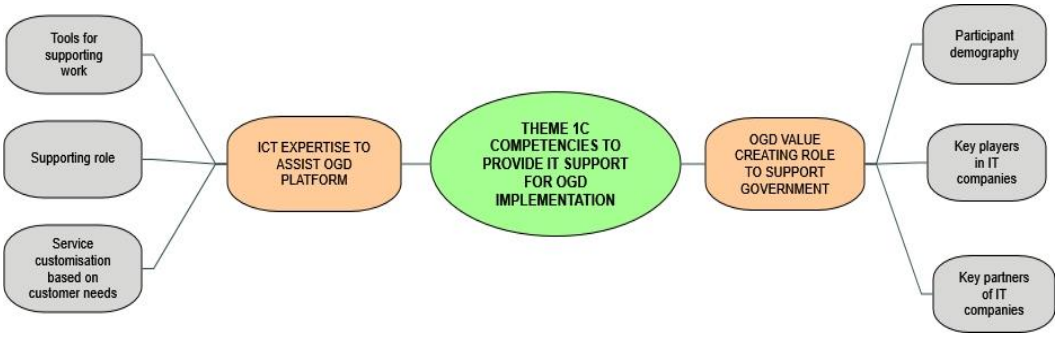


Figure 5-38 A conceptual framework of theme 1C -case study C (with NVivo Mind map)

Conclusively, illustrated by supported narrative above, a concept of theme 1C "COMPETENCIES TO PROVIDE IT SUPPORT TO GOVERNMENT' was summarised as: **By building and developing software and publishing government data, a company's Information Technology skills and knowledge assist the government in the OGD programme. It is the responsibility of IT companies to provide the government agencies with the tools they need to accomplish their jobs more efficiently and effectively in OGD implementation.**

5.5.5.2. Theme 2C "COMPANY'S CAPABILITIES TO SUPPORT OGD VALUE CREATION"

The second theme 2C resulted from two categories: "EFFORT TO SUPPORT OGD PUBLISHING" and "COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN

DATA" This occurred after running through on their coding clusters and underlying data including rereading the excerpted transcripts and the result of NVivo analytical tools that provided relevant context as the basis for developing this theme. The coding maps for the categories " EFFORT TO SUPPORT OGD PUBLISHING" and " COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA " are displayed in tables 5.20 and 5.21, respectively.

Table 5.20 The coding map of the category "EFFORT TO SUPPORT OGD PUBLISHING"

CATEGORY	SUB-CATEGORIES	SUPER CODES
EFFORT TO SUPPORT OGD PUBLISHING	OGD effectiveness	NOT CLOSE WITH OGD
		AUCKLAND CONCENTRIC
	Key factor to support OGD	DERIVE DATA VALUE WITH SOFTWARE
	Government motivation	MINING DATA VALUE
		DERIVE BETTER VALUE
	Customers of IT companies	ORGANISATION WITHOUT SOFTWARE DEVELOPER
		ORGANISATION WITHOUT IT DEPARTMENT
		AUCKLAND TRANSPORT
		AUCKLAND COUNCIL

Table 5.21 The coding map of the category " COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA"

CATEGORY	SUB-CATEGORIES	SUPER CODES
COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA	Work culture	CONSTANT CHANGE
	Organisation structures	EVOLVE INTO OPEN SOURCE
	Company's Guidance and Procedures	NON-DISCLOSURE AGREEMENT
		GOVERNANCE OPEN SOURCE
		ALL WORK OUTCOMES AND DATA BELONG TO CLIENTS

Effort to support OGD publishing. This category was determined by the participants' opinions regarding the success of OGD in creating value for users, the key factors of an IT company to support the government in implementing OGD, the government's motivation to publish data, and how the company dealt with its customers/clients.

According to the participant response as the underlying data of the sub-category *Key factors to support OGD*, the use of software to derive data value is the primary reason the company assisted the government in publishing OGD. They knew OGD value based on perspective as a software developer:

> *"For us is whether it's valuable or not, that's the main thing. You have to be able to derive value from it. So, if we were the decision-makers about making data…we understand the values of data in the use of software."* (PC3, 16:20)

In line with above, government motivation to open data highlighted by the participant as to share any data they have, so that public can use it and receive greater benefit from it. This feedback excerpted from the transcript as the source for the sub-category *Government motivation*:

> *"our client is basically government based. They have their motivation will be to share whatever data they've got, for, you know, the better good for other people to use it and derive better value from it."* (PC3, 10:43)

> *"I think ideally they should use it first and then make it available. Because then they know there is you sooner, but I also know that there is a huge drive and just making data available."* (PC3, 11:04)

The participant also explored the experiences of public and their perspectives on the effectiveness of OGD under sub-category *OGD effectiveness*:

> *"Because I know Auckland very well, so I know it from Auckland's perspective. The data I'm referring to is very Auckland concentric, but that's not to say that it should be made available for the rest of New Zealand if is interested."* (PC3, 18:13)

According to the sub-category *Customer of IT companies*, most of participants' clients/customers are government agencies:

> *"Our customers are other organizations that typically don't have their own it departments or they don't have their own software developers so they would come to us to prepare software services like to build a platform for them." (PC3, 14:57)*

Company's strategy to develop software for open data. This category comprised super codes and sub-categories about the company's policies and procedures, organisational structure, and work culture, which were used to develop a strategic plan to assist the government with the OGD programme. Considering that the company's role is to provide technical support for OGD implementation, the participant asserted that the

guidelines meant that the client chose which data to be opened and that all work outcomes belonged to the client:

> *"when we work for our clients, we make it very clear that whatever we do belongs to our clients. Again, we're software services, so we don't own our API. The API belongs to a client; they pay for it."* (PC3, 22:35)

> *"For us as I said, again, because we do work for our clients, public doesn't see us. Yeah, public doesn't realise it's [the company's name]."* (PC3, 22:35)

Participant discussed the implementation of the OGD's guidance and procedures. They maintained a record of their policies to facilitate the publication of OGD and increase its re-use.

Following Figure 5-39 is a conceptual framework for theme 2C that was created with NVivo mind mapping and content analysis of the categories "COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA" and "EFFORT TO SUPPORT OGD PUBLISHING" along with their subcategories and codes. The framework demonstrates the thematic coding, revealing how IT companies enhance their capabilities to support the government by adopting software service strategy and efforts in publishing OGD

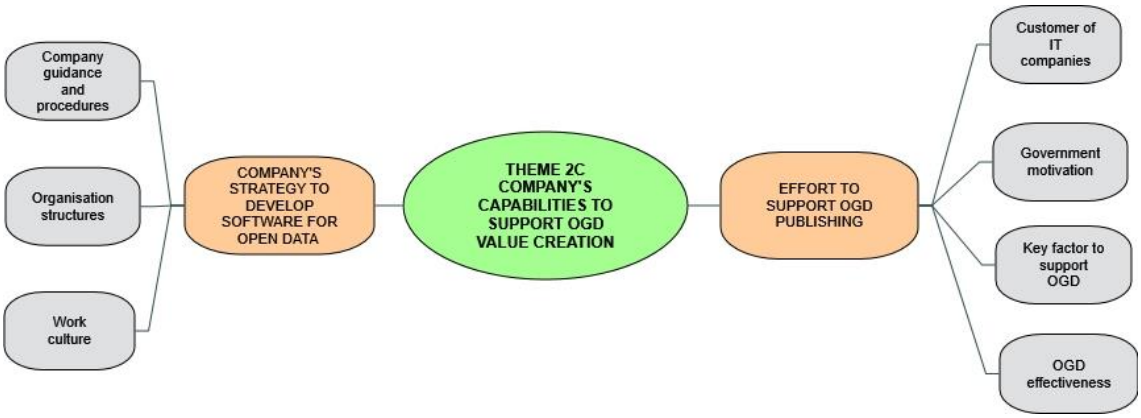


Figure 5-39 A conceptual framework of theme 2C - case study C (with NVivo Mind map)

Given the points above, Concepts of theme 2C, "COMPANY'S CAPABILITIES TO SUPPORT OGD VALUE CREATION ", were summed up as: **The IT company's technology and data analytic capabilities have helped to implement OGD across government agencies, leading to improved data transparency and sharing between agencies and the public. The company is also partnering with**

government agencies to help them better understand and process data, assisting government agencies to realise their data analytics potential.

5.5.5.3. Theme 3C "ACCELERATING OGD RELEASE TO MAXIMISE VALUE"

This theme developed as a participant perspective on the high contribution of IT companies to the OGD initiative, which is assisting government agencies in transforming government data into valuable open data. Tables 5.22 and 5.23 show the coding maps of two categories and their underlying data. This sub section discusses how the theme emerged from the category "ASSISTING TO PUBLISH GOOD OGD" and 'DRIVING FACTOR TO SUPPORT OGD INITIATIVE". The company's efforts to accelerate the OGD programme were built on building collaboration across government. This partnership, in turn, helped to improve the quality of service and efficiency of the OGD programme.

Table 5.22 The coding map of the category "ASSISTING TO PUBLISH GOOD OGD"

CATEGORY	SUB-CATEGORIES	SUPER CODES
ASSISTING TO PUBLISH GOOD OGD	OGD quality	USE IT TO KNOW THE VALUE
		PASSED DATA STANDARD
	Feedback about OGD programme	PROMPT RESPONSE FOR USER'S FEEDBACK
		FEEDBACKS FOR GOVERNMENT
		FEEDBACK ABOUT OGD PLATFORM
	Challenges and obstacles on supporting OGD implementation	TECHNICAL CONSTRAINT
		NOT AWARE OF OTHER PROBLEMS
		LICENSING AND PRIVACY ISSUES
	Tools for supporting work	NO FRAMEWORK
		LEAN CANVAS
	Supporting role	TO SUPPORT CLIENTS' PROJECTS
		SUPPORT ATLABS PROJECT
		SOFTWARE DEVELOPER
		OPENING UP DATA
		ASSIST CLIENTS WITH OPEN DATA
	Service customisation based on customer needs	SERVICE CUSTOMISATION WITH CLIENT NEEDS
		DIFFERENT APPROACH FOR START UP

Table 5.23 The coding map of the category "DRIVING FACTORS TO SUPPORT OGD INITIATIVE"

CATEGORY	SUB-CATEGORIES	SUPER CODES
DRIVING FACTORS TO SUPPORT OGD INITIATIVE	Source of Revenue	POTENTIAL MANAGING SERVICE REVENUE
		DIRECT REVENUE FROM CLIENTS
	Satisfaction of OGD	VERY SATISFY
		SATISFY
		NOT SATISFY
	output by supporting OGD implementation	USE CASE OF OGD POTENTIAL VALUE
		SUCCESFULL REAL-TIME DATA PUBLISHING
		RESOLVED ICT ISSUES
		LAUNCHED OPEN DATA POJECT

Assisting to publish good OGD. This category built this theme because the meaning taken from its six sub-categories and 17 super codes described the participants perspectives deal with obstacles and challenges and publishing good data when assisted OGD programme. Thus, the software developer helps the government meet the standards for publishing good OGD. One of important criteria for good OGD is defined by Open Data Institute as data that easily shareable, accessible in a standard format, and consistently available throughout time[30].

Concerning data quality as the critical aspect in OGD elaborated in the sub-category *OGD quality*, a participant highlighted that quality can be known either by using it before available to the public or got feedback from users after published:

> *"Yeah. Quality of data could be also a problem. But until people use it, you don't know if the quality is good or not. So, either use it yourself and you know, whether the quality is good or not, or you make it publicly available so that people use it and then they can provide feedback. And then we can go, Hey, this is not right. You know, instead of trying to focus on making things right before you make it available, if you pass the legal and privacy barrier,*

[30] https://theodi.org/article/what-makes-data-open/ Last accessed Mar 2022

you should just make it then people can start giving you feedback." (PC3, 12:07)

Under the sub-category *Feedback about OGD programme*, participant PAC9, affiliated with the public service department, provides feedback on how a software developer assisted government agencies with publishing open data. The software developer was a highly proactive and helpful partner, mainly when issues arose due to the uncontrollable user experience of open data:

"*It's a bit more difficult when you use software as a service, we're not necessarily control of that user experience side of our product, which is can be very frustrating to be honest, but koordinates.com, we works as a partnership. So, they're very proactive about helping us in that respect.* (PAC9,31:22)

Having experiences assisted government agencies in open data projects, the participants provided feedback that API's should be made public and OGD platform might be built into an open source model:

"Government from our perspective should always be helping seed Innovation, but they should not be trying to hold on to it because it's public money. Whatever API you've got out there should be made publicly available" (PC3, 02:55)

"Where we want to look at what government initiatives that is happening where platforms are being built. That perhaps could actually go into an open source model" (PC3, 02:55)

Under sub-category *Challenges and obstacles in supporting OGD implementation*, Participants indicated facing licencing and privacy challenges and technological constraints when worked with the agencies to publish OGD:

"Sometimes yes, the licensing issues with the data and we have to be, again rely heavily on people within that organisation to know about that." (PC3, 23:15)

"So one of the key technical constraints is that sometimes you can make data open in a public API, but the public API the way the API holes are being

formed, if no one has thought about it, it's not scalable, it's not usable." (PC3, 04:50)

Participants were unaware of additional issues, likely because they were preoccupied with preparing the Open data platform for data publication.

> *"I come from a tender for building software. I don't come from a different view, or maybe I'm not aware of what the other problem statements might be."* (PC3, 17:45)

Driving factors to support OGD initiative. Based on three sub-categories and nine super codes that supported this category, the IT company's objectives to assist OGD implementation range from revenue source, earning credibility by supporting successful open data projects and satisfaction with the results of OGD. Under the sub-category *Source of revenue*, one of the participants noted that revenue by providing service to clients certainly become the one of the main reasons to support OGD initiative.

> *"We're not a product company, we're a software service company. It just directs revenue from our clients."* (PC3, 23:54)

Another potential revenue related to OGD is managing platform service.

> *"We would still be doing service, but we'll do maybe managed Services. Because again a lot of our work actually with government organisations, and we believe with the drive of open sourcing, we don't believe in holding on IP*" (PC3, 24:27)

Participation in successful open data projects and direct assistance in resolving ICT issues, as reported by participants, represent a significant outcome from OGD implementation. These experiences extracted from sub-category *Outcome in supporting OGD implementation*, create the driving force behind OGD initiative support:

> *"We passed the technical platform related stuff back to coordinates. And they are either resolved the issue or explained why things are like that."* (PAC9, 29:24)

> *"we were very much involved with putting the API manager out in AT and also getting the trying. We worked very hard to get the real-time information out publicly available."* (PC3, 00:53)

"Majority of our work is to assure the API manager that we do for them." (PC3, 09:52)

Referring the sub-category *Satisfaction with OGD*, the degree of satisfaction with OGD is one factor for IT companies to measure their contribution with supporting OGD. One participant said satisfied as agencies published much data, has tangible use, has mutual benefit with users and might be useful for the data scientists:

"Yes, very much data." (PC3, 02:13)

"…by sharing the information, they can actually have mutual benefits.… a lot of siloed initiatives, so the whole point of open data is to bring together, …instead of duplication of similar data, you're actually have a shared platform for where all the data lives" (PC3: 27:31)

"So for me, open data has to come with some tangible use in the first place. If there has been no tangible use as just data for the sake of data, it may not be so useful. I could be wrong because I know there's a lot of data scientists out there. And so maybe open data just in itself is going to be very useful for them." (PC3, 04:50)

As shown in Figure 5-40, a conceptual framework for theme 3C was created by conducting NVivo mind mapping and content analysis of the categories "DRIVING FACTORS TO SUPPORT OGD INITIATIVE" and "ASSISTING TO PUBLISH GOOD OGD" as well as their sub-categories and super codes. The framework compressed thematic coding into consolidated representations to facilitate the case study analysis.

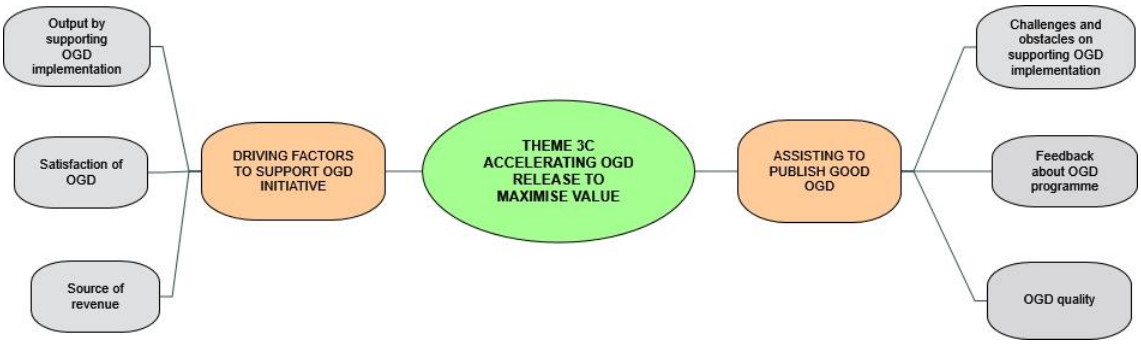


Figure 5-40 A conceptual framework of theme 3C - case study C (with NVivo Mind map)

Summarising the relevant facts presented above, the concept of Theme 3C "ACCELERATING OGD RELEASE TO MAXIMISE VALUE" is **how the IT companies**

maximise the value of OGD by accelerating the release of data, ensuring it is of the best quality and accessible to the maximum number of people. OGD release not only accelerates the pace of data value creation, but also ensures data is fit for purpose.

5.5.6. Thematic map of Case study C

Figure 5-41 shows the thematic map for case study C, which investigates IT companies-linked participants using thematic coding to construct three themes. The thematic map displays huge coding data. It reveals trends and correlations among themes, categories, and subcategories to understand case study's findings.

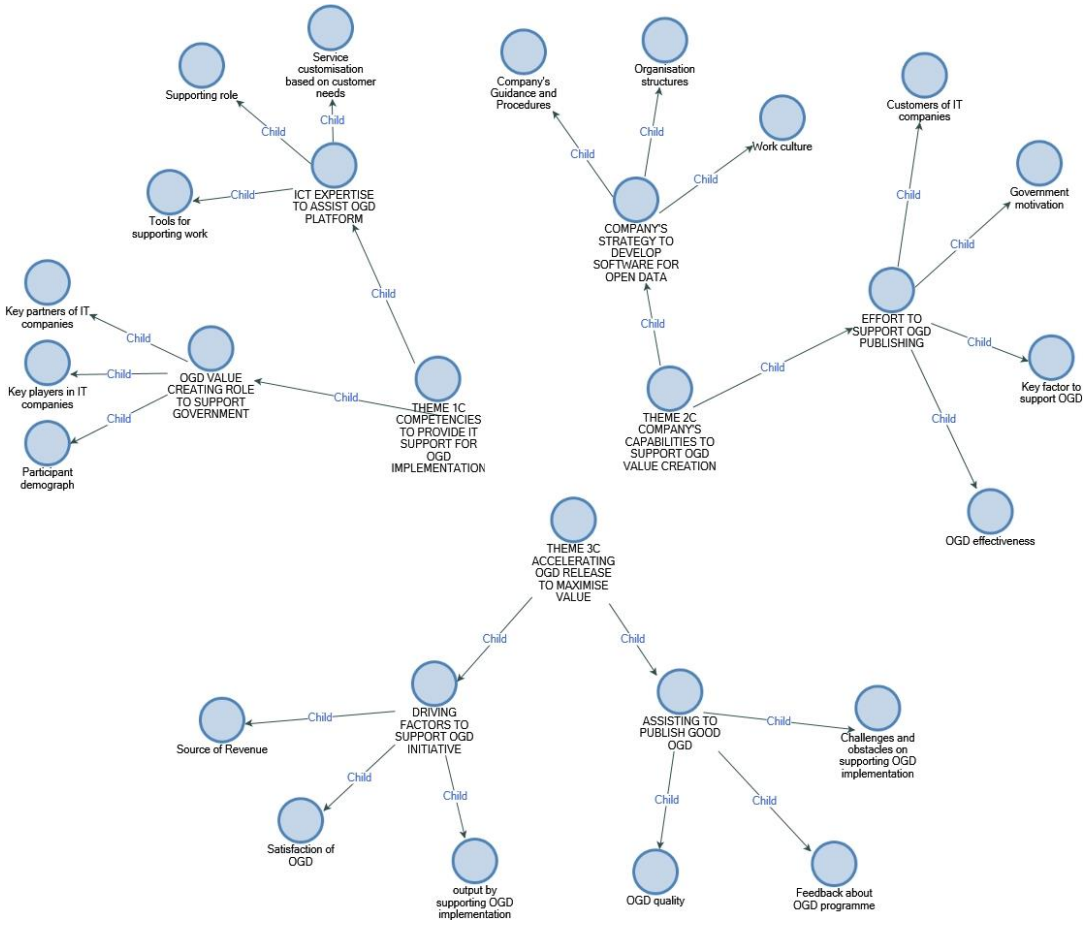


Figure 5-41 A Thematic map of case study C - IT companies

The three themes help this study's understanding of the pattern from the thematic coding analysis of this case study and serve as a fundamental point for the multiple case study

analysis. The first theme, theme 1C, highlights that a company's Information Technology skills and knowledge benefit the OGD programme by creating and developing software and releasing government data. In OGD implementation, IT firms must equip government agencies with the necessary tools to perform their duties more efficiently and effectively. The linked categories show the IT companies' value-creating roles and help government agencies transform data into open and reusable.

Theme 2C node highlights how the IT company's technology and data analytics helped integrate OGD across government agencies, improving data transparency and sharing. The two connected categories describe the company's collaboration with government agencies to help them evaluate and manage data and reach their data analytics potential. The third theme, theme 3B, explains how IT companies maximise OGD by increasing the availability of high-quality and accessible data. The categories associated with the theme node verify that OGD release promotes data value creation and ensures data quality.

As indicated, the thematic map provided an insightful and comprehensive view of the coding hierarchy for case study C by visualising the interconnection across the IT companies' capacities, people's competencies, and OGD value accelerations. The map provided a holistic understanding of the findings of case study C, which will be helpful in the cross-case analysis.

5.6. Cross-case analysis

This section synthesises the three case study analyses by conducting cross-case analysis. According to Yin (2014), this analysis highlights common relationships across three case studies and whether the case study's themes and thematic hierarchies surrounding one case study may be replicated. The cross-case analysis can help generalise explanations from individual cases because it identifies commonalities and differences across cases (Stake, 2006) and characteristics related to the participant's organisations being studied.

As described in section 5.1, the cross-case analysis consists of the third and fourth cycles to mobilise thematic maps from three case studies. The third cycle investigates the commonalities and relationship between the thematic maps of three case studies. The fourth cycle consisted of performing source triangulation by comparing empirical thematic data to secondary data and conducting a final check by identifying multi-case

study themes, logic model of OGD and a value creating role framework to provide answers to research questions RQ1 and RQ2 and develop essential frameworks and concepts adopted into the design of the ecosystem business model.

5.6.1. Third cycle: binding concept of themes and case study relationships

All the cases discussed until this point have accumulated a range of exploration from organisations and participants over a variety of topics with open government data initiatives, which has provided this study with a comprehensive empirical multi cases.

The three case studies show that the multi-case study method provides a multi-perspective of research problems. Each case study resulted thematic map of themes in coding hierarchies. This stage, all the case studies' themes collected to learn the interconnection to build frame works and logic models. Organised themes may elaborate from those themes. Figure 5-42 depicts the thematic map containing all the themes and codes of three case studies. Each case study concentrated on issues that comprised the OGD interconnection supply and demand pattern acted upon by government agencies and DDOs with the involvement of IT firms. Reading the visualisation map reveals that each case study has emerged-theme similarities: first, elaborated organisation capacities and capabilities; second, examined people competencies to cope with OGD; and finally, described strategy aspects of exploiting OGD value. The case study of data-driven organisations emphasised one distinction theme, theme 4B, by describing how they adopted active cooperation and partnerships to highlight the potential value of OGD.

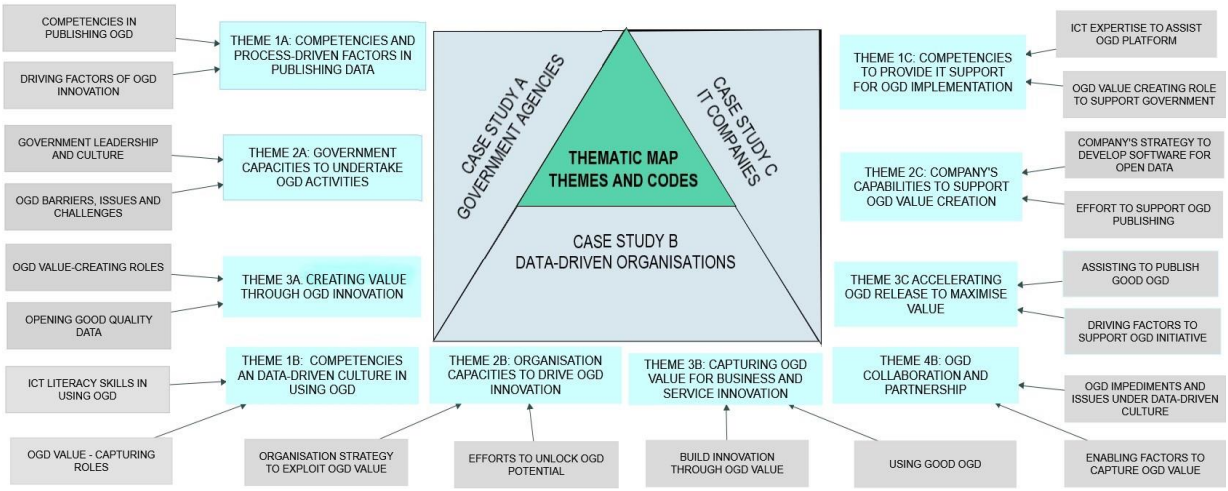


Figure 5-42 Thematic map with themes and codes of three case studies

Figure 5-43 depicts a comparison matrix for themes 1A, 1B, and 1C, illustrative of the relationships between themes and the data supporting each theme. For case study A, government agencies opened data intending to facilitate user data discovery, then DDOs aggregated open data with their internal data. This practice was also tied to a supporting data in case study C, which described how IT companies assisted the government in establishing an open data platform so that data may be published by government agencies and utilised by data-driven companies as the users.

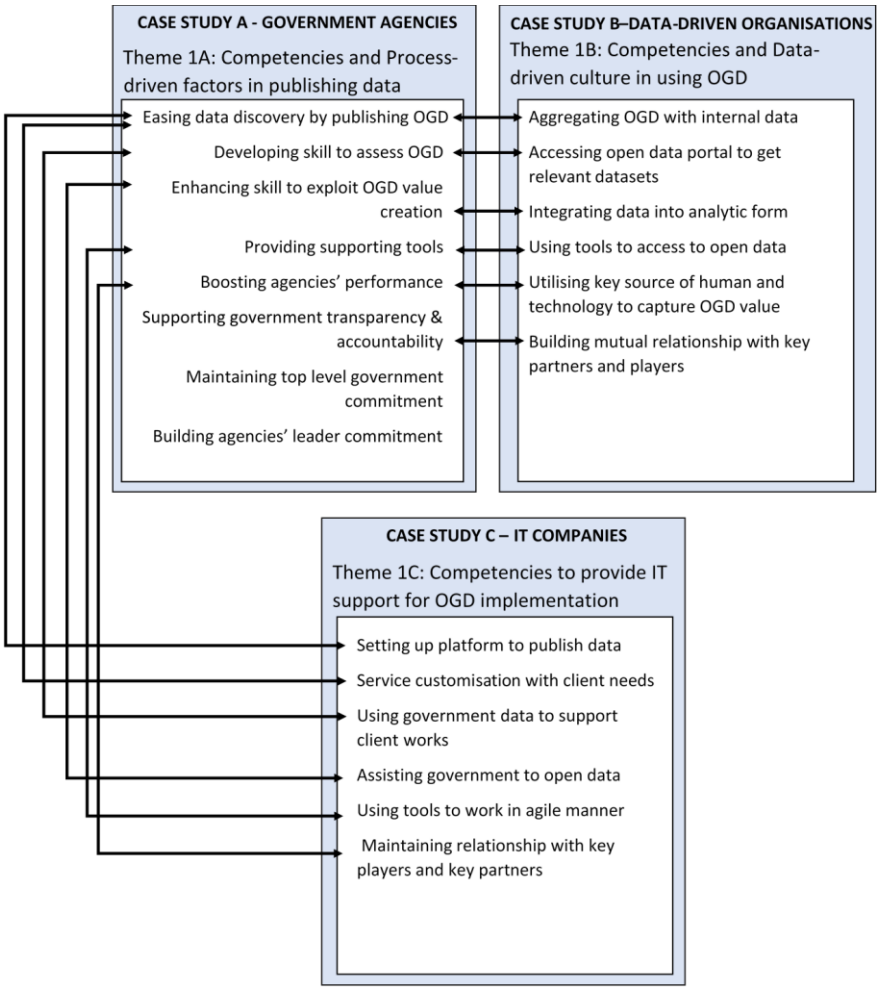


Figure 5-43 Comparison matrix of themes 1A, 1B and 1C

A further correlation between these three themes shows that to develop OGD value, agencies possessed their skills and expertise in opening data with assistance from IT companies, as the maximum value of data can only be extracted by making it public in a usable manner. The relationship was also connected to theme 1B, as DDOs captured the value by integrating data into an analytic format. With this type of interlinking, government agencies as supply-side actors become more adept at releasing data, hence

boosting the capacity of open data portals to publish demand-requested datasets. The connected process among supporting tools for the government (theme 1A), tools to access data for the DDOs (theme 1B) and tools for IT companies (theme 1C) formed an interrelated meaning in how integration of tools, application and software needed by them to support their roles in OGD. Supporting tools such as database, design and planning, and software package tools were necessary for government agencies in OGD initiative. On the other hand, agile work tools were essential for IT companies to support open data projects, while tools for automatic processing, Postgres database, and R statistical analysis were used for data-driven firms to access open data.

Case study A and B in dealing with human capital and technology capabilities have in common interpretation for themes 1A and 1B to boost OGD and capture the value. However, there are supporting data of theme 1A with no relevancy or similarity with themes 1B and 1C: commitments from top level government and agency's leaders to create awareness and motivate agencies to share data routinely. Because these process-driven abilities for OGD programme were established internally across government agencies.

In addition, the relevancy of themes 2A, 2B, and 2C was displayed in Figure 5-44 as a comparison matrix of supporting data for these themes. These themes had in common in developing an organisation's capacity and capabilities in relation to the OGD programme. According to supporting data, the government established its capacity to publish data in accordance with the open data principle. On the demand side of theme 2B, data-driven companies with a strategy to adopt a data analytic process captured OGD value for generating new business or meeting client's needs. There was further supporting data from theme 2A that was related to this data in theme 2B, which included processes and recommendations for data granularity standard, privacy data standard, user interaction management, and IT activities. These two-supporting data for theme 2A were also related to a supporting data for theme 2C in terms of how IT companies used guidelines and procedures to develop software for supporting OGD and non-disclosure agreements with clients.

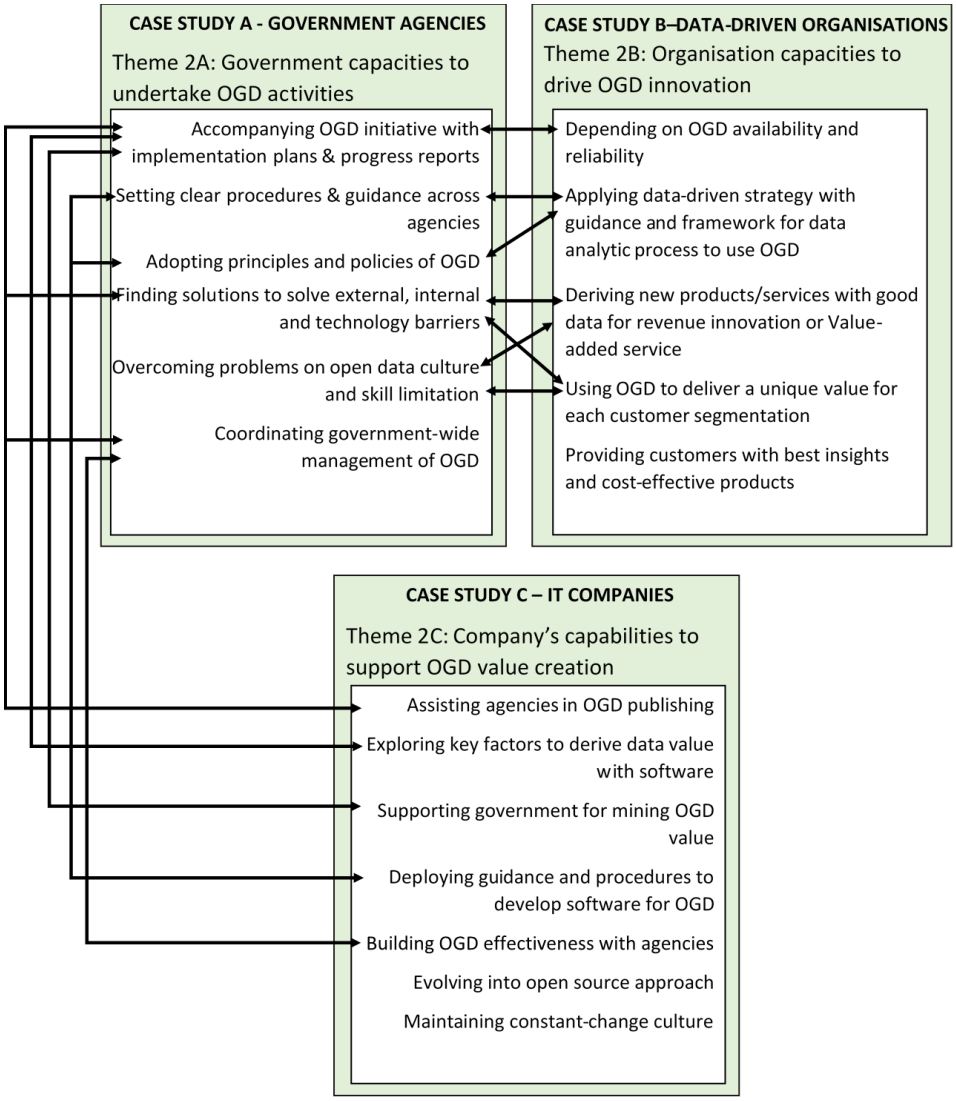


Figure 5-44 Comparison matrix of themes 2A, 2B and 2C

Another supporting data for theme 2A indicated that OGD implementation relies on the government's ability to resolve agency data culture issues. The data associated with theme 2B enabled users to extract benefits and develop new products/services through the usage of OGD. How government agencies discovered and overcame obstacles were also outlined in theme 2A's supporting data, which influenced the innovative approach to expose OGD value as indicated in theme 2B. This relationship was also tied to the data of theme 2C since IT firms assisted agencies with the OGD release.

Despite the interrelation meaning of themes, each theme had stand-alone data such as government coordination for OGD management in theme 2A, how data-driven firms served their customers with cost-effective products as noted in theme 2B and how IT companies retained their culture and evolved into the open-source approach.

The final comparison matrix is represented in Figure 5-45, illustrating the connections between themes 3A, 3B, and 3C. Theme 3A depicted the government's primary responsibility to create OGD value through innovation, whereas theme 3B highlighted how DDOs capture OGD value to achieve their enterprises' revenue and service innovation goals.

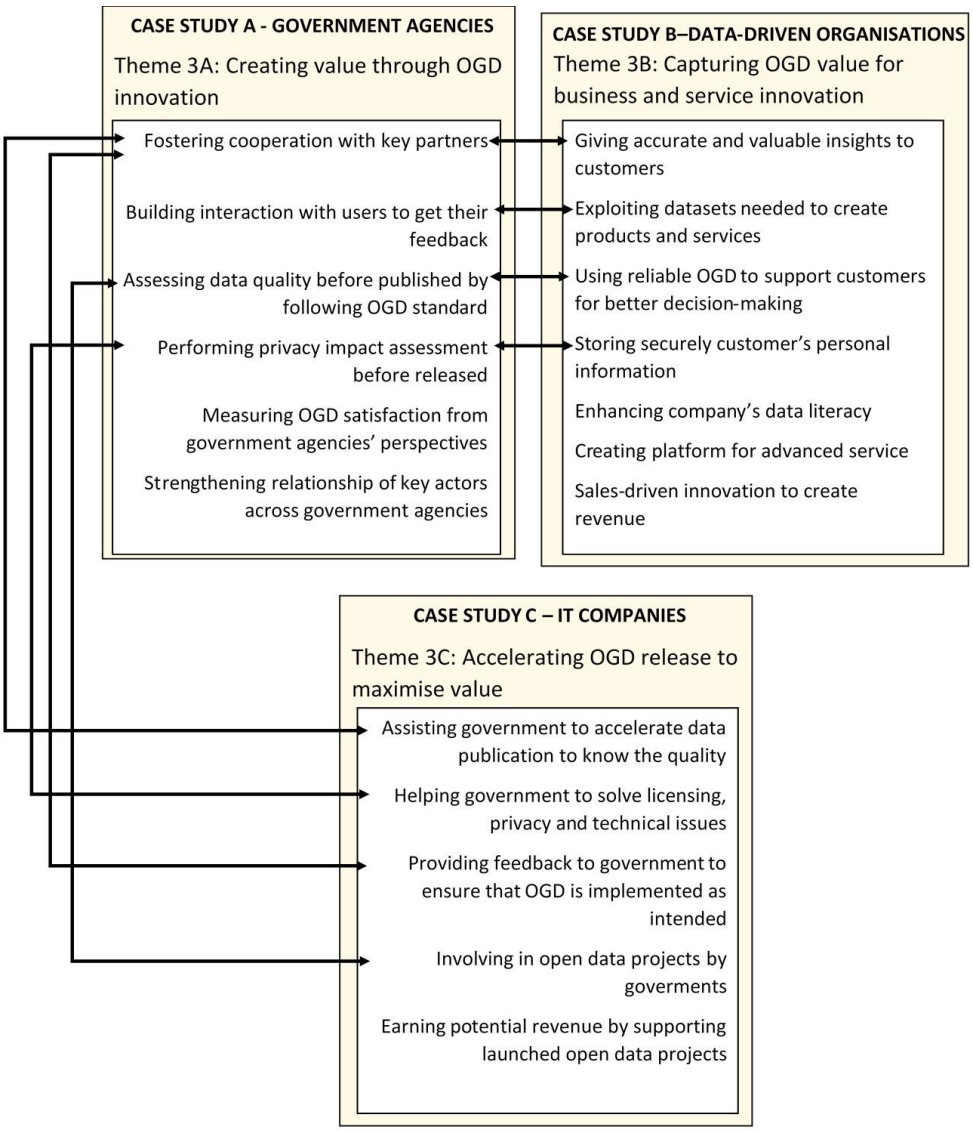


Figure 5-45 Comparison matrix of themes 3A, 3B and 3C

Theme 3C described the key contribution of IT companies to speedier OGD delivery. The similarities between these themes will be investigated in how each theme's supporting material formed a coherent concept or stood alone. The supporting data of theme 3A about the expansion of government agencies' collaboration with key partners

had a favourable impact on users, as mentioned in theme 3B, by providing their clients with accurate and pertinent insights.

On the other hand, one connected line from theme 3C's supporting data highlighted the role of IT businesses in supporting OGD programme, which was also linked to theme B's data. In addition, three additional supporting data of theme 3A connected to theme 3B revealed government efforts to produce OGD value by encouraging user involvement, evaluating data quality before publication, and undertaking privacy assessment prior to release. Those data were connected to theme B's supporting data because they pertained to how data-driven firms can exploit datasets to create benefits, use reliable datasets to serve their consumers, and protect their customers' personal information. These connections also required cooperation from IT companies; hence, links to theme C arose as a result of the involvement of IT companies in open data projects and their assistance to the government in addressing licensing, privacy, and technical issues. Despite the relevance of these themes, each theme contained supporting data that was unconnected to the others. These data elaborated the internal strategies of organisations concerning their efforts to create value and gain the benefits of OGD.

In summary, even though themes had commonalities and relationships in comprehending participants' organisations to open and use data, common themes could not be merged to simplify different case study themes becoming multiple case study's themes. Because the organisations, actors and roles for the supply and demand sides of OGD differed, and because their contributions to the OGD ecosystem occurred at a distinct phase, the supply and demand sides do not constitute a single ecosystem.

5.6.2. Fourth cycle: a synthesis of the multiple case study

As the final phase of the cross-case analysis, the fourth cycle aims to present findings and inferences in response to research questions RQ1 and RQ2 and provide crucial frameworks for building ecosystem business models. This fourth cycle consisted of conducting triangulation, conducting a complete review by identifying multi-case study themes, developing a logic model of OGD and a value-creating role framework in order to provide answers to research questions RQ1 and RQ2, as well as developing concepts adopted in the design of the ecosystem business model.

5.6.2.1. Case studies' triangulation

Triangulation is an excellent research approach for evaluating the consistency of findings by comparing it to data from two or more sources and validating hypotheses (Myers, 2013; Stake, 1995; Yin, 2014). Triangulation of sources is carried out in this section by comparing the empirical thematic analysis of the multiple case study to secondary data gathered from government and company websites and digital documents and literature review.

A. Data source triangulation to compare the thematic analysis with secondary data for clarifying the government agencies' efforts to open more data regularly

Focusing on Figure 5-30, which depicted the thematic map of all case studies and the thematic map presented in each section for case studies, the New Zealand OGD initiative established an approach to proactively publish data because the best way to increase the use of OGD is to open data. Data quality should not be the only factor considered when opting to publish data. According to the participants' responses in three case studies, agencies decided to open more data with the assumption that as long as the data are sufficient to assist users in making decisions and creating new products and services, they should be released unless there is a risk of bad decisions being made.

This empirical synthesis based on thematic coding result elaborated from participants' transcripts across themes and categories as follows:

1. Participants feedback of theme 1A 'Competencies and process-driven abilities in publishing OGD', under category 'Competencies in publishing OGD' noted

   "*So we're just formed a basically an overview board composed of senior council officers <u>to speed up and make more proactive the release of data</u> to regularise it."* (PA1, 14:23)

   "They collected such data, and <u>we are about making it more available</u>, …" (PAB8, 40:16)

   Taken from category 'Driving factors of OGD innovation' elaborated, several transcripts elaborated

   "The best way to increase the use of open data is <u>to release open data</u>." (PA1, 10:53)

"…means is a lot of people come to our website and then we can monetize the back for the advertising purposes." (PA6, 28:22)

"So, I suppose we're not actively promoting, we are passively promoting it, but <u>we still have it make it widely available as possible</u>" (PAB8, 19:36)

2. Theme 2A 'Government capacities to undertake OGD activities' that based on category 'Government leadership and culture' provided parts of participant's transcripts that clearly stated that:

   "So, we try to make it a go that <u>it is open and easily accessible</u>," (PAB8, 45:51)

3. Participants linked with DDOs as users contributed information regarding their interactions with government agencies. The transcripts coded as supporting data for theme 2B 'Organisation capacities to drive OGD innovation' under the category 'Efforts to unlock OGD potential', revealed that they might access government agency data for free:

   " …open data would be <u>to give it away to anybody who asked for it</u>." (PB6, 12:06)

4. According to participants from IT companies, when involved in an open data project, government agencies strongly motivated to open data. It contained under theme 3C 'Accelerating OGD release to maximising value' for category 'Assisting to publish good OGD':

   "… I also know that <u>there is a huge drive for just making data available</u>." (PC3, 11:04)

In addition, to address concerns regarding the validity of the synthesis on how the government prioritised opening data, a data source triangulation was performed by comparing and verifying the findings with dataset increments released on the open data portal (data.govt.nz). Screenshots of data.govt.nz are displayed in Figures 5-46,5-47, and 5-48 to illustrate the number of datasets published throughout 2018 and 2022.

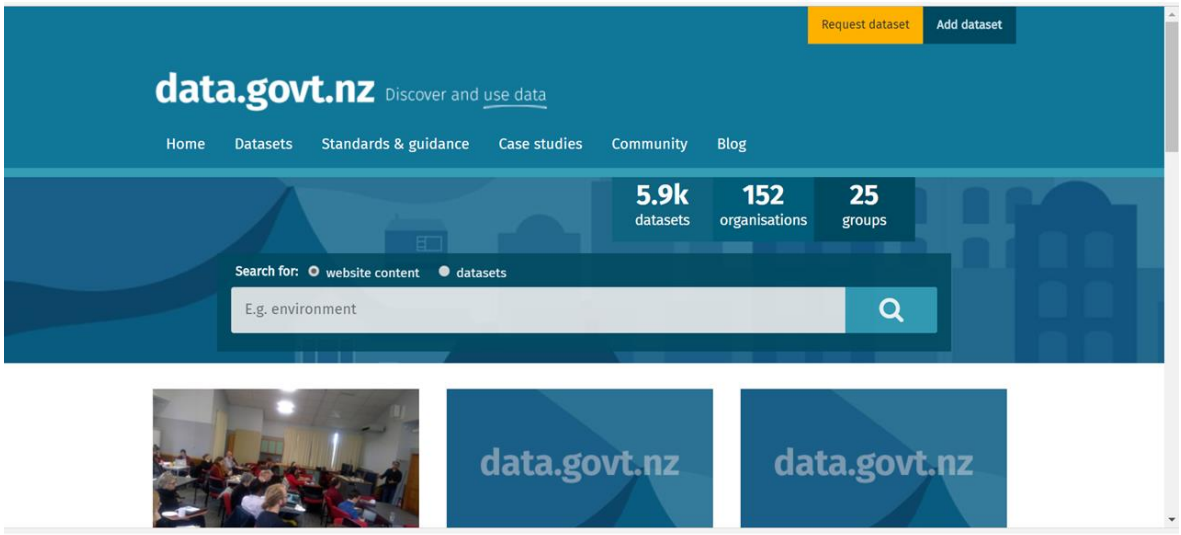


Figure 5-46 A screen capture of data.govt.nz taken in August 2018 published 5.9 K datasets

Open data site -data.govt.nz- published more than 5,900 datasets provided by 152 public agencies from 25 groups in August 2018, as shown in Figure 5-46. While in Figure 5-47, the number of datasets available to the public in June 2021 was about 28,600. The datasets significantly increased quadrupled compared to the number of available datasets in 2018. Additionally, the number of agencies sharing datasets increased for 24 agencies.

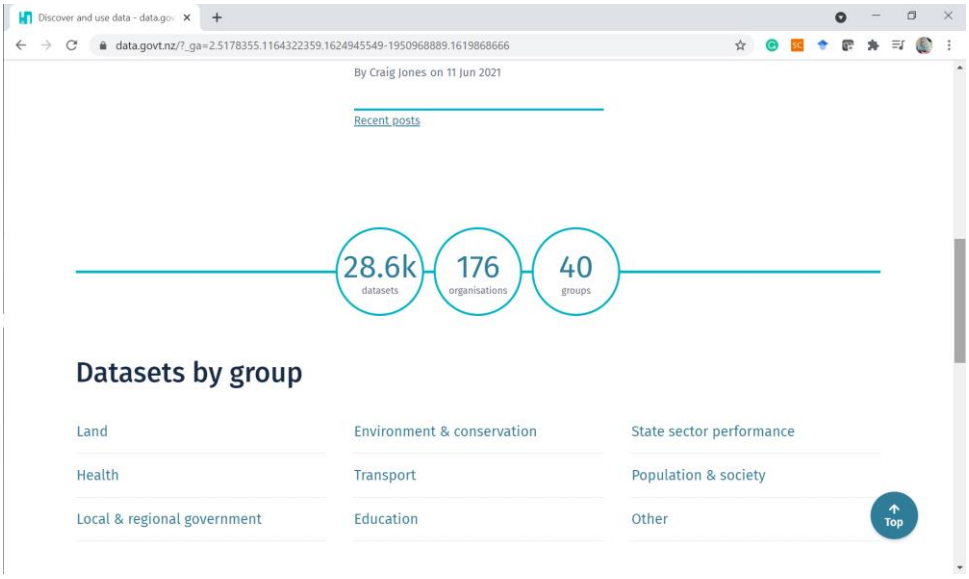


Figure 5-47 A screen capture of data.govt.nz taken in June 2021 published 28.6 K datasets

In addition, Figure 5-48 demonstrates that there were over 31,000 datasets accessible through the open data portal in January 2022, an increase of 2,400 datasets within seven months. These numbers strengthen the construct validity of empirical findings from multiple case study analyses with secondary data from screenshots describing how actively the government published datasets over nearly four years and encouraged more agencies to participate in this OGD programme.

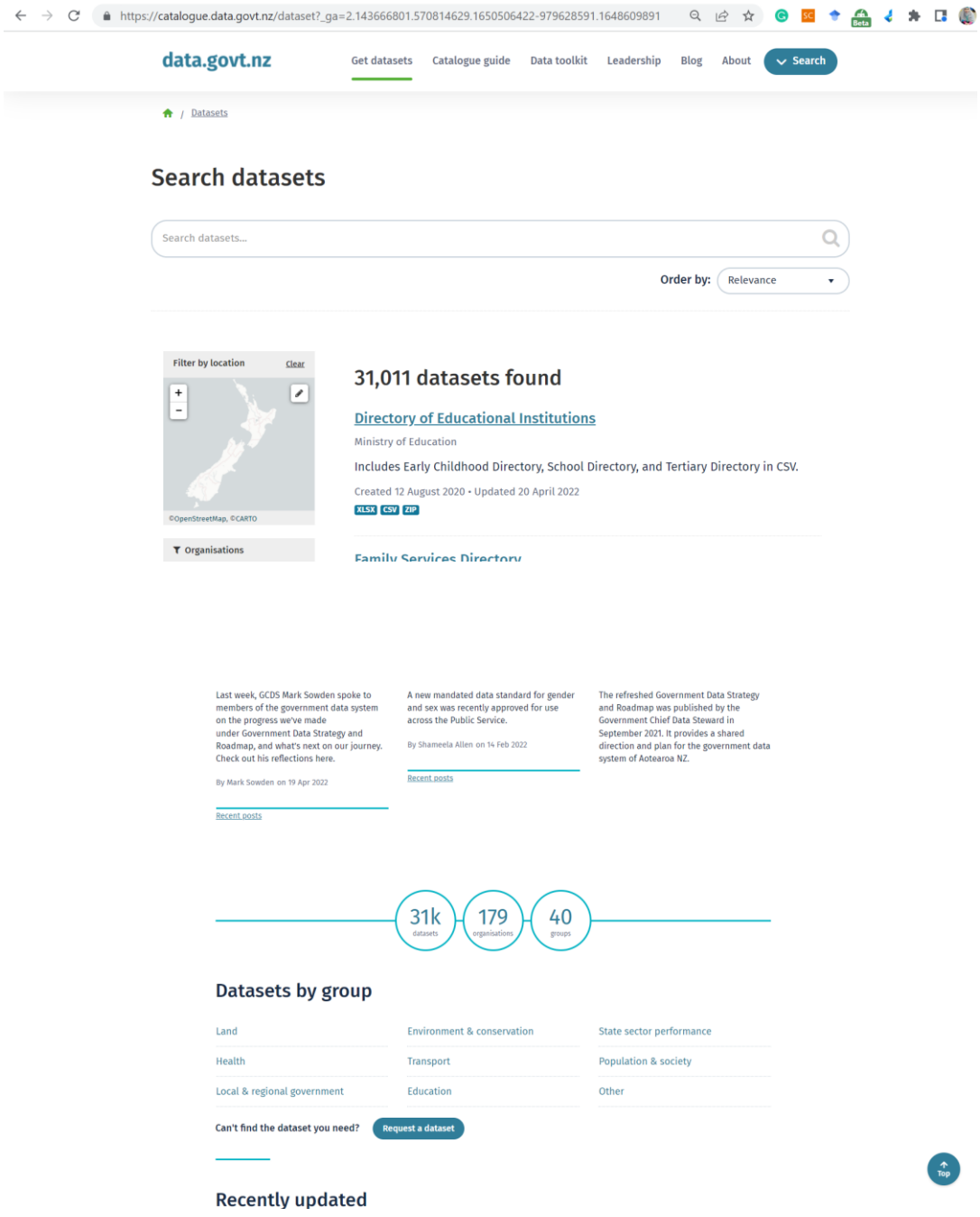


Figure 5-48 A screen capture of data.govt.nz taken in January 2022 published 31K datasets

B. Data source triangulation to determine construct validity of the thematic findings about a procedure for users to request datasets

According to the thematic findings of the case studies, one of the objectives of the New Zealand government to open their data is to prioritise users' demands regarding their requests for government data. However, before the users were interested in the request, they had to be aware that the government intended to release their government-held data. The most significant themes are the ability to evaluate OGD readiness and progress, to evaluate OGD quality and applicability, to successfully exploit data's potential value and an understanding of the nature and value of data. Capabilities in outreach and user engagement, as well as cultivating favourable relationships with OGD actors. With this form of interlinking, government agencies as supply-side entities become more proficient at increasing open data portals' capacity to publish datasets and managing data demand from variety of user types. Therefore, when users are asked which datasets they used and requested, they must be able to submit their requests effectively. The participants of the data-driven firms highlighted that they requested more datasets to be made available at the open data portal to have greater access to data so that they could essentially assist in raising user awareness. In addition, agreements from government and agency officials were to raise awareness and inspire agencies to share data frequently because these process driven OGD program components were built internally across government entities.

The cross-case analysis performed a data triangulation between the thematic map of three case studies and the secondary data of a procedure for requesting datasets through the open data portal data.govt.nz. Table 5.24 shows the thematic map of three case studies about how public/users requested data.

Table 5.24 The thematic map of three case studies about how users/public requested data

THEME 1A COMPETENCIES AND PROCESS-DRIVEN FACTORS IN PUBLISHING DATA	Category : DRIVING FACTORS OF OGD INNOVATION	
	Sub category : People's Awareness	
	Super code: THROUGH WEBSITE, MEDIA AND ADVERTISING	Super code: ACTIVELY APPROACH PUBLIC
	Code : Different communication channels	Code: what data people want
	Excerpt transcript: "*because there are <u>different communication channels</u> that Council has that we could promote through like our [the city's website]. So, you know, it could be promoted through there.*" (PAB8, 20:28)	Excerpt transcript: "*Thing is, it's not just about the uses for existing data, it's <u>what data people want / what problems they want to solve</u>*" (PA2. Text A.6)
	Sub category: OGD contribution to government	
	Super code: IMPROVE ADMINISTRATIVE PROCESSES	
	Code: save a lot of administrative burden	
	Excerpt transcript: "*Their operational benefits, so we <u>can reject official information requests if we have already opened the data</u>, so that <u>saves us a lot of administrative burden</u>*" (PA1, 38:11)	
THEME 2A GOVERNMENT CAPACITIES TO UNDERTAKE OGD ACTIVITIES	Category: OGD BARRIERS,ISSUES AND CHALLENGES	
	Sub category: Barriers and concerns on publishing OGD	
	Super code: IMPEDIMENTS WITHIN AGENCIES	
	Code: more people are looking when data published	
	Excerpt transcript: *"To be honest, releasing data is the best way to improve data quality because <u>more people are looking at</u> then tell you what's wrong with it."* (PA1, 17:18)	
THEME 2B ORGANISATION CAPACITIES TO DRIVE OGD INNOVATION	Category: EFFORTS TO UNLOCK OGD POTENTIAL	
	Sub category: Objectives to use OGD	
	Super code : TO GET FREE GOVERNMENT DATA	
	Code: Open government give it to anybody who asked for it	
	Excerpt transcript: "*you know, the honourable and the right and open government thing to do would be to give it away to anybody who asked for it.*" (PB6, 12:06)	

Based on the thematic findings of participants linked with government agencies and DDOs, as indicated in table 5.24, three themes elaborated on five aspects to entice the public to capture, use, and request their preferred OGD. First, contact consumers through various communication channels, such as government agency websites, the open data portal data.govt.nz, community meetups, and hackathons. Second, actively engage the audience to determine the types of datasets they desire and the problems they wish to solve. Third, establish a transparent data request mechanism to reduce administrative work. Fourth, the agencies were able to publish as much open data as feasible without disregarding the data quality standard by releasing as much open data as possible. The final step is to perform data management to provide datasets to anyone who requests them.

The theme findings of the case studies will be triangulated with the 'request datasets' function on the open data portal data.govt.nz to study how government agencies created procedures to handle datasets requests. Figure 5-49 visualises the screenshot of the

portal page of the data requests. It is recommended that users who intend to request datasets from government agencies visit data.govt.nz for the agency's response to be automatically published on that portal. Anyone can get datasets by entering keywords to locate the necessary datasets in the catalogue. If they cannot find it, they can complete an online form to seek non-personal, non-secure government data. The request will be reviewed and forwarded to the appropriate agency that likely possesses the data, which will then respond online. The agency that owns a dataset will determine whether or not to disclose the data. The individual must complete the online request form by giving the title of the data request, the data description and formats, the problems that will be solved by accessing the desired data, the likely source agency, and their name and email address. All information other than the individual's name and email address will be made public so that others can view the data request.

Anyone who accesses the portal can view the requests depicted in Figure 5-49, which are arranged in chronological sequence. Each request includes information on the data's title, description and preferred format, date of creation, date of notification/response by the government agency that owns the datasets (source agency), and the name of the agency that responded to the request.

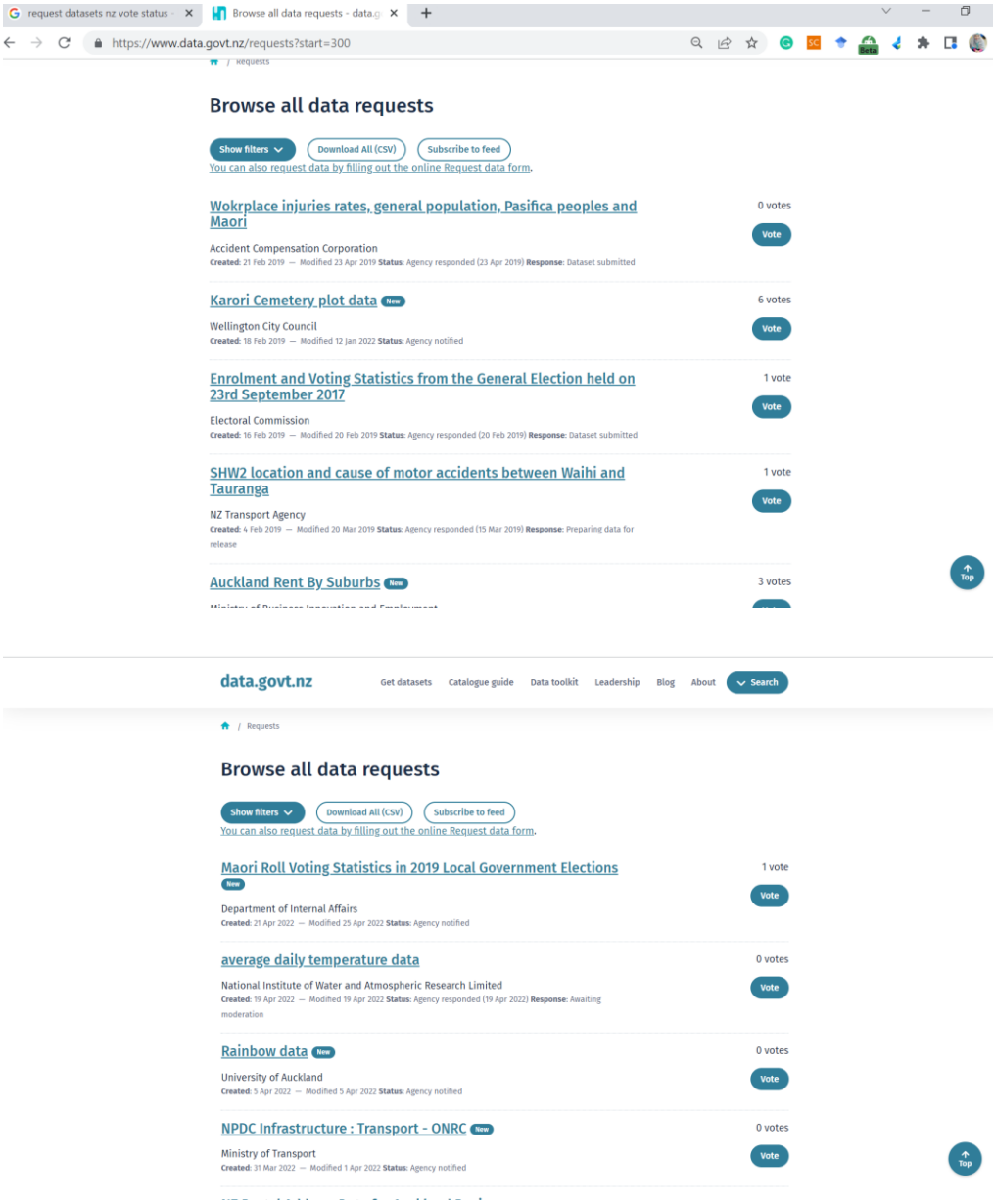
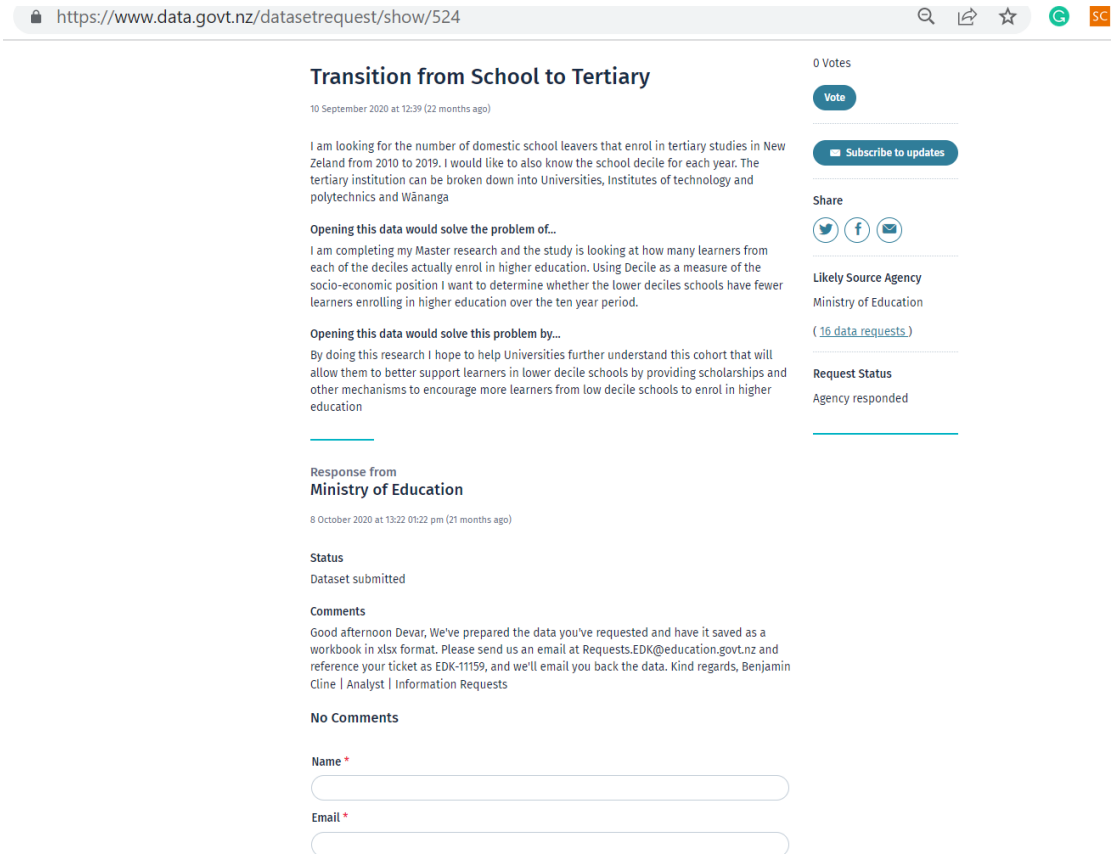


Figure 5-49 Screenshot of the “all data requests” page of open data portal data.govt.nz

As an example of the specific information that the public can view in response to a data request, Figure 5-50 depicts a master's student's request for data regarding the 2010-2019 tertiary entrants from New Zealand's domestic high schools.



https://www.data.govt.nz/datasetrequest/show/524

Transition from School to Tertiary

10 September 2020 at 12:39 (22 months ago)

I am looking for the number of domestic school leavers that enrol in tertiary studies in New Zeland from 2010 to 2019. I would like to also know the school decile for each year. The tertiary institution can be broken down into Universities, Institutes of technology and polytechnics and Wānanga

Opening this data would solve the problem of...

I am completing my Master research and the study is looking at how many learners from each of the deciles actually enrol in higher education. Using Decile as a measure of the socio-economic position I want to determine whether the lower deciles schools have fewer learners enrolling in higher education over the ten year period.

Opening this data would solve this problem by...

By doing this research I hope to help Universities further understand this cohort that will allow them to better support learners in lower decile schools by providing scholarships and other mechanisms to encourage more learners from low decile schools to enrol in higher education

Response from
Ministry of Education

8 October 2020 at 13:22 01:22 pm (21 months ago)

Status

Dataset submitted

Comments

Good afternoon Devar, We've prepared the data you've requested and have it saved as a workbook in xlsx format. Please send us an email at Requests.EDK@education.govt.nz and reference your ticket as EDK-11159, and we'll email you back the data. Kind regards, Benjamin Cline | Analyst | Information Requests

No Comments

Name *

Email *

0 Votes

Vote

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Likely Source Agency

Ministry of Education

(16 data requests)

Request Status

Agency responded

Figure 5-50 A screen capture of the detailed information of one data request

The requester indicated that the data would solve the problem of determining the relationship between low-decile schools and fewer students enrolled in higher education within a specified time frame. The request was made on 10 September 2020, and the Ministry of Education responded within a month. The notifying agency provided the needed information. Probably due to the request for an Excel file – which is not a typical format for OGD – the datasets were not published through the site. Instead of giving through email to the requestor. Other requests that prefer standard open data format such as CSV, RDF or XML published by the source agencies were included in the datasets catalogue. Nevertheless, agencies could not promise that all requests would be approved. Reviewing the list of data requests revealed that the majority received responses within one month. However, the agency notified some of the requests' status, but no more feedback was received.

In summary, by conducting the data triangulation in this last cycle, the cross-case analysis of the multiple case study on the New Zealand government's Open Government Data (OGD) program has revealed several themes. The most significant themes are the

ability to evaluate OGD readiness and progress, to successfully exploit data's potential value and understand the nature and value of data. Based on the secondary data, open data portal data.govt.nz has been triangulated with the 'request datasets' function on the open data portal to study how government agencies handle public requests for datasets. Users can get datasets by entering keywords to locate the necessary datasets in the catalogue. If they cannot find it, they can complete a form to seek non-personal, non-secure government data. The request will be reviewed and forwarded to the appropriate agency that likely possesses the data, which will then respond online. Each request includes the data's title, description and preferred format. Reviewing the list of data requests revealed that the majority received responses within one month. Other requests that prefer standard open data formats such as CSV, RDF or XML were included in the catalogue.

C. Theory triangulation for the case study B about the organisation capacities and competencies with a framework of Open data competitive capability for data-driven organisations

The goal of this theory triangulation is to examine the case study themes on DDOs and their capacities and competencies for open data competitiveness using the framework of open data competitive capability indicated in Figure 2-8.

Zeleti and Ojo (2017) developed this framework that encompasses four crucial areas and activities that add value. The framework describes how data-driven organisations can become familiar with the areas in which they need to plan and establish a strong picture and actionable foundation for leveraging OGD-related sources and capabilities to boost their competitiveness.

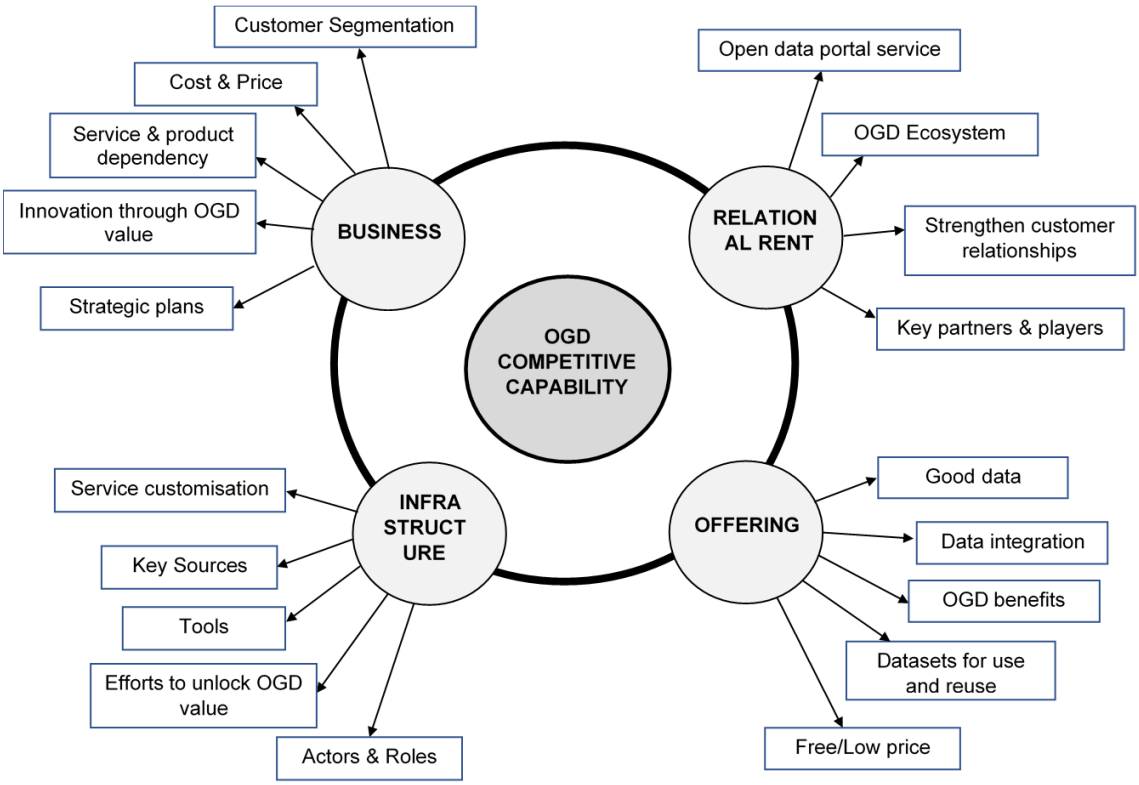

Figure 5-51 A Competitive capability framework for data-driven organisations using OGD. Adapted from Figure 2-8 (Zeleti & Ojo, 2017)

Four capabilities in the context of OGD are presented in the framework as Business, Infrastructure, Offering and Relational rent (Zeleti & Ojo, 2017). Figure 5-51 visualises the framework elaborated from the thematic cluster of case study B and the conceptual frameworks of themes as presented in Figures 5-17, 5-18, 5-19 and 5-20, that investigated DDOs as the users of OGD. Based on themes 1B, 2B, 3B and 4B including analysis on their coding clusters such as categories, supercodes and codes, the capabilities can be explained as follows:

1. The business capability aligns customer requirements and usage patterns with data-driven companies' capabilities. Core competency is built on the organisation's strengths and resources in long-term business planning (Zeleti & Ojo, 2017). The business plan involves developing and executing a plan or set of tactics to assure the company's sustainability by capturing and using OGD to make strategic decisions and enhance its operation. The case study's thematic analysis resulted six factors that included in this capability:
   - *Customer segmentation*. Customer segmentation is recognising and comprehending individuals or companies who/that consume business's products

and services. Customer segmentation for data-driven firms entails leveraging public data to determine who utilises their products and services and how. This allows businesses to determine their present consumers and whom they should seek to attract and service.

- *Cost and price*. As a result of the expense expended for using and integrating free OGD with other data, data-driven companies offered their consumers cost-effective products or even free, at no price, because the services aimed to provide good customer service. It was anticipated that the cost of utilising OGD would be minimal compared to its value. Data-driven businesses indicated that exploiting open data for their services produced revenue, and the possibility of obtaining data for free was a benefit to reducing cost.
- *Service and product dependency.* Integrating their data with OGD enables data-driven businesses to give innovative services and products to their customers. Some of these services and products were made by integrating their data with OGD, while others were created using proprietary data sets.
- *Innovation through OGD value.* Integrating their data with OGD enables data-driven firms to give innovative services and products to their customers. Some of these services and products were made by integrating their data with OGD, while others were created using proprietary data sets.
- Strategic *plans.* This is a plan developed by data-driven companies to direct their business operations. A data-driven business strategy is a collection of goals and directions that help them to exploit OGD value. A strategy plan often considers what customers/clients want and how they intend to fulfil their desires, such as defining customer segmentation and enhancing organisation capacities to drive innovation.

2. The Infrastructure capability area develops how data-driven firms elaborate their database and data analytic infrastructure, skilled humans and supporting analytic tools to in line with the organisation's motivation and objectives to use OGD. The case study's thematic analysis identified five factors for this capability:
   - *Service customisation.* DDOs developed service customisation to provide innovative products and services to meet customer needs. The use of OGD, such as traffic, property and public space datasets, was captured as a new product and value-added service for customers.
   - *Key sources.* Data-driven firms can create product/service innovation by integrating their data and OGD because of key sources such as skilled humans,

online database system and meaningful datasets. Human skill was one source that machines or robots could not replace.

- *Tools*. Tools and software available to assist companies in data extraction, analysis, management data and business planning.
- *Efforts to unlock OGD value*. Data-driven firm's efforts to unlock OGD value were triggered by motivation, objectives and desired outcomes in using OGD. The motivation to use OGD was to get early and regular data, free data and easily accessible datasets published through the open data portal and accessed online database system. On the other hand, the objectives to exploit OGD were to get free datasets, add data value in different ways, and simplify the company's insight to customers. In comparison, the company's desired outcome by capturing OGD was to aggregate GOGD with their data to create revenue and derive new services.
- *Actors and roles*. The government agencies create and deliver the OGD value, while DDOs capture and use the created value; IT developers and intermediaries could facilitate this collaboration. To create and capture value simultaneously, organisations must understand the roles of all OGD ecosystem actors. Therefore, actors must be involved in the earliest stages of ecosystem formation to enable value creation and capture in OGD ecosystems. Every actor has a role and is connected to others (Teece, 2010; Ubaldi, 2013). Interaction between actors of DDOs promotes and accelerates organisational learning by capturing and using data value.

3. Implementing the Offering capability, data-driven firms may describe that OGD used to create innovative products and services is in its best form and can be delivered quickly to customers (Zeleti & Ojo, 2017). This strategy ensures the data's quality. This capability includes five factors that investigated from the case study's theme analysis:
   - *Good data*. Data-driven firms can facilitate various innovative uses and enhance the quality of life of customers and the community because government agencies publish good data to serve the public better. The Open Data Institute defines “good”

OGD as easily shareable, accessible, and consistent data[31]. OGD is a crucial infrastructure for users to access information and services.

- *Data integration*. The process of combining data from multiple sources into a single dataset is known as data integration. Data-driven firms combined OGD with their data to develop products or value-added services. Data integration is crucial to the success of both public and private organisations in the information era.
- *OGD benefit.* The benefits of OGD allow data-driven firms to increase sales-driven innovation and create a platform for service innovation. The service may not generate revenue through sales, but rather by connecting users, sellers, and buyers for brand endorsements and supporting customer's needs. OGD benefits are not only income and service enhancements but also to improve the data literacy of users.
- *Datasets for use and reuse.* Data-driven organisations use and request different kind of datasets, such as datasets of statistics, geospatial, transport, investment, and datasets from local councils about property sales and city imagery. Open government datasets are made publicly available at the open data portal for more than 31K datasets for anyone to use and re-purpose. The government adopts Creative Common License to grant public permission for using data. They intend to migrate to Open Knowledge's CC BY license which allows re-distribution and re-use as long as the original creator is credited. Governments use this standard to open data.
- *Free/low price.* As data-driven companies obtain datasets for free, they can give cost-effective products and services to clients, even for free, as a complimentary for their customers and the public. On the other hand, the price of their products and services might be complex to define because they need to calculate the cost of exploiting the data, such as the database system, data analytic tools, and human capital.

[31] https://theodi.org/article/what-makes-data-open/ Last accessed Mar 2022

4. Firm groups that need the relational rent capability are considered an inter-organisational network that produces a mutual relationship between linked companies. Group-affiliated organisations that are members of a cross-network can combine and trade their specific data and capabilities and improve their productivity. IGI global defines relational rent as a higher return jointly earned in an exchange partnership that can only be created by the distinctive joint contributions of the alliance parties [32]. The term is usually related to the value creation process of networked organisations. This capacity contains four factors based on case study's thematic analysis:
   - *Open data portal service.* The open data portal is the primary point of interaction among open government data providers, the public, users, IT infomediaries, and intermediaries to access OGD. The Open Data Portal is a web-based platform that allows anyone to access government data. If the organisations cannot locate the datasets they require, they can request the data transparently through the portal.
   - *OGD Ecosystem.* Open government data ecosystem facilitates collaboration among providers, users, intermediaries, and other stakeholders through the following mechanisms: making previously inaccessible data available to the public, providing portals for people to discover data, and enabling users to locate, access, and work with data.
   - *Strengthen customer relationships.* Integrating OGD with other data to provide insights for customer business reasons leads to the priceless strengthening of customer relationships. With reliable data, the companies might provide their customers with information to assist them in making more informed decisions.
   - *Key partners and players.* The OGD's key partners were classified as government agencies contributing data, clients, and IT developers who established mutually beneficial relationships during the value creation and capture process. The key players are those inside the company, such as the top leader, Chief of Data, and

[32] https://www.igi-global.com/dictionary/relational-rent/24961#:~:text=1.,of%20the%20specific%20alliance%20partners.

IT team, who helped set up the infrastructure for their clients, and it is their responsibility to go through the data governance process.

As a final review, the framework delineates a perspective and a practical foundation for designing ecosystem business models. This framework enables this multiple case study analysis to clearly outline the competitive positions of data-driven companies concerning the open data they capture and utilise. As highlighted in the case study B, the DDOs have two key capabilities: data-driven strategy, which involves using data and analytics to make strategic decisions, and data-driven operations, which involves using data and analytics to enhance the performance of operations.

5.6.2.2. The multiple case study's themes

Following the three triangulation processes to evaluate the consistency of findings to come with the multiple case study final analysis, I elaborate new themes to complement the existing themes resulting from the three case study's thematic coding analysis, as seen in Figure 5.30. The new themes emerge based on examination of the key points presented from the triangulation process as follows:

a. Thematic analysis resulted that open data is the best way to enhance the use of government data; hence the New Zealand OGD project devised a strategy for proactive data publication. Data quality should not be the only consideration when deciding to publish data. By triangulating secondary data of the screenshots of the open data portal describing the consistency with which the government uploaded the number of datasets four times over nearly four years and by encouraging more agencies to engage in this OGD program. It determined the size of the OGD programme.
b. According to the main results of the case studies, one of the goals of the New Zealand government in releasing their data is to prioritise user requests for government data. The findings triangulated with the feature "request datasets" in the open data portal (data.govt.nz) that every request is transparent. Anyone who visits the page can see request updates. The data-owning agency usually responded within a month, although some requests took months or received no response.
c. Examining case studies on DDOs and their open data competitiveness using the framework in figure 2-8 explains how data-driven firms may plan and build a solid basis for exploiting OGD-related sources and capabilities to increase their

competitiveness. Case study B shows that DDOs use data and analytics to make strategic decisions and to improve operations.

d. OGD ecosystem encourages collaboration among suppliers, users, intermediaries, and other stakeholders by making previously inaccessible data available to the public and giving portals to discover data. The OGD's key partners were data-contributing government agencies, clients, and IT developers who formed mutually beneficial connections during value development and capture. The data governance process is the duty of the company's top leader, Chief of Data, and IT team, who helped put up the client infrastructure.

As a result, two new themes elaborate in the fourth cycle for the multiple case study analysis:

- **Theme 1D: Strengthening a network of interrelationships and communications among different OGD actors.** This theme elaborates given that OGD value can be created, delivered, and captured through the government agencies' and data-driven companies' motivation and objectives, strategic plans, and capabilities, taking into account all sources and fostering excellent partnerships with all actors in an integrated network.
- **Theme 2D: Building OGD ecosystem to leverage organisations' competitive capabilities.** This theme was derived from an analysis that the network of OGD implementation must emphasise the roles of actors associated with their organisations' capabilities supported by technology. The OGD ecosystem approach helps to understand dynamic connections across actors and their affiliated organisations and to share the network's successes and failures of the OGD initiative.

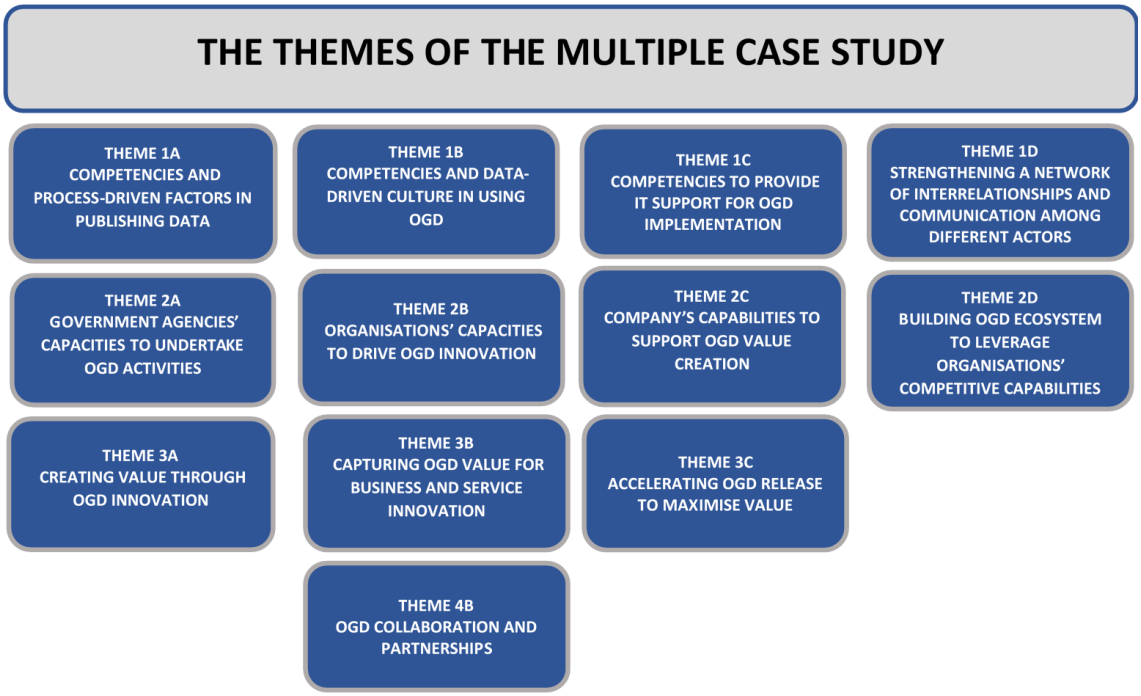

Figure 5-52 The Multiple case study's themes

Finally, Figure 5-52 presents the multiple case study's themes. The two themes that emerged from the cross-case analysis bond the themes of the three case studies that were analysed from the primary data. Themes from coding analysis of participant transcripts from case studies A, B, and C were formed based on the empirical investigation of how each organisation dealt with OGD implementation. The last two themes connect the case studies' themes to establish an inter-organisational network in building the OGD ecosystem.

5.6.2.3. Addressing Research Question RQ1

This section presents a further interpretation of the themes and their coding hierarchies that resulted from the in-depth investigation of the findings to address research question RQ1 "*What are the value-creating roles played by different actors in Open Government Data and data-driven organisations?*". An in-depth analysis is conducted of the multiple case study findings and the thematic maps from all of the case studies to relate these findings back to research question 1 stated in the section 1.3.

According to the multiple case study analysis, nearly all aspects of the OGD initiative depend on how government agencies open data to create value and how data-driven firms capture the created value to reap the benefits. Consequently, the network across organisations and actors is comprised of their interdependent resources, competencies,

capabilities, and activities; The idea that actors exchange value within OGD network in interrelational responsibilities. An OGD ecosystem needs to clearly specify how government agencies as the data provider and publisher conduct the value creation process and how data-driven companies as the users conduct the value capture process.Therefore, the answer for research question RQ1 is not only explain about value-creating roles of the government agencies but also value-capturing roles of the DDOs.

As a preliminary study related to this topic, I have published a research paper identifying the fundamental elements that influence or are influenced by value creation from the perspective of OGD actors with value-creating roles. The paper "*Value-creating Roles Played by the Actors in Open Government Data: A Systematic Literature Review*" was presented at Australasian Conference on Information Systems (ACIS) in 2020 and published at ACIS 2020 proceedings under AIS eLibrary https://aisel-aisnet-org.ezproxy.aut.ac.nz/acis2020/14/. Based on a systematic literature review of 18 published papers, the study analysed value-creating roles, actor empowerment, and OGD impediments to highlight their importance by identifying key value creation and co-creation roles, actors, and operational contexts. The findings of the qualititave meta-synthesis approach indicate that the value-creating roles of the OGD ecosystem actors initiate the value co-creation required to transform data value into social and economic benefits for stakeholders as a result of the efforts of all actors and the government's dedication to OGD initiatives. This is evidenced by the requirement for value co-creation to convert data value into social and economic benefits for stakeholders.

According to Mokobombang et al. (2020, p. 6), value-creating roles was defined as "*those actor-related activities within the OGD initiative which focus explicitly on creating, exploiting and delivering OGD value, through a data process that aims to provide social and economic benefit*". Each case study resulted a thematic coding cluster to investigate OGD actors, their roles and responsibilities. Table 5.25 presents the meta-synthesis result of who are actors and what their roles and responsibilities. The result was extracted from the theme maps and coding hierarchies. The mapping of theme 3A identified actors linked to the government agencies' roles, whereas the mapping of theme 1B defined actors and roles with data-driven firms, and the mapping of theme 1C identified actors and their roles from IT companies. The actors and roles matrix as visualise in table 5.25 as follows:

1. Government agencies is the key actors because they have the most role in OGD implementation. They have a role as *data producer* with the responsibility to conduct data procurement and maintain data quality.
2. There may be different *data managers* and *data owners* for a government agency. Aerial imagery data, for instance, has *a data owner* and *a data manager*. *A data owner* is responsible for the data's acquisition, arrangement, and justification, regardless of whether it must be released. *A data manager* is accountable for data quality and manages an internal self-publishing process.
3. The government entities serve as *Data curators* as well. While a Data manager is responsible for the initial phase of the data life cycle, *a Data curator* is responsible for the last phase. Before release through the open portal or agency websites, *the data curator* is responsible for analysing and finalising datasets in compliance with OGD principles for making data more valuable. The data curator role is also applied to the DDOs. A data curator for the firm is crucial in ensuring that the captured data is accurate and up-to-date before making it accessible to the companies. Activities of the data curator are responsible for data cleaning to monitor that the curation process is complete and accurate, as well as for harvesting and managing big data sets to turn that data into valuable and actionable information. This role is also responsible for creating metadata to enhance the usefulness of the data.
4. Another role for the government agencies, such as Stat NZ, is a *data advocate*. It accomplished this through developing networks of users, mediating relationships between government and users and advocating for the release of data to aim for transparency and benefit for the public.
5. Considering the culture-shifting to 'open by default' is the main concern, each government agency was motivated to nominate *a data champion* to lead open data release in their organisations, usually a senior manager. *The Data champion network* was the person in-charge by serving as the agency entry point and ensuring proper engagement to publish data.
6. *A data publisher* is the government's primary role in OGD implementation because an essential process for creating OGD value that users may capture. *The data publisher* and data curator collaborate to open code enforcement data and manage the open data portal. The Department of Internal Affairs operates the open data portal data.govt.nz, which houses the OGD catalogue. While most government agencies have their websites, it was simpler for them to contribute to the centralised registry than to manage their own.

Table 5.25 Metasynthesis summary of actors and roles in the OGD initiative based on the thematic coding analysis

ACTORS	ROLES	RESPONSIBILITIES	CASE STUDY A			CASE STUDY B				CASE STUDY C		
			Theme 1A	Theme 2 A	Theme 3A	Theme 1B	Theme 2B	Theme 3B	Theme 4B	Theme 1C	Theme 2C	Theme 3C
Government agencies	Data Producer	Responsible for data procurement and quality			■	■						
senior managers with knowledge of the organisation	Data Champion Network	A champion for the culture change within the government			■							
OGD official leaders	Chief Data steward	Encouraging the use of data throughout government & improving services for public			■							
Ministry of Internal Affairs	Data publisher	Opening code enforcement data and managing open data portal data.govt.nz			■							
Government agencies	Data owner	- Making sure strategic ideas based on government needs in procuring, organising, justifying, and publishing data.			■	■						
Government agencies	Data manager	- Overseeing OGD management - Maintaining data quality and running an internal self-publishing process.			■							
Government agencies	Data Curator - government	Making data more usable and valuable with upholding OGD principles			■							
Government agencies	Data advocate	- As a liaison between OGD users and government agencies - Approaching OGD transparency and benefit for public			■							
Back-end administrators, software developers	Service designer	- Designing the service platform - Drag and drop data sets and view analytics			■					■		
Open data publishing service, Web application and software developers	IT Infomediaries	Supporting government to make OGD more accessible to create value			■	■				■		
Open Data Charter, Open Government Partnership	Intermediaries – international partners	Underpins and develops the New Zealand Declaration on Open and Transparent Government			■							
Data-driven companies, firms, businesses	Intermediaries-private sectors	Repackaging and improving OGD for public use			■	■						
communities, meetup groups, hacker groups, Open Data Ninja	Intermediaries- Non-profit organisation	Act as a liaison between parties seeking to share, access, or integrate OGD			■							
Citizens, data-driven organisations, government agencies, NGOs, businesses, academics, media, economists, international users	Data consumer/user	Using OGD to improve their operations and/or develop services/products			■	■				■		
Citizens, data-driven organisations, government agencies, NGOs, businesses, academics, media, international users	Data prosumer	Not only using data but also provides feedback to data publishers for enriching OGD			■	■				■		
Data team of firms	Data integrator	Collecting and integrating all datasets needed for organisations				■				■		
team of firms	Data curator – private sector	Determine how organisations utilise OGD and how IT adopt technology to capture OGD value				■				■		
Leader of innovation in IT companies/software developers	Data innovator	Working with agencies to create innovation by creating OGD and solving data problems			■	■				■		
Chief of data in the data-driven organisations	Data innovator	Serve customers with service/products innovation by capturing OGD value				■						

7. According to the analysis of multiple case studies, in addition to government and data-driven organisations, IT companies have played a supporting role in assisting government agencies in creating OGD value and in helping data-driven firms capture

the open data. IT companies hold at least three roles: *IT infomediaries, Service designers*, and *data innovators*. The IT firms linked with the interview participants are representative of *the IT infomediaries* that support the OGD programme. Janssen and Zuiderwijk (2014) defined the infomediary business model as an initiative that used social media and open data to connect data sources and users. This study describes an IT infomediary role as the role of IT company entities that integrate Information Technology services with open data to serve the government and improve the interaction between governments and data users.

Concerning the issue that datasets were previously only used by data experts with good data literacy skills, *a service designer* role is particularly suited to address this, as it bridges descriptive and analytical data to assist the data publisher in visualising the data for public consumption. A software development firm such as Koordinates supported the government by building a data management platform and offering a back-end administrator to interface drag-and-drop datasets, fill out metadata, and monitor data analytics.

A data innovator is responsible for assisting the agency's data teams in creating innovation and resolving issues, on the other side assisting data-driven firms to serve their customers with the innovation products/services. *The data innovator* role is typically held by the IT industry's innovation leader or Chief of data.

8. In addition to the government's essential role in the implementation of OGD, the data consumer is the user of OGD who captures the value provided by open data. This position is crucial because actors are the focus of the OGD programme to get the benefits. Users such as data-driven companies, citizens, government agencies, non-governmental organisations, academics, and international users capture OGD to enhance their operations and develop new services/products.

   To capture the value of data, consumers must comprehend how the data may be utilised and what they will benefit. On the other side, lack of awareness of the benefits of OGD was an impediment to the use of data. Moreover, even if the data is freely accessible, there is still the possibility that the data consumer's capacity to extract value from OGD will vary. This is because some individuals lack the ICT literacy skills necessary to utilise OGD benefits. The findings of the multiple case study expound on these issues in case study B for DDOs, which was investigated under theme 1B's super code "ICT literacy skills in using OGD."

9. Users of OGD have another key role that defined as *a data prosumer* role who act both consumer and producer (Aguilera, Peña, Belmonte, & López-de-Ipiña, 2017). The *data prosumer* captured open data, aggregated the OGD with all different kinds of information and published them in one application that was easy for people to use.
10. Based on the thematic cluster analysis, this study reveals that the key supporting actors not only IT companies but also other entities that accomplished role of *the intermediaries*. The intermediary role is hold by organisations that coordinated the data providers and users (Janssen & Klievink, 2009). Referring to the table 5.25, there are three different of intermediary roles follow the type of the entities.

    Actors such as The Open Data Charter and the Open Government Partnership perform *the intermediary roles* as the international partner of the New Zealand government to underpin the New Zealand Declaration on open and transparent government. The Open Data Charter and the Open Government Partnership are cooperations by governments and organisations, one of which is New Zealand, to open data based on agreed-upon principles.

    Other actors, such as private firms including DDOs are not only perform data consumer and prosumer roles but also *the intermediary role* to repackage data if needed to improve OGD usage for public use. In addition, non-profit organisations such as communities, meetup groups, hacker groups, and Open Data Ninja serve as liaisons between actors collaborating on OGD co-creation to meet the intermediaries' role.

11. *A data integrator* role in data-driven integrates data from several open government data sources , external and internal data sources. This can be accomplished in a variety of ways, including training data augmentation and machine learning. The data integrator may be a single data integrator or a team of data integrators in the organisation. *Data integrators* use their skill and capability to proactively conduct data collection and combining processes, improve the data quality, and assist in interpreting the data to facilitate more informed decision making and/or product and service offerings. In brief, *data integrators* make data more valuable and reliable to reveal the benefits of OGD.

To provide a further comprehensive answer to research question RQ1, the summary of actors and roles listed in table 5.25 is analysed into a matrix framework of value-creating and value-capturing roles mapped along the open data use and impact approach as

shown in Figure 5-53. The framework was integrated with the use and impact framework (Charter, 2018) presented in Figure 3-1 to explain how the actors perform their roles along the data-value process. It visualises the data value chain from production to impact, highlighting the contribution of value-creating and value-capture roles played by various actors throughout the chain within the OGD ecosystem. Concerning the analytic path of data availability leading to accountability, each value-creating and value-capture role is responsible for a specific set of tasks, ranging from data production, publication through its utilisation to action and feedback.

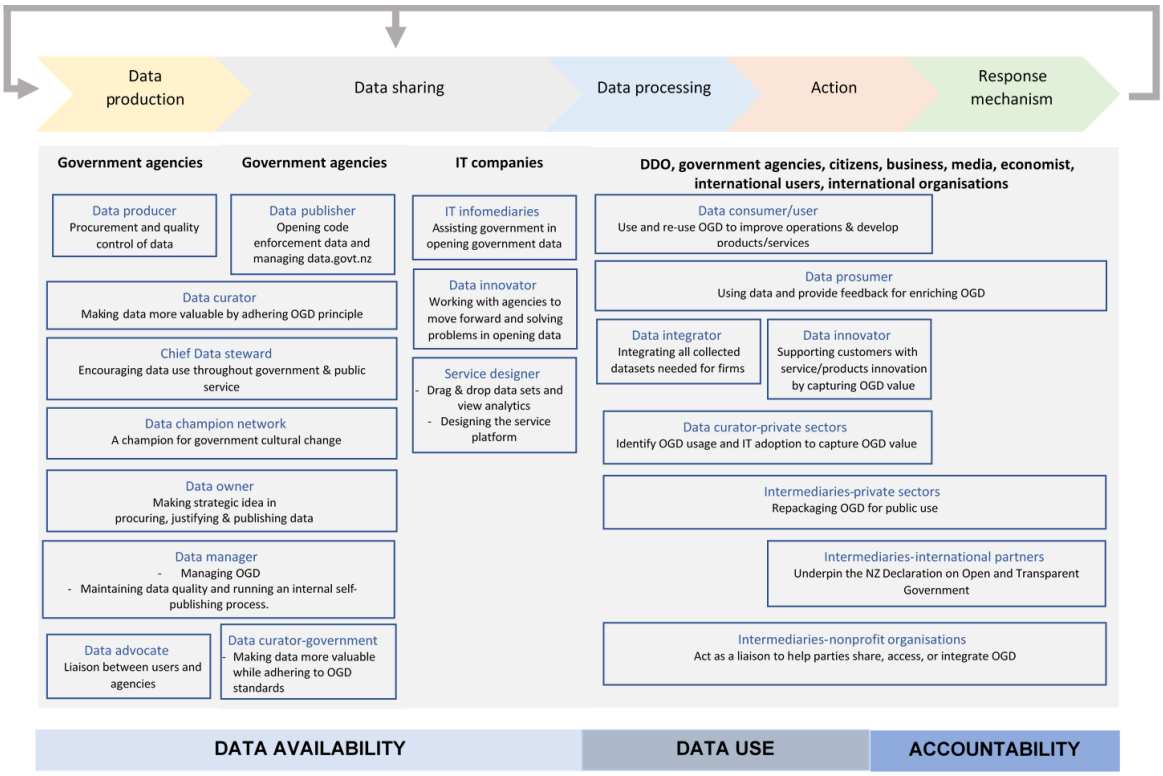

Figure 5-53 A framework of value-creating and value-capturing roles mapped along the open data use and impact. The framework was integrated with the use and impact framework in Figure 3.1 (Charter, 2018)

The framework in Figure 5-53 illustrated that government agencies and IT companies play crucial roles along the path to data availability in the OGD ecosystem. The government agencies fulfil multiple roles such as Data curator, Chief data steward, Data champion network, Data owner, Data manager and Data consumer along data production, sharing and processing chain. This might be understood as the need for the New Zealand government to meet its people's and the Data Action plan's commitments. IT companies, as the actors that actively support New Zealand Government, also perform three essential roles in data sharing dealing with open data platforms and their

technological features, such as giving their capabilities for data analytics, promoting interaction with other data, and enabling data visualisation and publication in many formats. Those value-creating roles have provided the public with access to open data, leading to a greater understanding of their government, allowing the government to perform better and encouraging users to capture the OGD's value.

Under data processing, actors like DDOs, citizens, government agencies, business firms and media are the key players by capturing OGD then action by using the OGD to create services/products or reusing for clients' needs. All roles under data processing, action and respon mechanism chain are the value-capture roles. Minimising gap between data sharing and processing that as the interaction point between actors with value-creating roles and with value-capture roles. Minimising gaps that might raise for example datasets that were published do not match with the type of datasets that were expected by user to process the data. The supply-demand actors that comprise the OGD ecosystem build co-creation to maximise OGD value by maintaining interaction. This study presents this framework to determine if any gaps exist. The goal of the OGD ecosystem seems to affect how well it grows and how dynamic interaction across actors in OGD co-creation with their value-creating and value-capture roles.

It is concluded that the OGD ecosystem generates co-creation across all actors, especially central actors responsible for value-creating and value-capture roles. The OGD value is created from procuring government data via a number of processes in the data value chain. Through the competitive capabilities, open data culture and dynamic cooperation within the OGD ecosystem, the value of OGD is transformed into social and economic advantages for all entities involved by the interdependent activities of the ecosystem's actors and organisations.

5.6.2.4. Addressing Research Question RQ2

This chapter addresses research question RQ2 "*What is the motivation of Government agencies and data-driven organisations to publish and use Open Government Data?"* based on a comprehensive examination of the empirical multiple case study analysis, focusing primarily on the thematic analysis of the case studies and their respective coding hierarchies.

The thematic analysis resulted that government agencies and data-driven organisations have different motivations and objectives for publishing and using open government data, which have impeded their ability to realise the value of their data. They use some

strategies to overcome challenges to publish more data and create products/services from OGD. Figure 5-54 presents a thematic map elaborated from the thematic clustering consist of the case study C extracted from the category " EFFORT TO SUPPORT OGD PUBLISHING" under sub category " Government motivation", the case study A extracted from the category "COMPETENCIES IN PUBLISHING OGD" under sub category "Objectives to open data", and the case study B extracted from "EFFORTS TO UNLOCK OGD POTENTIAL" under sub categories "objectives to use OGD" and "motivation to use OGD".

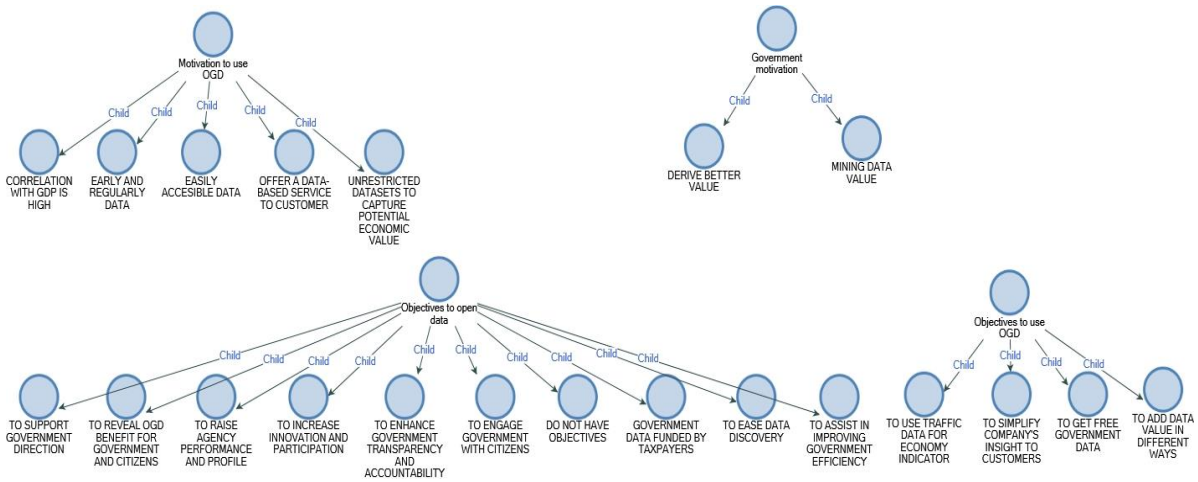

Figure 5-54 Thematic map for categories of the motivations and objectives to open and use OGD

The thematic map describes not just the motivations of government agencies and data-driven companies but also their objectives for opening and utilising OGD because motivations and objectives are related in terms of their purposes to publish and capture OGD, the implementation directions, and the expected outcomes. Motivations are how government agencies and data-driven businesses become willing to do their activities and achieve their goals. At the same time, their objectives represent the desired outcomes in detail.

Government agencies were motivated to contribute whatever data they owned for the public good so that users could use it and derive better value from OGD. Another motivation was the OGD value not in the data itself but instead in the process of mining data. Data mining included analysing large amounts of data to find patterns and extract information. However, data mining can be a complex and time-consuming process that requires extensive specialised skills. For that reason, IT companies were needed to

assist government agencies in developing a platform that will enable data-driven organisations and other users to capture and analyse data easily.

According to participants from DDOs, they have a solid motivation to use OGD. There are five factors that motivate them to use OGD. First, data-driven companies are keen to use OGD because it is an easily access to generate new value. The government data is essentially already available. Finding a way to place a link to distribute it in an open platform that meets the criteria of good open data is only a matter.

Second, it was timely and quick to obtain the open government data required to serve their customers. The data provider delivered the data promptly, and it was what the participants needed. The data publisher was easy to work with, and they responded to participants within a week. In addition, they desired data that could be permanently accessible on a regular basis, not just when required. For instance, monthly traffic datasets can be layered with other data to produce regular economic insights for their clients.

The third motivation is to capture the potential economic value that can be unlocked by building services on top of open data and monetise that. Participants in case study B have highlighted the economic impact of open data. For example, one firm surfaced all open data about property in one place that the public could access in an easy-to-use way through their website and application. The company created revenue by developing a property-search service to connect users, buyers and brands.

The fourth DDOs' motivation to use OGD is that it provides a much more reliable data source for reports to their clients. Typically, the datasets are highly correlated with the other data used in the report to support the client's decisions. This provides not only better report content but also better client relations.

Lastly, another motivation to use open government data is offering customers a data-based service. Access to large amounts of OGD has enabled new capabilities with excellent benefits that it has become a primary factor in the decision-making process for data-driven organisations. On the other hand, the data literacy skills to use open government data has become a crucial part of companies' strategy.

Government agencies' objectives when opening government data are as follows:

1. *To support government directions by tying data products to strategic outputs*. It also aims to promote open data, which allows the public to access government information and data. This opens government data to public scrutiny and can help improve government services, such as providing better weather forecasts. Opening up government data also helps government agencies recruit talented employees and build their careers, strengthening their operations.
2. *To reveal the government and citizen benefits of OGD*. It enables the public to access government information and use it to solve problems and expand access to government services, thereby improving the public's quality of life.
3. *To raise the agency's performance and profile* by developing people and capabilities and enhancing operations. The release of government data helps agencies recruit and develop qualified staff and strengthens their operations. It helps the government's reputation as a credible source.
4. *To boost innovation and economic and social participation*. OGD enables users to utilise data for their own needs, enhancing productivity and efficiency. When datasets are so large and complex, innovation is required to make them accessible and valuable by combining skills, tools, and infrastructures.
5. *To enhance government transparency and accountability*. The best solution is to disclose as much government information as possible to the public. It will empower the public to hold the government accountable, boost public comprehension of government activities, and enhance government decision-making. The best way to accomplish this is to publish government data through an open data portal in an easily accessible and usable format.
6. *To engage citizens with the government*. It offers the public access to information previously restricted to government officials, select parties, and professionals, as well as a platform for public participation in government. This access strengthens democracy by ensuring that everyone has access to the government's own information, enabling the government to serve the people better.
7. *To ease data discovery*. The government is committed to publicly exposing data to the greatest extent without sacrificing data integrity or system security. This is a key part of the government's digital strategy as the Open Data Plan's first stage, making data easy to find. This involves partnering with IT companies and other government

agencies to benefit the public while being transparent about results and taking responsibility for decisions and actions.

8. *To assist in increasing the effectiveness and delivery of government services*. This goal is accomplished through OGD, which is information that has been used in various ways by individuals, communities, media, academics, businesses, and governments. OGD assists the government in optimising the use of existing resources and people, identifying service delivery gaps, and fostering a culture of data transparency.
9. *The public funds government data*. Data is collected at the taxpayers' expense and made public per the New Zealand open data rules, NZ Goal, which the government sets for such data sharing. It must be open and transparent. This indicates that the public has the right to access and use OGD.
10. *Do not have any objectives in opening OGDC.* As the central government was responsible for determining Open data guidance, including objectives, goals, and commitment, participants linked with a local council indicated that they followed the leader's objectives in the OGD project and did not set any local council's objectives in opening data.

In addition, the objectives of the data-driven organisation's use of OGD are also presented in Figure 5-42. The investigation of case study B's thematic coding explains four objectives, which are detailed below:

1. *To use traffic datasets for economy indicators such as car traffic and truck traffic data*. The datasets can be captured by the users so that they can do their own statistical and business analysis, which can serve as a source of information for their clients as well as a means of improving the economy.
2. The second objective is *to simplify insights derived from OGD mining for their clients* to comprehend the business's current predictions better, hence fostering greater engagement and loyalty. DDOs exploit data to identify client demands and apply this information to create enhanced experiences and services.
3. The third objective of DDOs is *to get free open government data*. With open data, they can expand their databases and undertake in-depth research, which leads to improved client decisions. Early-stage entrepreneurs can establish businesses and expand their operations without relying on conventional financing sources. To secure their long-term viability, DDOs rely on a range of revenue streams, such as advertising and advice, as opposed to traditional funding channels such as venture capital.

Although open data is at no cost, data mining and analytic need money to create OGD value.

4. *Adding data value in different ways* is the last objective described in Figure 5-42. DDOs use data to inform strategic decisions, develop products/services, enhance operational efficiency, and cultivate good customer relationships. By making public data accessible to their clients and the public, DDOs contribute to innovation and developing a data culture in their communities.

To conclude the explanation above, government agencies and DDOs have clear motivations and objectives for publishing and using OGD. They can better comprehend their constituents and address their needs and concerns. This may enhance the quality of government services and activities for the public. Consequently, these two sets of actors have a strong correlation, essential for building and sustaining an ecosystem of open government data.

In a simplified diagram, a logic model was developed to represent the logical relationships between the motivations and objectives of government agencies and DDOs, which resulted in motivational factors for the OGD ecosystems related to value-creating and value-capturing roles performed by these two sets of actors. Figure 5-55 depicts the logic model that hypothesised the answer to research question RQ2.

To promote openness and accountability across government agencies, government agencies have incrementally implemented their objectives over the past twelve years by publishing large volumes of government data. The increment amount of government data available for usage in 2022 to more than 31,000 datasets is more than four times the number of datasets available in 2018.

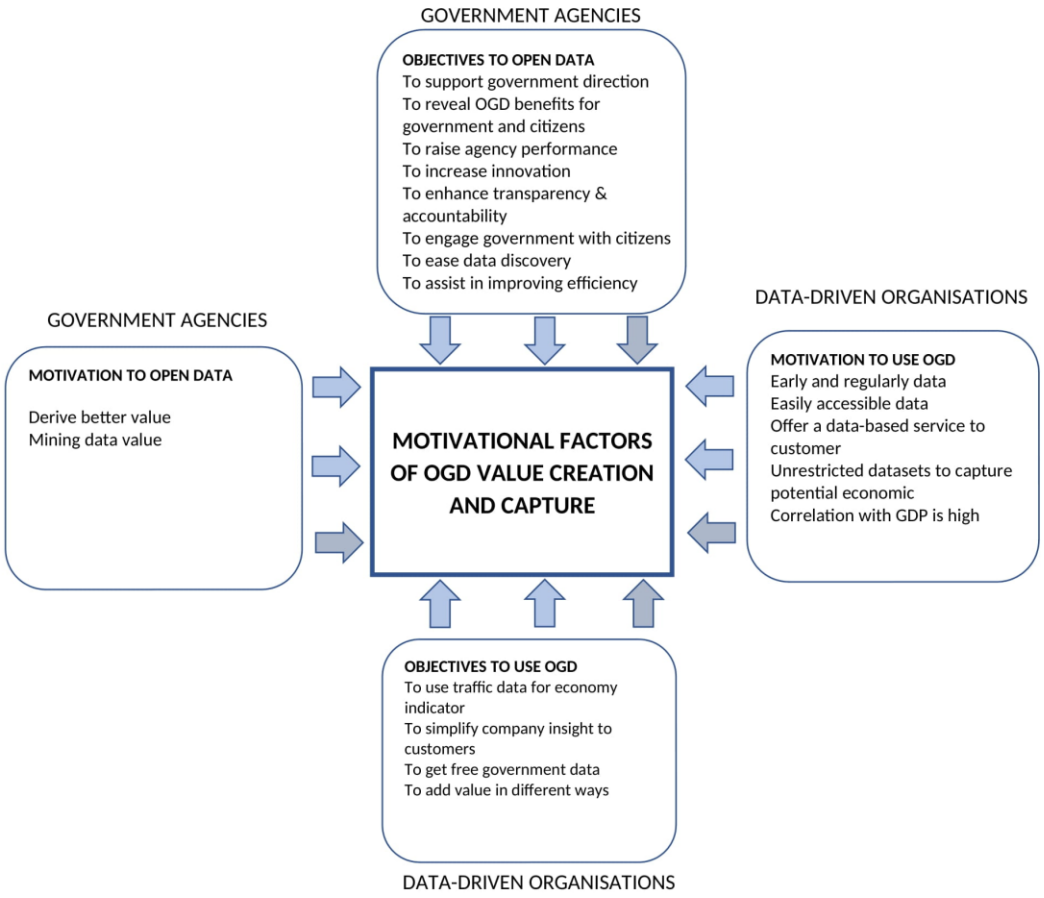

Figure 5-55 Logic model for motivational factors of government agencies and data-driven organisations

In turn, data-driven enterprises have begun to leverage OGD to produce new services for the public. Furthermore, government agencies have been motivated to share government data, encouraging data-driven enterprises to exploit government data to produce new services for the public. Data-driven companies have been motivated to capture OGD to establish new revenue streams and grow business operations. This logic model shows mutually reinforcing motivational factors between the two sets of actors in the New Zealand OGD ecosystem. The next chapter will adopt this model as a starting point in designing ecosystem business models.

5.6.2.5. A collaborative model of the New Zealand OGD ecosystem

According to a secondary data taken from StatNZ online document[33], a cycled diagram of New Zealand's data system map describes government data's potential to affect people's lives and alter how people connect as the result of Open data, Official statistics and Open government implementation. The diagram in Figure 5-56 shows how data flows through the New Zealand government data system. Data held by the central government and local councils is leveraged to create value. This results in data that New Zealanders can access. Different groups use open data, official statistics and open government in different ways, including NGOs, the private sector, ministers, media, academics, Iwi/Maori and citizens. They can use and reuse data for enormous benefits such as creating innovative products/services using OGD, delivering service, advocacy for Te Ao Māori (the Māori World) and researching.

In addition, their efforts to capture the value of data help several sectors, including the environment, economy, community & culture, and wellbeing. The captured value of data is the process of transforming data into a decision-making-friendly format. This upgraded data can be deployed in several ways to enhance the sector. Not only do the benefits extend to the public and essential sectors, but they also provide the government with a feedback mechanism in the form of heightened people's awareness of privacy, governance, and stewardship.

[33] https://www.stats.govt.nz/assets/Uploads/Data-leadership-fact-sheets/NZ-government-data-system-map.pdf . Last accessed on June 7, 2021

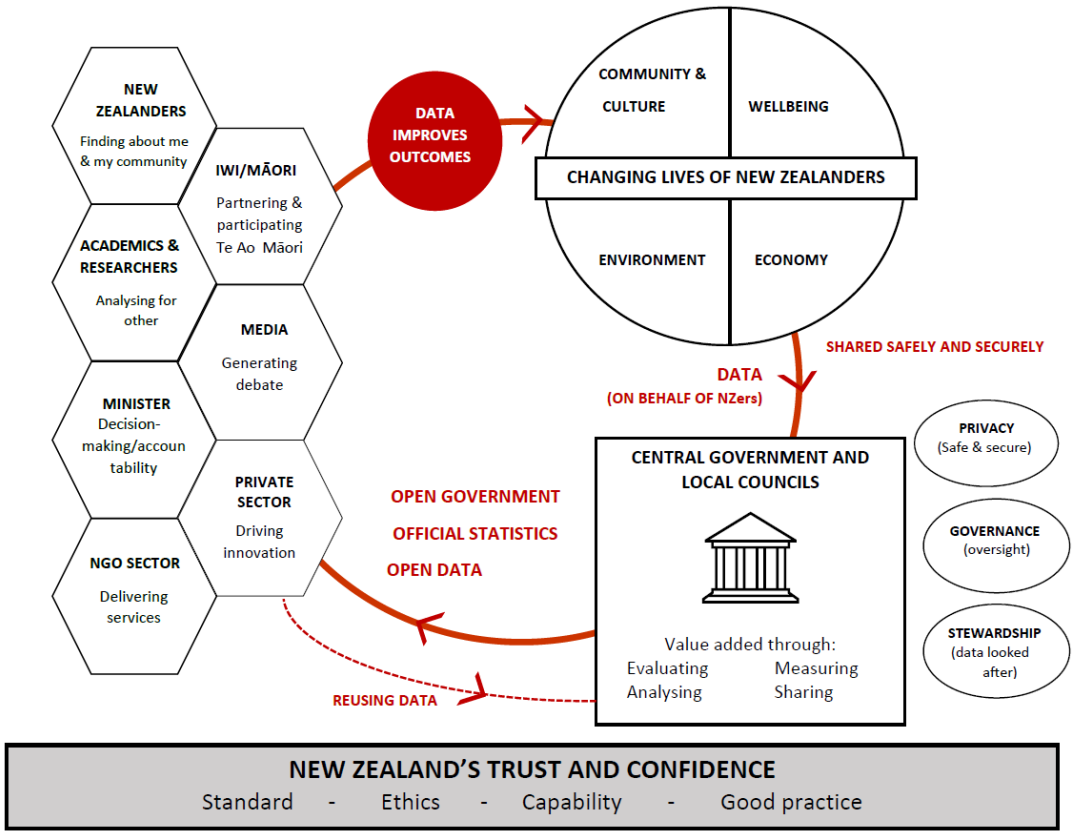

Figure 5-56 The New Zealand data system map. Adapted from StatNZ [21)]

The multiple case study investigated the central actors of the New Zealand OGD initiative that creates and captures the open data's value. The OGD value is boosted by the engagement with government agencies, data-driven organisations, IT companies, communities, media, and international partners within the OGD ecosystem. The success of the collaboration was due to the actors' competencies, the entities' capacities, and the driving factors such as motivational factors, key resources, and competitive capabilities. Therefore, a sustained ecosystem is essential because the OGD ecosystem, an expanding network of actors, depends on and contributes to the OGD value.

The findings of this multiple case study have provided novel insights into the complex process of OGD value creation and value capture within the OGD ecosystem. Adapting the principle of the New Zealand data system map displayed in Figure 5-44 and complementing the framework of value-creating and value-capturing roles (Figure 5-41), I present a high-level illustration with the collaborative model that depicts the New Zealand OGD ecosystem's network of actors, relationships, and value creation and capture. Figure 5-57 represents this model as a core concept for designing ecosystem business models, which will be explained in the following chapter.

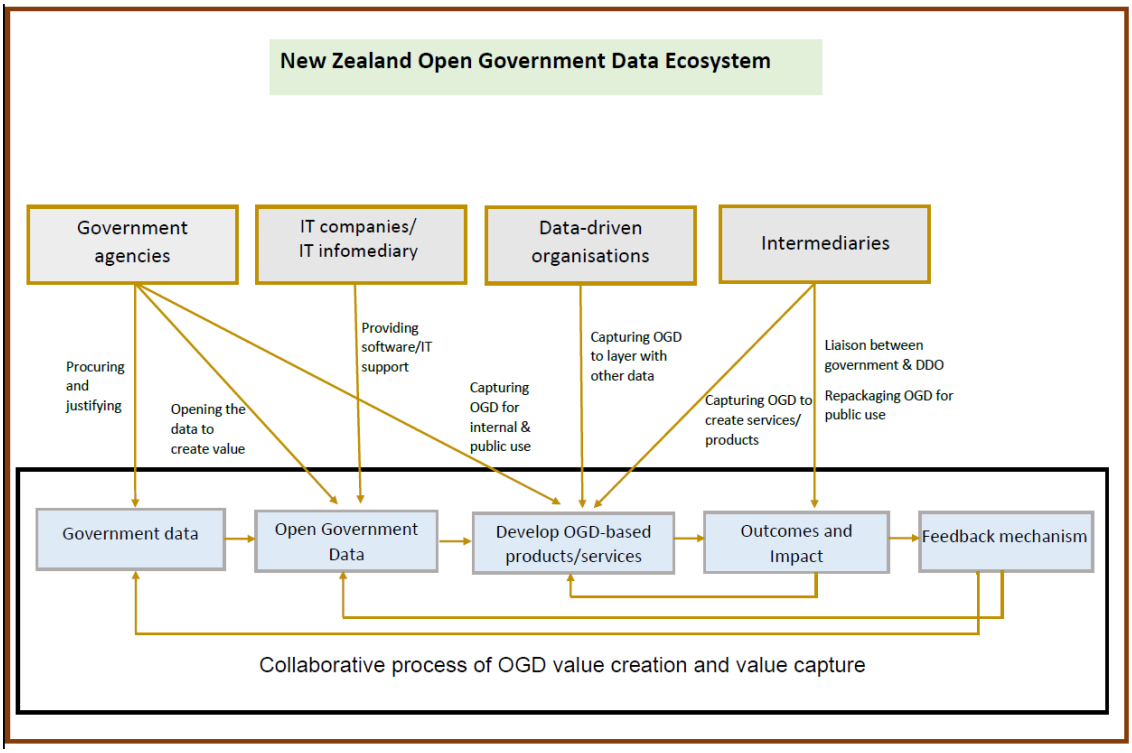

Figure 5-57 Collaborative model of OGD value creation and value capture

In the context of this study, the four central actors in the New Zealand OGD ecosystem are the government agencies, IT companies, DDOs and Intermediaries. The government agencies participate in this collaborative model to procure, justify, publish, capture and use OGD. The first two are purely production roles, while the latter are purely consumption roles. The government agencies are the primary producers of the government data and are responsible for procuring, justifying and publishing the government data on the platform. The government agencies are also the data consumers/users of the OGD, capturing the information and data they need to fulfil their mandates.

When it comes to making government data accessible, government agencies rely on IT companies for assistance rather than doing it themselves. The technology sector plays a crucial role in this ecosystem by providing government agencies with the infrastructure and support they need to publish their data. IT companies have leveraged their expertise in data storage, technology, and software to provide critical support to government agencies in helping to meet the New Zealand OGD initiative.

The collaborative model positions data-driven organisations as the primary users of OGD, and their role in the ecosystem is critical to capturing the data value and

contributing to the sustainability of the ecosystem. DDOs have built competitive advantages by leveraging data, potentially generating new ecosystem business models.

Another actor, the intermediary, gives the strategic capabilities needed to co-create with OGD. These intermediate collaborations result in configurations from multiple businesses aligned to provide public value and may not have the same skills but collaborate with partners who do.

This co-creation with OGD can be seen as the development of OGD value creation and value capture. This further impact data-driven organisations and intermediaries as the data consumers and prosumers create innovative outcomes and a feedback mechanism. A feedback mechanism is essential to assist the New Zealand government in determining what data users need and ensuring the quality of data, hence increasing the OGD value. In addition, it enables the government to prioritise which data to keep and improve to deliver better user services. The collaborative model describes that OGD enables the government agencies to be more transparent and responsive to citizens' needs.

The New Zealand OGD ecosystem is a dynamic and constantly evolving environment that can both shape the context in which OGD value creation and capture take place and have an implication on it. Depending on the nature of this impact, it may impede or encourage OGD value creation and capture process. Different aspects surrounding the actor collaboration might operate as accelerators or barriers to this process, not just in the context but also during value co-creation.

5.7. Summary of Chapter 5

This chapter presents the findings and analysis of the multiple case study by following an in-depth description of the two cycles of the thematic coding process, two-step of cross-case analysis supported by explanations with excerpted transcripts, screenshots of NVivo analytic tools, and data tabulations. This chapter also presents the findings and analysis of the multiple case study. In order to finish the analysis of thematic coding, I first derived coding clusters, then thematic maps, and finally the themes of the case studies. The findings of each case study, cross-case analysis, and multi-case study were investigated further to address research questions RQ1 and RQ2. This was done to establish a connection between the findings and research questions. The following

chapter discusses the process of designing ecosystem business models and provides answers to research questions RQ3 and RQ4.

Chapter 6 Ecosystem business models

Chapter 5 has explained the multiple case study findings and analysis that provide in-depth results to answer research questions RQ1 and RQ2 and the fundamental concepts for designing Ecosystem business models. This chapter contributes to the last part of this study which is the analysis to design Ecosystem business models. The following section, 6.1, will examine the analysis of the Design concepts to answer research question RQ3 "*How does one design new ecosystem business models for an ecosystem that is not mature yet?*". It will provide an in-depth investigation of the development of this study's findings and analysis to develop frameworks to design Ecosystem business models. Furthermore, section 6.2 will present the design features to address research question RQ4 "*How does one design ecosystem business models for data-driven organisations using Open Government Data and to unlock open data potential benefits for all actors?*". This section will explain the development of the Extended Business Model Canvas and Business model types such as the Ecosystem business models for Data-driven organisations using OGD.

6.1. Design concepts: Addressing Research Question RQ3

Various analogue and digital tools have been presented to address the requirement for methodological and technical support with business models (Bouwman, Faber, Haaker, Kijl, & De Reuver, 2008; Bridgeland & Zahavi, 2009; Voigt et al., 2013). According to Bouwman et al. (2008) and Osterwalder and Pigneur (2010), these tools are intended to support various stages and activities of business model development, including the design phase, the implementing phase and the evaluation phase (Schoormann, Stadtländer, & Knackstedt, 2021).

Figure 5-57 in the previous chapter depicted the collaborative model to illustrate the initial layout of the network of actors, interconnections, and value creation and capture within the New Zealand OGD ecosystem. This model illustrates the four key actors that will act in the New Zealand OGD ecosystem utilising ecosystem resources, entity capacities, actor capabilities, and adherence to the data process, but each actor will continue to execute their specific roles. Adopting this model facilitates a deeper comprehension of the ecosystem and its processes to build design principles of ecosystem business models.

A business model emphasises creating valuable output, primarily due to the actors engaged. As demonstrated by the cross-case study in section 5.6, there is a high correlation between the activities of the actors and the desired benefits of OGD. Thus, the central actors strengthen their responsibilities by contributing innovative activities to the overall ecosystem performance of the New Zealand OGD initiative. This synthesis emerges from the collaborative model of this New Zealand OGD ecosystem in Figure 5-57. The business model facilitates the identification and tracking of these actions and benefits.

To address research question RQ3, I reiterated the collaborative model developed in the cross-case analysis by expanding Verhulst and Young's (2017) logic model to develop a thorough investigation within and among ecosystem aspects about actors, activities, outputs, and impacts. In building a business model for an ecosystem that is not mature yet, Table 6.1 shows a framework of an in-depth summary and logic model was developed to answer research question RQ3. Below is an explanation of the seven factors that comprise the framework.

(1) **Input.** In terms of creating value, the range of data formats constitutes the supply side of open data. The input, which plays a significant role in determining the eventual impact, ranges from large datasets such as city imagery and geospatial to traffic, statistical, and property datasets. Data formats, regardless of their size, can be valuable sources of information for data users. Essential to the New Zealand OGD initiative is the collection and supply of government data by government agencies. As intermediaries, the Open Data Charter and Open Government Partnership have pushed and assisted the government as the data providers to make some types of datasets accessible following several principles and standardised formats such as data quality, data visualisation, and transparency.

Table 6.1 A framework of the in-depth logic model. Advanced list of the framework from Verhulst and Young (2017)

INPUT (1)	ACTORS (2)	ACTIVITIES (3)	OUTCOMES (4)	IMPACT (5)	FEEDBACK (6)
OGD Datasets Including: ▪ City imagery datasets ▪ Traffic datasets ▪ Statistic datasets ▪ Datasets related to public facilities ▪ Property sales datasets	Government agencies	▪ Data procurement ▪ Open data portal management ▪ Data publishment ▪ OGD principle implementation ▪ OGD management ▪ Service improvement ▪ Decision making ▪ Mediating government and users	▪ High quality datasets ▪ Social and economy benefits ▪ Benefits for government agencies ▪ Policies ▪ Strategic asset for Maori	▪ Raising government profile ▪ Gaining public trust ▪ Generating knowledge ▪ Improving administrative process ▪ Developing data capacity ▪ Easing policy-making process ▪ Citizens involvement and participation ▪ Ongoing official cultural change	▪ Transparent with information ▪ Good open communication ▪ Reliance datasets ▪ Government learnt the OGD
	Data-driven organisations	▪ Using OGD ▪ Capturing OGD value ▪ Repackaging OGD ▪ Providing feedback to government ▪ Integrating datasets	▪ New products/services ▪ Economic reports ▪ Create platform for innovative service ▪ Revenue from aggregate of OGD and property data ▪ Get free OGD	▪ Good customer relationship ▪ Add data value in innovative way ▪ Monetize OGD ▪ Enhance user data literacy ▪ Enhance organisations' capability and performance	
	IT companies, such as ▪ Software developers ▪ Open data publishing service ▪ Back-end administrators	▪ Supporting government ▪ Data publishment ▪ Designing service platform	▪ Publishing datasets ▪ Creating OGD value ▪ Direct revenue ▪ Managing service revenue ▪ Launched open data projects	▪ Derive data value with software ▪ Resolved ICT issues ▪ Successful data publishing ▪ Use case of OGD potential value	
	Open Data Charter (ODC) Open Government Partnership (OGP)	▪ Assisting the NZ OGD initiative ▪ Reinforcing NZ government in OGD ▪ Providing a set of OGD principles ▪ Assessing the government commitment	▪ Enhanced capability of the NZ government ▪ Shared knowledge	▪ Releasing value for the government's constituents ▪ Encouraging the implementation of OGD principles	
	Citizens	▪ Using OGD ▪ Giving feedback ▪ Requesting datasets	Enriched OGD Added knowledge	Citizens involvement and participation Developed transparency and accountability	
	Meetup groups	▪ Bridging actors ▪ Articulating OGD demand	Shared data with public	Facilitate change Data usefulness	
	Hacker Groups	▪ Mediating between actors ▪ Socialising OGD	OGD demand	Better OGD value Informed OGD value	
	Open Data Ninja	▪ Mediating between actors ▪ Providing feedback	Feedback	Better OGD value	
	Researcher, academia and Media	▪ Using OGD ▪ Requesting datasets ▪ Giving feedback	▪ Research findings & analysis ▪ Data journalism ▪ Shared information	Disseminated knowledge	
	International users	Using OGD Giving feedback	New products/services Feedback	Better leverage on OGD use	
ENABLING CONDITIONS ▪ OGD potential benefits ▪ Change of work culture ▪ Actors' motivation and objectives ▪ Organisation strategy ▪ Efforts to unlock OGD potential ▪ Organisation structures			**DISABLING CONDITIONS** ▪ Specific issues with big datasets ▪ Obstacles related to data ▪ Communication barrier ▪ Licensing and privacy issues ▪ Technical constraint		

(2) **Actors.** While the ecosystem of the New Zealand OGD initiative has not yet reached full maturity, one of the key findings of this study is that several actors play a role in making OGD open, useful, and supported to create and capture OGD value. These actors are outlined in the framework of value-creating and value-capturing roles (Figure 5-53) and the collaborative model of this ecosystem (Figure 5-57). Government agencies are working to improve the supply side of OGD, and IT companies are acting as intermediaries to help with this goal. The demand side may benefit from a more robust collaboration among demand-side actors, such as data-driven organisations and government agencies, and the identification of additional stakeholders, such as citizens, who can exploit OGD. The demand side of open government data is the main yet distinct segment of users that benefit from open government data. Researchers, academics, the media, and global users with various interests are among the segments that benefit from OGD.

(3) **Activities.** Not only do the capabilities and skills of all supply- and demand-side actors play a part in conducting the activities in performing roles, but the efforts in fostering the collaboration across actors do as well. This is significant because it helps to improve the coordination of the activities being conducted. The key activities of each actor are listed in this framework taken from Table 5.25. For example, government agencies must proactively manage and distribute their data through an open data portal to gain and maintain the public's confidence. They should first identify and evaluate their data needs and acquire the required data. Once the data has been collected, it must be published in a searchable and publicly available format on an open data portal. These activities are critical to optimising the effectiveness of OGD Initiatives.

(4) **Outcomes**. As with the activities that open data facilitates, OGD can have a lot of different outcomes. It all just depends on what challenge OGD is supposed to solve and what goals are to be achieved. Data regarding the outcomes resulting from each actor's activities are extracted from the coding map of categories of all case studies in Chapter 5. The outcomes of open data for the government are higher quality datasets, social and economic benefits, and policies and strategic assets for Māori

[34]. OGD about Māori are among the Māori data relating to Māori and their surrounding environments. On the other hand, DDOs may use OGD to create new products and services or to develop new platforms for innovative services. As the supporting partner for the government agencies in publishing data, the IT companies' supporting roles are to benefit from direct revenue, manage service revenue and create OGD value. They support government agencies in addressing the challenges of providing secure access, data quality, and privacy protection. The Open Data Charter and Open Government Partnership act as the New Zealand government's worldwide partner by implementing open data principles and enhancing government capabilities. They are intermediaries that assist in the implementation of the New Zealand OGD programme.

On the other hand, citizens, meetup groups, hacker groups, and Open Data ninjas, among others, participate in this ecosystem as users and intermediaries, resulting in enriched OGD and feedback. As a result of employing OGD, groups such as the media and academics profit from data journalism and collaborative research.

(5) **Impact**. The outcomes of the New Zealand OGD initiative result in different impacts on the actors and ecosystem. By examining all the impacts, I can better understand the New Zealand OGD initiative and the current state of the ecosystem. However, there are a few that stand out as being particularly important. First, when government agencies publish valuable and meaningful data to citizens, it enhances the agency's profile and the citizen's involvement and participation. Second, the Open Data Charter's involvement in this ecosystem can increase the availability and use of open data across governments to promote economic development and improve public service. While the Open Government Partnership's assistance aims to secure governments' concrete commitments to promote transparency, empower

[34] https://www.temanararaunga.maori.nz/patai#ImportantforMaori. The latest access on July 2022

citizens, and harness new technologies to strengthen governance. Furthermore, third, the DDOs can benefit from monetising open government data, which would also enhance firms' capability and performance. Lastly, the meetup groups and researchers are other actors who have had positive impacts by facilitating change and disseminating knowledge.

(6) **Feedback.** A feedback mechanism for current and potential users is essential for assisting the New Zealand Government in establishing what data users require and improving data quality, hence maximising the value of OGD. In addition, it helps the government to prioritise which data to publish in enhancing users to exploit more datasets. Introducing a feedback and request mechanism for current and potential users is crucial for supporting government agencies in establishing effective communication with users, promoting information transparency, and enhancing data quality, maximizing the benefits of OGD. This necessitates establishing a user-friendly online feedback system that enables users to submit feedback directly to the agencies responsible for OGD. The feedback and inquiry system collects user feedback on all areas of OGD, such as data quality, accessibility, usability, and data requests, to which agencies should respond promptly.

(7) **Enabling and disabling conditions.** These enabling and disabling conditions are not specific causes of either success or failure but rather a set of hypotheses to be evaluated as the area of open data in developing economies grows and evolves. Since evidence of the OGD initiative's impacts varies widely, I do not use the enabling and disabling elements to estimate the performance of this ecosystem.

The factors of enabling conditions are based on the Logic model for motivational factors in Figure 5-55. In addition, the disabling condition factors were extracted from the coding map of categories of all the case studies in Chapter 5 related to the challenges and obstacles in publishing and using OGD.

Figure 5-58 presents a logic model that summarises the frameworks of the ecosystem of the New Zealand Open Government Data programme. The model is an iterative process that assists the government in determining whether their data gathering and opening efforts correspond with the OGD initiative's goals. In building new ecosystem business models for an ecosystem that is not yet mature, the logic model illustrates a more detailed

examination within and across ecosystem elements as part of the New Zealand OGD initiative to provide a comprehensive answer to research question RQ3.

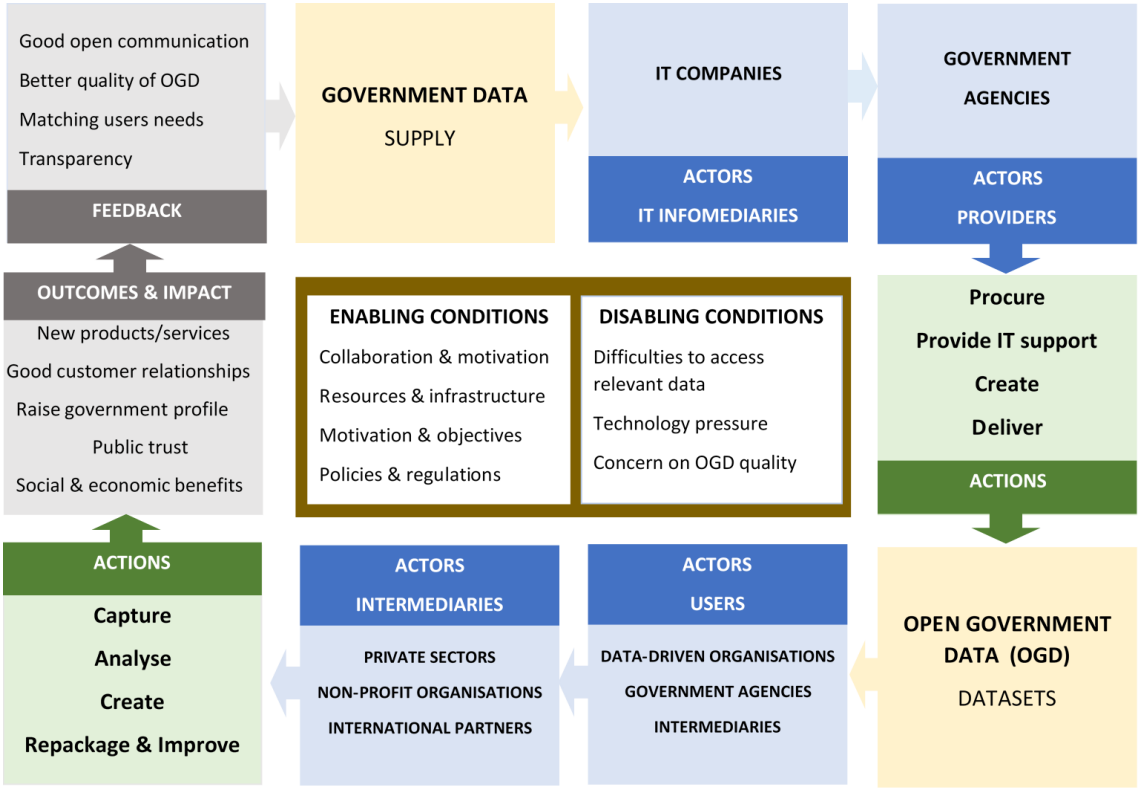

Figure 6-1 Logic model of the New Zealand OGD initiative's ecosystem, the extended version of the logic model by Verhulst and Young (2017)

The logic model framework as illustrated in Figure 6-1, is an extended version of the logic model (Figure 2-2) by Verhulst and Young (2017). It summarises the framework's enumerated components that influence the analysis and collection of evidence on the ecosystem of the New Zealand OGD programme in building new ecosystem business models for the ecosystem that is not mature yet. The components in the logic model are from data supply and open data through its outcomes and feedback, several enabling and disabling conditions influence the impact. The logic model was used to generate hypotheses about how the ecosystem would impact the development of new business models. It provides a visual summary of the framework for the ecosystem analysis and ecosystem business model development and is useful for identifying gaps, structuring new parts of each component and communicating the approach to the current and

prospective actors and other interested parties. The model is designed to allow for the change that is inherent in any complex ecosystem. This is a living document that will be updated as the ecosystem of this OGD initiative evolves in maturity and as the actors' understanding of how it influences the ecosystem changes.

The logic model presents that government data, as the supply data, are procured by governmental actors, published with support by IT companies, and delivered as the OGD. Unless there is a risk of privacy violation, the government agencies choose to publish more government data as long as they are sufficient to benefit users. The datasets are captured and used by two actors, users and intermediaries, to create value by repackaging and improving the service and product innovation. The outcomes and impact of opening and using OGD affect the entire life cycle of data production, from initial data supply to its eventual reuse. Thus, the feedback process helps the New Zealand Government determine which data is to be published and developed, prioritise which data is most beneficial to be published, and ensure data quality. The cycle of the model is maintained by reinforcing enabling conditions and inhibiting disabling factors.

6.2. Design features: Addressing Research Question RQ4

This study followed recent research by assuming that the Business Model Canvas (BMC) has become a quasi-standard for business model tools (Massa et al., 2017). Nonetheless, while this approach is widely used in academia and practise, BMC does not always prioritise sustainability (Bocken et al., 2014). It is insufficient to affect the necessary transitions toward sustainability (Schaltegger et al., 2016). This is also shown by the fact that there is currently a lack of agreement on the key components that need to be included to formally represent sustainability in business models. Additionally, Terrenghi, Schwarz, and Legner (2018) determined from interviews with business model experts that the BMC must be adaptable with additional frameworks to accomplish certain tasks. This section elaborates answers for research question RQ4 in designing ecosystem business models for DDOs using OGD and to unlock open data potential benefits for all actors.

6.2.1. An Ecosystem Business Model Canvas (EBMC): The extended BMC template

Hence, in mapping ecosystem business models and value-stream diagrams for the DDOs using OGD, this study adopted Osterwalder and Pigneur's Business Model Canvas template. I choose to use the elements of the Business Model Canvas template as a reference point because it is a well-known model that provides a robust foundation for building ecosystem business models. The elements are derived from the themes of the multiple case study depicted in Figure 5-52, the summary of actors and roles in Table 5.25, the Collaborative Model illustrated in Figure 5-57, and the Logic Model shown in Figure 6-1.

As discussed in Chapter 4 about the BMC, Alexander Osterwalder first introduced the business model canvas in 2004, outlining its nine essential elements: value proposition, customer segment, customer relationships, channels, key activities, key resources, key partners, revenue streams, and cost structure. The business model template assists in considering how an organisation generates, captures, and delivers value. Identifying a value proposition that is attractive to clients and defines the company's offers from its competitors is critical to the success of the BMC template.

Drawing from the findings and analysis of the multiple case studies in Chapter 5 and the fundamentals of the ecosystem business models described in section 6.1, a clearly defined set of beneficial relationships must exist amongst the actors to build an ecosystem for the OGD initiative. Therefore, I developed an Ecosystem Business Model Canvas (EBMC) as the extended version of the BMC template (Osterwalder & Pigneur, 2010, 2013) with three additional elements: networks and relationships, customer motivation, and customer requests and feedback elements. The EBMC can help DDOs better understand the dynamics of their ecosystems and their potential for growth by analysing these relationships and making better decisions about how to grow their business. It can identify new opportunities and optimise existing ones by considering the three additional elements. The EBMC was designed to help the actors in the ecosystem of the New Zealand OGD initiative better understand their ecosystems and growth potential and how they impact their customers/clients.

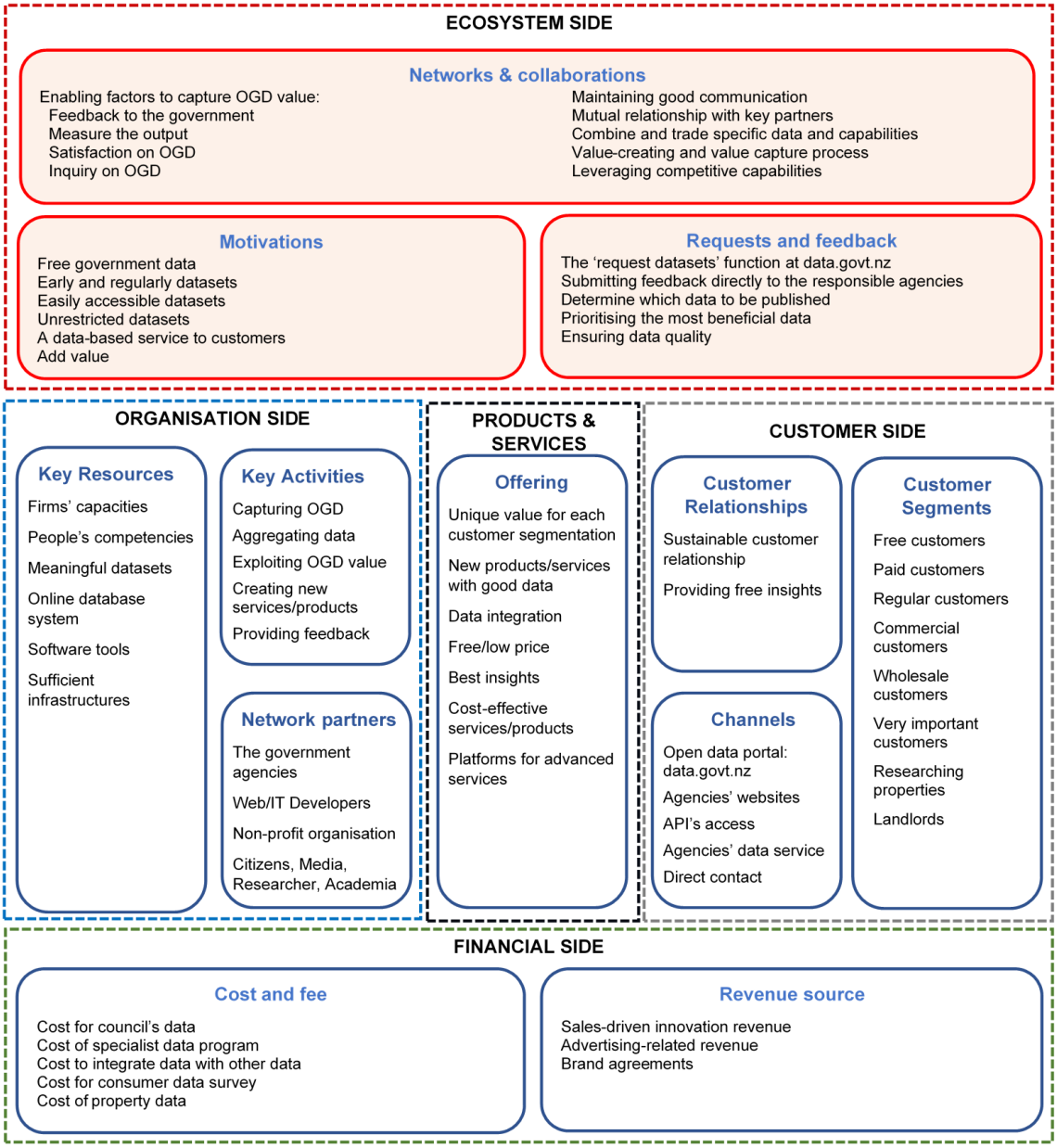

Figure 6-2 An Ecosystem Business Model Canvas for the Data-driven organisations using OGD. An extended BMC template by Osterwalder and Pigneur (2010, 2013)

The ecosystem BMC as shown in Figure 6-2 has three additional elements: Networks and collaborations, Motivation and Requests and feedback. To distinguish elements that are developed to design the robust ecosystem, the elements are grouped into four sides as illustrated in the ecosystem BMC to organise all components into a vast linked system. The three additional elements are classified as the Ecosystem side.

1. **Customer segments**

   Potential and current customers or clients are the key point for the DDOs to sustain in their business competitiveness. Their business goals always related to how to boost the number of customers and how to keep their loyalty. In order to achieve these objectives, the DDoS need to understand the customers' behaviour and needs by defining customer segmentation. The property-data provider used a variety of strategies to both attract potential customers and maintain current customers, such as developing innovative platforms tailored to the customer's segmentation. The firm defines segmentation by leveraging its data integration to determine how their services are utilised. On the other hand, the banking industry categorised its clients to offer various approaches to assist them with their business needs, such as a morning briefing on the situation of international markets. Due to the highly technical nature of the information, some of its services are only available to wholesale buyers. If it is a very important client, the firm arranges a private board meeting, but the bank representative hosts a cocktail function for commercial clients.

2. **Customer relationships**

   Sustaining customer/client relationships implies that DDOs provide better customer service and meet customer needs. Loyalty is key for the DDOs because it increases the chances of customer referrals and, ultimately, more offered service. This loyalty can be fostered through a number of means, such as creating a sense of value, being attentive to customer needs, and continuously providing valuable services. The bank industry integrated OGD with its data has strengthened customer relationships. The bank might assist clients in making wiser business decisions with reliable data. Data-driven organisations like banks can build strong customer relationships by releasing public data. The release of this data allows the bank to give further support and advice to their clients. The bank did not charge clients for this service, as it was seen as a way to build customer relationships. As a reputable bank with solid customer service, this was expected.

3. **Channels**

   Channels are the point of interaction for the value creation and capture in this ecosystem. The channels contain OGD that the government agencies open to be captured by users and the public for free. New Zealand has created data.govt.nz, a

centralised open data portal operated by the Department of Internal Affairs, to allow anyone to access the OGD while several government agencies, including LINZ, NZTA, StatsNZ, and local councils, have developed APIs for easier data sharing. The open data portal, data.govt.nz, contains datasets published by government agencies for free. The purpose of having an open data portal is to provide a space for anyone to access, use and create value from OGD. The portal is also a way for the government to promote open data use and increase transparency and accountability. Another channel is government agencies' websites to improve the public's experience accessing government data. The agencies deploy their website to monitor data quality and respond to user feedback by providing a contact email. Direct access to an agency's database or APIs to the open data service are also channels for DDOs to access open data across the government agencies.

4. **Offering**

The products or services offered are what make a value proposition. To create a successful value proposition with OGD, DDOs must offer a unique and appealing set of products or services to attract customers. The property-data provider created a convenient application/web service platform to capture a larger portion of the property market by combining all necessary property-related information in a user-friendly application. The banking industry combines OGD, for example, traffic and statistics data, with data from other providers to freely produce updated economic insights for their clients. The value-added service is an example of indirect economic benefits as well as the development of networked marketplaces.

5. **Key resources**

DDOs must have access to financial and nonfinancial resources to perform essential activities in using OGD. Key resources refer to everything that can be utilised to meet a company’s objectives to exploit OGD benefits. One key resource is the firm’s capacities that grow through adopting big data and analytics technologies, implementing business strategies, deploying guidance and a framework for data-driven strategies and business rules, and customising services and products to exploit OGD value for customers. To unlock OGD value, ICT literacy skills and value-capturing roles are two components of people's competencies. The ICT literacy skills

include the ability to engage in data visualisation that makes use of government data to improve the efficacy of OGD programs. To utilise OGD, each user of government data requires a unique set of skills, such as data aggregation, computing power and storage management, and software tool management. In comparison, value-capturing roles are activities undertaken by DDOs within the OGD initiative centred on capturing OGD and exploiting OGD value for social and economic gain. Such expert analysis requires human abilities that a machine or robot cannot replicate.

6. **Key activities**

In order to provide a value proposition for their customers/clients, DDOs need to engage in key activities, which are depicted in the collaborative model of the ecosystem (Figure 5-57). DDOs perform the activities by capturing and aggregating OGD data, which can then be used to create various services. For instance, capturing OGD data can involve transforming the data into a format that is more useful for decision-making. Further action is often done by integrating OGD data with other data sources to create innovative outcomes, thus offering feedback to the data provider to improve OGD quality and supply-demand matching.

7. **Network partners**

For the DDOs in this network to achieve their strategic goals, they need to maintain strong ties with other actors as their partners over the long term. The banking industry partners in the ecosystem are data providers, such as LINZ, NZTA, StatsNZ, communities, and web developers. On the other hand, the property-data provider maintains partners such as local councils, LINZ, real estate agents, media, communities, and software developers. A value proposition can be created by fostering all key resources and partners in an integrated network.

8. **Revenue source**

The revenue sources relate to the amount of money each customer segment is willing to spend in the value proposition. The property-data provider generates new revenue streams by developing an innovative platform to provide its customers with the highest-quality data and establish a strong brand in the property-data market. The company collects all property sales data in one location, publishes them on its website, and markets them as a one-stop application. The company generates

revenue through connecting users with suppliers and buyers for advertising, and brand agreements, instead of service sales. In contrast, the bank industry uses the OGD by delivering free economic reports to the public. The business had customised the service because it was generally offered solely to its customers. Nonetheless, the business created a unique strategy for the New Zealand market. Therefore, the company does not generate revenue from exploiting OGD but to strengthen relationships with its clients.

9. Cost and fees

The cost of using OGD would be minimal compared to its value. The property-data provider paid for council data instead of receiving it for free, as with open data. The banking sector evaluates data exploitation costs, including the database system, data analytics tools, and human capital. The company also paid for a Roy Morgan consumer survey, which necessitated accuracy to yield meaningful results. An analysis of survey data combined with OGD traffic figures was presented as economic insights for the public and customers.

10. Requests and feedback

"Requests and feedback" is a new element included in the EBMC to accommodate the ecosystem perspective of the study's findings and analysis, compared to the original BMC template. A feedback mechanism is essential for supporting the New Zealand Government in determining the needs of DDOs and other users, ensuring data quality, and enhancing the value of OGD. As depicted in the collaborative model (Figure 5-57) and the logic model (Figure 6-1) of the New Zealand OGD initiative's ecosystem, the feedback mechanism is essential for keeping the OGD cycle process in a constant state of evolution. It also provides the data provider with the necessary input to minimise the gap between OGD supply and demand. The DDOs can communicate their feedback and inquiries to government agencies through various means. For instance, most local councils provide the public's email addresses to facilitate the optimal use of OGD and enhance the public's experience when accessing OGD. The "request datasets" component of the open data portal (data.govt.nz) enables anybody to submit a request and track the status of their queries, including responses from government agencies that possess the requested

datasets. DDOs can also give opinions or requests regarding OGD directly to their regular partners, who provide them with appropriate datasets.

11. Motivations

This newly introduced feature to the EBMC highlights why DDOs are willing to use OGD as their source to derive value from OGD. Referring to the motivational factor logic model (Figure 5-55), the ecosystem requires mutually reinforcing motivations, particularly between government agencies and DDOs, to be sustainable and unlock the potential value of OGD. The interests of DDOs for capturing OGD must be balanced with government agencies and other key actors' objectives to publish and deliver meaningful datasets to DDOs as the users. The motivation to get free government data is to produce products/services cost-effectively. Another factor is accessibility. Government data is accessible, and it is simple to connect to an open platform that satisfies the criteria for appropriate open data. OGD assists data-driven firms in rapidly creating new value. Access to government data is enhanced by connecting to an open platform that meets the criteria for unrestricted datasets. A strong motivation for utilising the potential social and economic value of OGD is harnessed by establishing services based on open data to generate positive outcomes.

12. Networks and collaborations

The three new elements included in the EBMC emphasising how the ecosystem influences the development of business models- are incredibly beneficial. For example, the element of "Networks and collaborations" is beneficial for identifying gaps across actors and structuring new parts of each ecosystem component if needed. The newly added element is included in the EBMC because the dynamic process of OGD value creation and value capture within the ecosystem depends mainly on the sustained collaboration and interrelationships among the various actors. The OGD collaboration and partnership aim to increase the value-creation and capture the ability of resources, people, organisations, and communities by interlinking them.

Enabling factors in using OGD are crucial for DDOs and government agencies to improve the quality, accessibility, and value of OGD. DDOs should identify OGD

that benefits their firms and the clients they serve. OGD are essential for earning benefits, resolving issues, and encouraging DDOs to utilise them. However, when OGD are not maintained effectively, communication between the data providers and users can be hampered, relationships can be harmed, and potential benefits might be lost. Consequently, DDO must maintain strong communication, partnerships, and competitive capability while interacting with OGD actors within the ecosystem of the OGD initiative.

Ecosystem business models must be developed to leverage OGD's potential benefits. Business model representations can facilitate the study and development of a specific logic for value creation and capture within the New Zealand OGD ecosystem. This allowed for the establishment of hypotheses regarding the potential impact of the study's findings and analyses on ecosystem business models. The findings and analysis of developing the Ecosystem Business Model Canvas for DDOs to use OGD have led to the following section, which describes the business model types of DDOs as the ecosystem's main actors for the OGD initiative.

6.2.2. Business Model types for the Data-driven organisations collaborating in the ecosystem of the OGD Initiative

The concept of this study is that ecosystem business models can provide a sustainable and valuable solution to data-driven organisation collaboration and partnership across actors of the OGD initiative ecosystem. This section presents further explanations to research question RQ4 following the answers provided in the preceding section discussing the EBMC (section 6.2.1). Based on the EBMC, this section explores the different types of ecosystem business models of DDOs and their value-stream diagrams to support sustainable and valuable collaboration and partnership in the OGD initiative ecosystem. All the types of the ecosystem business models require all actors to collaborate with DDOs in the orchestrated ecosystem.

1. Service integrator business model

   The service-integrator business model generates a value proposition by capitalising on the OGD value that is created when many types of services are combined into a single offering for the benefit of the company's customers and the public. The DDOs benefit not from selling services but from the agreement with the brand and

advertisements. Figure 6-3 shows the Value-stream diagram of Service integrator business model.

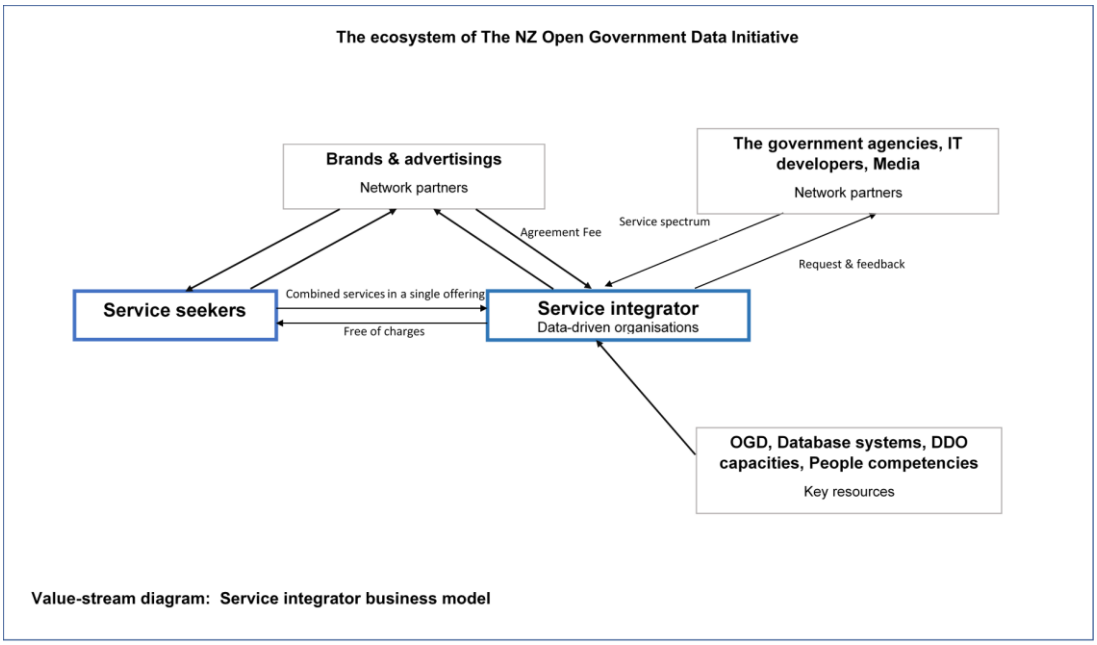

Figure 6-3 A Value-stream Diagram for Service Integrator Business Model

The type of business model known as a service integrator works in conjunction with innovated data provider partners such as LINZ, local councils, NZTA, software developers, real estate agents, communities, and numerous property-related industries and media outlets as the key partners in order to innovate or meet the requirements of its customers.

2. Enriched-value aggregator

The business model type of enriched-value aggregator collects OGD and other data from various providers. It presents it in a way that enriches and improves the services given by application software and real estate agents. It provides enhanced services to their users beyond what the data providers offer. Figure 6-4 presents the Value-stream Diagram in how the customers is benefited from the services offered by DDOs in the enriched-value aggregator business model.

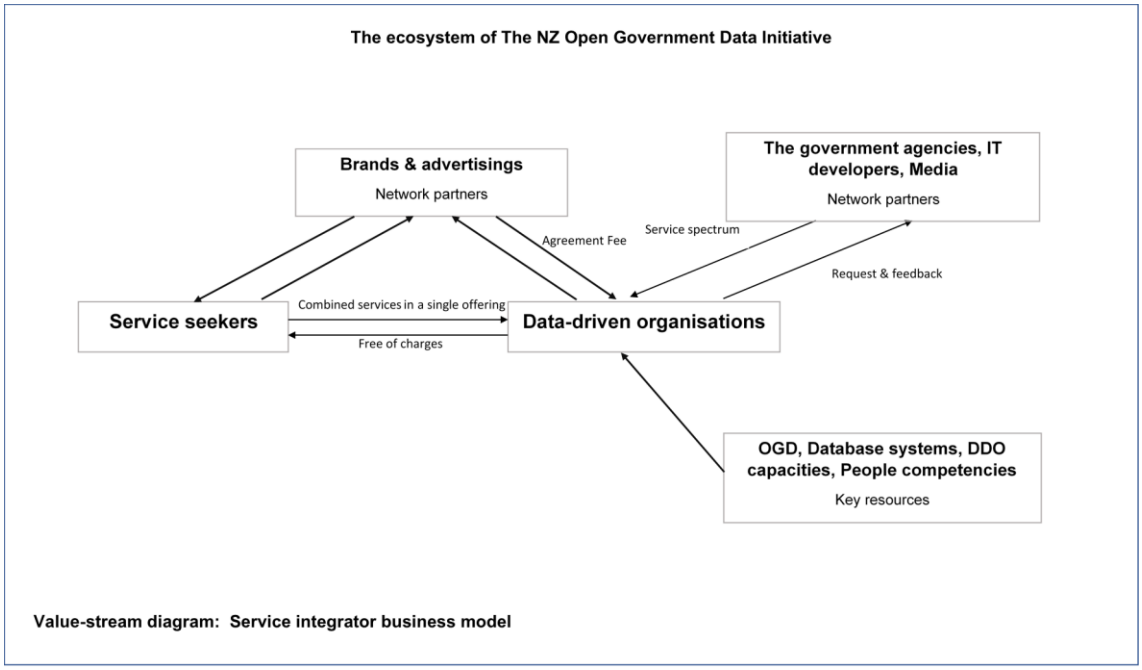

Figure 6-4 A Value-stream Diagram for Enriched-value aggregator Business Model

The aggregator, like DDOs, provides a service to data providers and users by collecting OGD and other data from various sources relevant to the services given by application software and real estate agents. They present this data on their website, application, or other platforms for business users. For example, a DDO might collect data from multiple real estate agents in a particular area and present it on its website for users looking for houses in that area. DDOs do not charge a fee to users for access to their enhanced services; instead, they earn revenue through connecting users, sellers and buyers for advertising and brand agreements. For example, DDOs collect data about recreation, culture, and event facilities from various public organisations and present it on their website. Doing this can better match buyers with sellers and landlords with tenants. Furthermore, this information can help people search for a home and find information about the surrounding community, which helps them make a more informed decision.

3. Unit-service loyalty

   The unit-service loyalty business model is a way for DDO to sustain a long-lasting relationship with its business and individual clients. The value propositions of unit-

service loyalty are data-rich services that provide insights, business reports and complementary services. This business model empowers regular, commercial, wholesale, and very important customers, as customer segments, by giving them the data they need to make informed decisions for their business. Thus, the key activity of the unit-service loyalty is dedicated to customer services. The value-stream diagram for unit-service loyalty business model is illustrated in Figure 6-5.

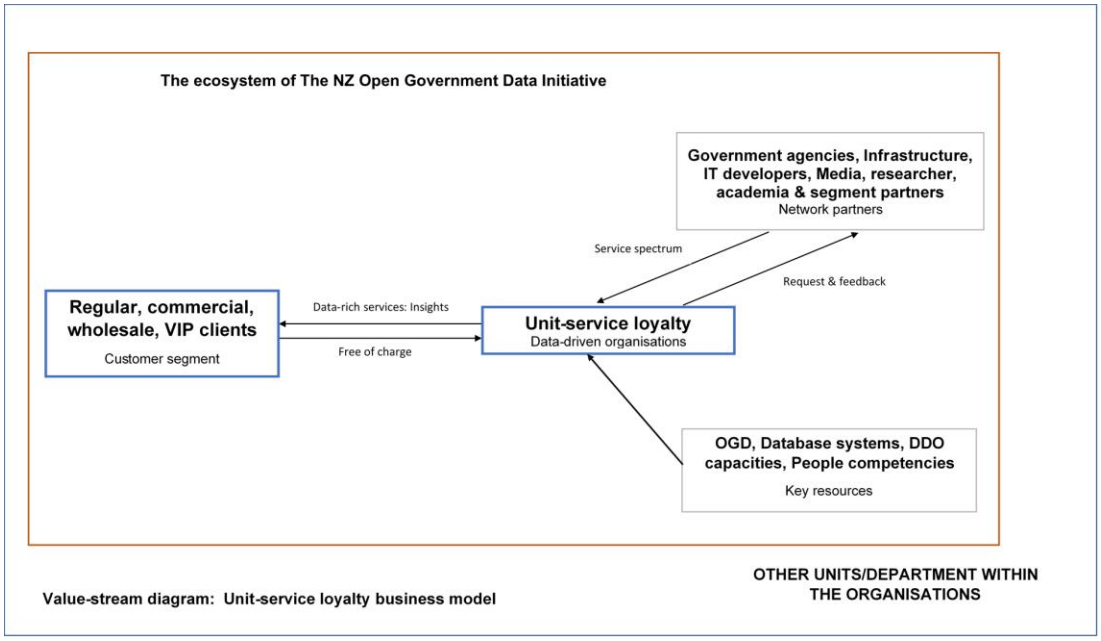

Figure 6-5 A Value-stream Diagram for Unit-Service Loyalty Business Model

Unit-service loyalty's network partners include data providers, such as local councils and the NZTA, as well as non-governmental data services, citizens, media, researchers, and IT developers. Additionally, they have partnerships with infrastructure and segment partners. As this business model provides free service to its consumers, no revenue is generated from OGD or any matter relating to the OGD initiative, despite DDOs earning revenue from providing other products, services, and facilities. Figure 6 illustrates how the customer segment benefited from the services provided by the unit-service loyalty business model.

4. Value-creation collaborator

   A value-creation collaborator is a business model that collaborates data-driven business and the OGD ecosystems to empower value-creation by opening, delivering,

capturing and using OGD to exploit the value. I developed this business model based on the concept of collaborative value-creation (de Man & Luvison, 2019; Joniškienė, Šaparnienė, Juknevičienė, Limba, & Reinholde, 2020) and it emerged from this study's findings and analysis. Joniškienė et al. (2020) defined collaborative value creation as the momentary and permanent benefits organisations, individuals, and communities obtain as the outcomes of their collaborations within an ecosystem. This definition encompasses both the immediate and long-term benefits that are earned. Figure 6- presents the value-stream diagram in how DDOs perform the value-creation collaborator business model.

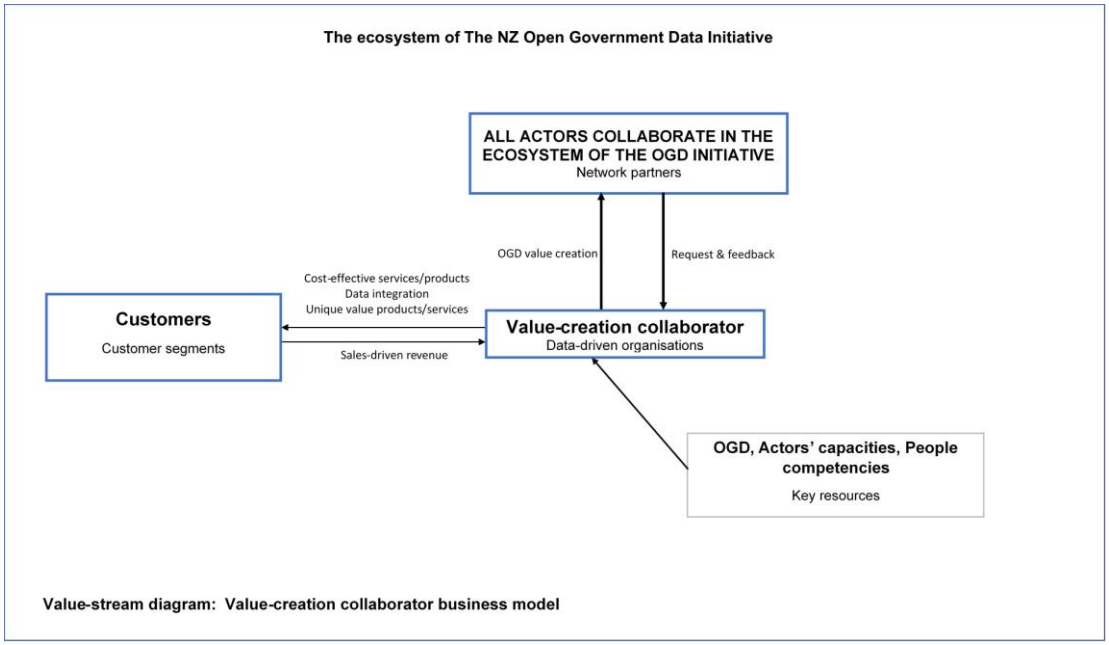

Figure 6-6 A Value-stream diagram for Value-creation Collaborator Business Model

DDOs perform the business model by exploiting the created open data produced by government agencies and other actors within the ecosystem of the OGD Initiative. All actors work together to pursue their common goals, and as a result, they cultivate long-term partnerships that bring about reciprocal economic and social benefits from OGD value. The value proposition is cost-effective services/products, data integration and unique value for each customer segmentation which resulted from the networked activities performed by all actors within the ecosystem. All the actors orchestrating the components in the ecosystem are the network partners of the value-creation

collaborator model. To do this, DDOs have created a variety of products and services on top of the OGD value.

In summary, the distinctive strength of the New Zealand OGD ecosystem is its monopoly on producing open data such as OGD. No organisation can compete with the New Zealand Government. In this ecosystem, government agencies in New Zealand are the central/leader actors. Other actors may change over time, but government agencies do not. However, the value of their work depends heavily on how DDOs, as data consumers and prosumers, utilise OGD with their organisation's capacities and people's competencies. These are the key points of four business model types developed for DDOs to examine data-driven organisations' contributions to the ecosystem of the OGD Initiative.

6.3. Summary of Chapter 6

This chapter presented the findings and analysis of designing Ecosystem business models. The findings and analysis of the design concepts and features addressed research questions RQ3 and RQ4. The following chapter discusses the synthesis and discussion by revisiting the research design and all the findings and analyses of the multiple case studies and the Ecosystem business model designs.

Chapter 7 Synthesis and Discussion

This study aims to consolidate ecosystem business models in academic and practice literature, identify the roles of each actor and the required services, and develop ecosystem business models on how DDO can successfully translate OGD to create impact. In order to contribute to the research aim, this chapter synthesises and reflects on the empirical findings and analyses of the multiple case studies discussed in Chapters 5 and 6. This is offered by section 7.1. Section 7.2 then discusses how the study meets the criteria for reliability and validity. In addition, section 7.2 presents theoretical propositions by revisiting the answers to the research questions presented in Chapters 5 and 6.

7.1. Interpreting the Data

This study adopts the philosophical assumptions underlying the constructivist method, which focus on interpreting individuals' responses in various social circumstances. I began this research by conducting a literature review and obtaining the opinion that there are numerous realities concerning OGD advantages depending on which organisation handles them. The epistemological premise is compatible with this investigation. It seeks to raise concerns regarding the truth, the actual knowledge, and the relationship between the researcher and the object of study. I intend to approach the interviewees with the epistemological paradigm. Consequently, subjective data is compiled based on the individual perceptions of OGD participants to understand through the knowledge and experiences of others.

The qualitative method was chosen because it gives instruments for explaining numerous phenomena and circumstances. In qualitative research, the significant philosophical concept is based on people's interactions with one another and their social circumstances. By performing extensive literature reviews and analysing multiple case studies in New Zealand, the research collects empirical evidence for creating ecosystem business models. This study is appealing for two reasons: to comprehend rich, contextual, and thorough data and to emphasise good management of complex findings. This project combines the Endnote and NVivo software to collect the case study

information. It tries to justify the theories and models of open data and ecosystem business models used as a framework to comprehend New Zealand's Open Government Data (OGD) activities.

The study utilised a variety of sources and methods, including in-depth interviews to collect primary data and website searches, and document evaluations to obtain secondary data. The qualitative data from case studies are encoded using thematic analysis coding. Study ethics must be thoroughly anticipated and addressed throughout the entire research process.

7.1.1. The multiple case study context

Data were collected from July 2019 to January 2021 in New Zealand for several reasons. Open Data Barometer ranked New Zealand as one of the top five high-capacity countries for open government based on readiness and effect variables in its 2015 worldwide report. Open data can benefit the government, citizens, communities, and private companies. Also, New Zealand is a pioneer in publicising government data as Open Knowledge International's 2016-2017 Global Open Data Index ranks New Zealand eighth.

7.1.2. Data gathering

Figure 7-1 shows a flowchart of data gathering that illustrates the whole process of especially the semi-structured interviews as the method to collect primary data. After the Auckland University of Technology Ethics Committee (AUTEC) approved the study's ethics in June 2019, participants were recruited based on their OGD implementation and experience in New Zealand with a purposeful sampling method. Even though competent participants from multiple New Zealand organisations were available, a sample was required to give context-appropriate data. The final list included ten people from six government agencies, two DDOs, and an IT company. All participants possessed OGD technical abilities and knew how their organisations used or published data.

It starts from the preparation, interviews, and post interview activities. When selecting government and DDOs in the smart cities of Auckland, Wellington, and Christchurch, data collection limits were also considered. After identifying public and private organizations interacting with Open Government Data in New Zealand, access was

granted to potential participants. This required contacting the leaders via email, explaining the study, and obtaining permission to interview the chosen participants.

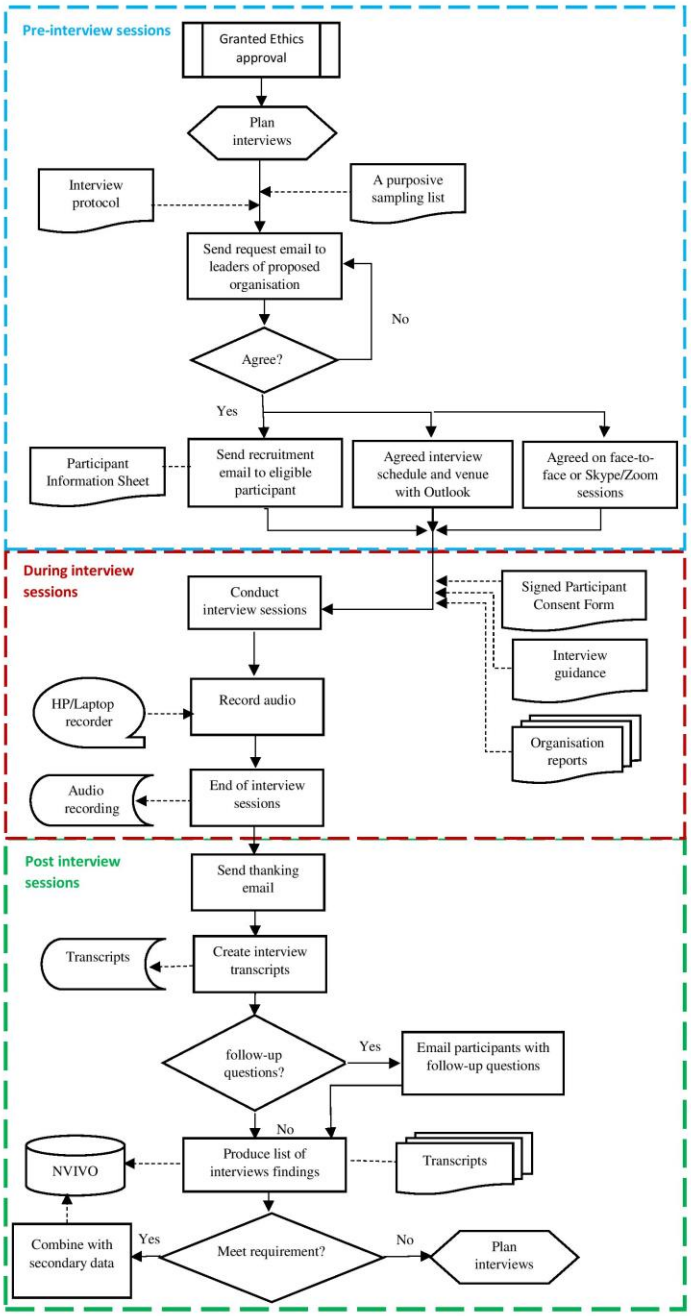

Figure 7-1 Flowchart of Data Gathering

The study needed a sample of data having context-appropriate information; thus, it used a non-probabilistic sampling approach called "purposeful sampling". Based on research questions, semi-structured interview protocols with pre-formulated questions were developed for members of the New Zealand OGD programmes. The protocol consists of 40 to 42 questions designed to determine the experts' perspectives on OGD concerning New Zealand Government data management policies, IT-company's assistance and DDOs as open data users. There are two interview protocols for this study. One was designed for participants from government agencies and the other from DDOs and an IT company. I chose a semi-structured open-ended interview method because it allowed participants to freely share their opinions and perceptions on the broad topic of open data and the OGD initiative in line with the constructivism paradigm approach. Four interviews were conducted in the participants' offices and six online, using Zoom or Skype at the request of the participants. For the interviews that were conducted face-to-face, two mobile phones were used to record them, with the first phone serving as the primary recording device and the second as a backup. Zoom's online session recording resulted in MP4 (Motion Picture 4) video and M4A audio files, whereas Skype's online session recording resulted in MP4 files.

The transcript process started when each audio recording file was transcribed using the Live Transcribe application on the smartphone which generates raw text data of sounds. The second stage entailed the researcher closely observing the recordings using an audio/video player while checking the rough-text transcriptions generated in the first stage. This study uses a non-verbatim transcription method to make transcripts easier to read by eliminating all excessive noise, such as thinking sounds or laughing, without altering the conversation's meaning or structure.

7.1.3. Coding and analysis

This study adopted four cycles of a multiple case study approach as an observational design. Three cases were purposefully selected because they best represented a range of different development contexts, inferences, and implications based on the replication logic of organisations with different roles in the OGD initiative: case study A: New Zealand Government agencies, case study B: Data-driven organisations and case study C: Information and Technology company. Case study A focuses on exploring and

analysing participant replies about government agencies. In contrast, case study B examines participant responses related to data-driven organisations. Case study C focuses on the IT company, which was identified based on its relevance to the participants' transcripts as key support for the government agencies. Each case study was conducted through two coding cycles. During the first cycle of the initial coding cycle, transcripts' excerpts were coded using In Vivo coding (Literal coding) to code meanings as close as possible to the actual participants' phrases. This cycle employed a deductive method to assure alignment with the study's objectives, resulting in a deductive In Vivo coding cluster for each case study. Case study A's deductive coding analysis produced 856 In Vivo codes grouped into 27 categories, whereas case study B's analysis produced 255 In Vivo codes with 26 categories and case study C's analysis produced 117 codes with 19 categories. The second inductive cycle re-coded the In Vivo coding cluster with Pattern coding to simplify the complex coding cluster, resulting in the case study's inductive coding cluster. Then, the coding cluster based on thematic analysis with Pattern coding developed meaningful themes of each case study described in the conceptual framework of each theme.

The third and fourth cycles were a cross-case analysis of the three case studies' findings to generalise explanations from the individual case because it identifies commonalities and differences across cases. In the third cycle, each case study's thematic map of themes in coding hierarchies was compared to find interrelationships across themes to build frameworks and logic models. The third cycle resulted in comparison matrices of themes across case studies A, B and C. The fourth cycle included triangulation, an examination by finding multi-case study themes, generating a logic model of OGD and a value-creating role framework to answer research questions RQ1 and RQ2, and developing ecosystem business model concepts.

Furthermore, an understanding was advanced by adopting the findings and analyses derived from the multiple case studies to develop a framework and logic model for the unestablished ecosystem based on the collaborative model of the ecosystem of the New Zealand OGD initiative. To address research question RQ3, I replicated the model developed in the cross-case study by expanding Verhulst and Young's (2017) logic model to develop a comprehensive investigation of actors, activities, outputs, and impacts within and between ecosystem elements. To construct a business model for an

ecosystem that is not yet established, a framework consisting of an in-depth summary and logic model was created to address research question RQ3.

To establish an ecosystem for the OGD initiative, a clearly defined set of beneficial interactions must exist among the participants to address research question RQ4. This is based on the findings and analysis of the multiple case studies in Chapter 5 and the ecosystem business models mentioned in section 6.1. As a result, I created an Ecosystem Business Model Canvas (EBMC), an extended BMC tool (Osterwalder & Pigneur, 2010, 2013), based on the themes of the multiple case study shown in Figure 5-52, the summary of actors and roles in Table 5.25, the collaborative model presented in Figure 5-57, and the logic model depicted in Figure 6-1. In addition, four types of business models were developed using EBMC tools to specify DDO contributions to the OGD Initiative ecosystem.

7.2. Research Reliability and Validity

Two standards must be met, reliability and validity, to produce rigorous qualitative research (Creswell, 2018). Reliability is the consistency of measurements. In other words, it is the repeatability of the results. The foundation of reliability is data sufficiency, which can be defined as the degree to which the data being provided are adequate to support the conducted analysis (Yin, 2014). Validity, on the other hand, is the accuracy of measurements. It means that the research results accurately reflect what is being studied (Siccama & Penna, 2008).

7.2.1. Evaluation of Research Reliability

To ensure reliability of this study, I adopted several approaches to be implemented ranging from data collection, the multiple case study findings, and analysis. The interview protocols that were prepared before conducting the semi-structured open-ended interview sessions were essential for improving each case study's reliability because the protocols allowed me to collect sufficient data from participants in every case (Yin, 2014). Two different protocols were prepared for different participants, from government agencies, data-driven organisations, and an IT company.

Next, this study adopted a strategy of purposeful sampling to ensure the reliability of data gathering by collecting a representative sample from a variety of New Zealand

government agencies and DDOs. Participants with relevant knowledge and experience dealing with open data were interviewed to obtain sufficient responses to be used as primary data. Another approach to improve the reliability of the study was to collect primary and secondary data by conducting interviews, gathering government reports, and examining the open data portals and websites of government agencies and DDOs. The variation of data sources helped to improve the reliability of the study and identify gaps in knowledge and new research areas.

A database was developed for the case studies to manage the documentary evidence. Interview transcripts and participant consent forms were kept at the AUT campus premises, while interview audio and video recordings were saved on AUT OneDrive, a Microsoft Cloud Service provided by AUT. The supervisors knew the document's storage and the link drive for the audio-video files.

7.2.2. Verification of Research Validity

Validity refers to the repeated checks and verifications conducted by the researcher to verify data accuracy (Creswell, 2018). This study established validity by gathering the experiences of participants linked with government agencies, DDOs, and an IT company based on their personal experiences provided during the interview sessions, as opposed to the researcher's perspective. The shared experiences were captured on audio-visual recordings, which were then transcribed into interview transcripts. To strengthen internal validity, I did regular reviews on data collection procedures and multiple case study analyses with the supervisors.

The validity was also verified to ensure a high saturation during the interviews and the thematic analysis. I asked the questions outlined in the interview protocols and then asked follow-up questions based on the interviewee's responses. The interviewees were able to discuss their experiences in relation to OGD in detail and share their motivations for taking actions. They were able to do this with minimum supervision from the interviewer, allowing for a more in-depth exploration of their thoughts. The interviewees were very open with their experiences and provided much detail that helped understanding of their motivations, actions and perspectives related to OGD. In addition, the validity of the research was verified when data collection was exhaustively coded until no further coding was possible in the thematic analysis of all case studies. The high-

data saturation enabled an accurate representation of the data. In other words, the research is reliable because all participants' responses in the transcripts were collected and coded. The first cycle in every case study was conducted with a deductive approach. Every phrase that stood out was coded with In Vivo coding until all transcripts were excerpted as many codes as possible using thematic analysis.

Additionally, a triangulation approach as a form of validation was adopted to ensure dependability and authenticity of data by comparing data from two or more sources. The triangulation was implemented across each case study findings and cross-case analysis. In the first cycle of each case study, one of the essential steps of the triangulation approach involves re-reading the data and correlating them to the interpretation of the NVivo text search query to locate all instances of a specific word related to another phrase. The fourth cycle of the cross-case analysis confirms source triangulation by comparing empirical thematic data to secondary data, followed by a final verification. The triangulation led to significant analysis, such as the multiple case study's themes, a logic model of OGD, and a framework of the value-creating roles.

Finally, three triangulation processes were conducted by comparing the empirical thematic analysis of the different case studies to the secondary data collected from the open data portal, the websites of organisations, government papers, and the published literature. These three triangulation processes are (1) Data source triangulation to compare the thematic analysis with secondary data for elucidating the government agencies' efforts to open more data regularly; (2) Data source triangulation to determine construct validity of the thematic findings regarding a procedure for users to request datasets; and (3) theory triangulation for case study B regarding the organisation's capabilities and competencies within the framework of open data competitive capability. To sum up, the final multiple case study analysis resulted in new themes emerging based on examining the key points presented from the triangulation process.

7.3. Theoretical Propositions: Revisited Research Aims and Questions

As described in Chapters 5 and 6, the thematic maps, coding hierarchies, the themes of the multiple case studies, and the collaboration, framework, and logic models that

emerged from the data analyses were investigated further by addressing all of the study's research questions RQ1, RQ2, RQ3, and RQ4. This section extends the examination of the data by revisiting the answers to research questions. The overall research aims to provide an organised representation of the study, highlighting the interconnection between the case and theories. In order to accomplish this, Chapters 5 and 6 employed the results of the thematic analysis to develop a theoretical framework and future study.

7.3.1. Revisiting the Research Questions

Chapters 5 and 6 provided in-depth explanations of all the answers to research questions. In addressing each research question, some of the most crucial points are revisited here.

*Research question RQ1 "**What are the value-creating roles played by different actors in Open Government Data and Data-Driven Organisations?**"*

The answer to research question RQ1 is not only about the value-creating roles of government agencies but also the value-capturing roles of the DDOs. An OGD ecosystem needs to specify how government agencies as the data provider and publisher conduct the value creation process and how data-driven companies as the users do the value capture process. The answer was extracted from each case study's thematic coding cluster to find OGD actors, their roles and responsibilities. Based on the result of the meta-synthesis, it is possible to argue that OGD actors are central in implementing OGD. Since OGD actors take on diverse roles and responsibilities, they need a clear understanding of their roles and responsibilities. The results of this analysis are in a matrix as shown in Table 5.25, which shows the roles and responsibilities of OGD actors.

Government agencies are the most important actors, as they play the most significant role in OGD implementation. According to the findings of the case studies, there are six roles identified. They must acquire and maintain data quality as *data producers*. There may be several *data managers* and *data owners* inside a government organisation.

As the *data curator*, the government is responsible for finalising datasets in accordance with OGD standards. A *data manager* is responsible for the beginning of the data life

cycle, whereas a *data curator* is responsible for the conclusion. As a *data curator*, StatsNZ advocates for data to mediate between the government and users. Each government agency appointed a *data champion*, typically a member of senior management, to oversee the distribution of open data within their organisations. The government's primary responsibility in OGD implementation is to disclose data, which produces value for consumers. The *data publisher* manages open data portal and *data curator* maintain data related to code enforcement. As the *data publisher*, the Department of Internal Affairs oversees the OGD catalogue on data.govt.nz.

In addition to the government's key role in implementing OGD, the *data consumer* is the OGD user who derives benefits from open data. Users such as DDOs, citizens, government agencies, non-governmental organisations, academics, and multinational users collect OGD to enhance their operations and develop new products/services. In addition, even if the data is freely available, the data consumer's ability to extract value from OGD may differ because some individuals lack the essential ICT literacy abilities to utilise OGD benefits. The *data prosumer* captured open data, aggregated the OGD with all different kinds of information and published them in one application that was easy for people to use.

Moreover, the multiple case study analyses indicate that in addition to government and data-driven organisations, IT companies have played a supportive role in assisting government agencies in providing OGD value and in assisting DDOs in capturing open data. There are at least three roles that IT companies play: *IT infomediaries, service designers, and data innovators*. The IT companies associated with the interviewees indicate the *IT infomediaries* who support the OGD initiative. This study defines the role of an IT infomediary as an IT company that integrates Information Technology services with open data to serve the government and enhance interactions between governments and data users. A *service designer* role is ideally suited to address the issue that datasets were previously only used by data experts with strong data literacy skills. It bridges descriptive and analytical data to assist the data publisher in visualising the data for public consumption. Thus, a *data innovator*, usually a Chief of Data of IT companies, helps government data teams create innovation, resolve difficulties, and assist DDOs in serving their customers with innovative products/services.

This study reveals that the key supporting actors are not only IT companies but also other entities that accomplished the role of the *intermediaries*. The Open Data Charter and the Open Government Partnership play intermediary roles as the New Zealand Governance's international partners to support the New Zealand Declaration on open and transparent government. Other players, such as private companies and DDOs, execute not only the roles of data consumer and prosumer but also the function of an *intermediary* to repackage data, if necessary, to promote OGD consumption for public use. In addition, non-profit organisations such as communities, meetup groups, hacker groups, and Open Data Ninja serve as *intermediaries* between actors engaging in OGD co-creation.

In addition, a *data integrator role* in DDOs or private companies integrates data from several external, internal, and open data sources. The organisation's data integrator may be a person or a team of data integrators. Briefly, data integrators increase the value and dependability of data to reveal the benefits of OGD.

Provide additional answers for research question RQ1, the summary of actors and roles listed in table 5.25 is analysed into a matrix structure of value-creating and value-capturing roles mapped along the open data use and effect approach. It depicts the data value chain from production to impact, highlighting the contribution of value-creating and value-capturing roles played along the chain by important OGD ecosystem members.

As indicated in Figure 5-53, government agencies and IT firms play crucial roles in the OGD ecosystem's path to data availability. This could be seen as the New Zealand Government's responsibility to satisfy the responsibilities of its citizens and the Data Action plan. As entities that provide active support to the New Zealand Government, IT companies play three crucial roles in open data platforms and their technological features in data sharing. These include providing their data analytics capabilities, promoting interaction with other data, and enabling data visualisation and publication in various formats. Obtaining government data through a series of data value chain actions creates OGD value. Through the competitive capacities, the culture of open data, and dynamic cooperation within the OGD ecosystem, the value of OGD is translated into social and economic advantages for all organisations engaging in the interdependent activities of the ecosystem.

*Research question RQ2 "**What is the motivation of Government agencies and Data-Driven Organisations to publish and use Open Government Data?"***

According to the thematic analysis results, government agencies and DDOs have diverse reasons and purposes for publishing and using OGD, which has hindered their capacity to maximise the value of their data. They employ several strategies to overcome obstacles to publish more data and develop products and services based on OGD. A thematic map illustrating the motivations and objectives for opening and utilising OGD is shown on Figure 5-54. The thematic map describes not only the motivations of government agencies and DDOs but also their objectives for publishing and using OGD, as motivations and objectives are related in terms of their reasons for publishing and capturing OGD, implementation directions, and anticipated outcomes. Motivations are how government agencies and DDOs become willing to engage in their operations and attain their objectives. As a result, government agencies require the assistance of IT companies to design a platform that will enable data-driven organisations and other users to acquire and analyse data quickly.

According to the participants from DDOs, there are five reasons why they choose to use OGD. First, it is simple to develop new values. Second, getting the OGD necessary to service their clients is easy and quick. The third motive is to capture and monetise the potential economic value that might be unlocked by creating services over open data. Fourth, it gives a considerably more reliable data source for client reports. Moreover fifth, it provides clients with a data-based solution. On the other side, the data literacy skills required to use OGD have become an integral component of business strategy.

The objectives of government agencies when releasing government data are outlined below.

To support government directives by associating data products with strategic outcomes. Open data increases public access to government information. It makes government data public and can improve government services. *To promote open data*, which allows public access to government information and data. *To disclose OGD's government and citizen benefits*, which help the public solve problems to improve their quality of life. Combining skills, technology, and infrastructures can make datasets useful *to increase*

innovation and economic and social engagement, which improves productivity and efficiency with data. Furthermore, the government's objective is also *to increase government openness and accountability*, which enhances public comprehension of government actions and decision-making.

The most effective option is for the government *to engage citizens with the government*, which gives the public access to information previously used by the government, chosen parties, and professionals. *Easing data discovery* is vital to the government's digital strategy, which discloses data without compromising integrity or security by partnering with IT companies. Thus, *to help improve the efficiency and delivery of government services*, where OGD optimises government resources, staffing, and data openness. Another objective is *the public funds government data* because data is acquired at taxpayer expense and made public per the New Zealand Goal open data regulations. The central government is responsible for determining the open data guidance, including objectives. Participants from a local council were informed that they followed the leader's objectives and did not establish any local council's objectives in opening data.

In addition, the objectives of the data-driven organisation's use of OGD are also presented in Figure 5-42. The results of case study B's thematic coding highlighted four objectives of the data-driven organisation's use of OGD. First, DDOs can *capture traffic data for statistical and commercial analysis* to better serve their clients. Second, *simplify insights gained from OGD mining for clients* to comprehend the company's forecasts better, enhancing client engagement and loyalty and identifying client demands. Third, *obtaining free open government data* allows them to expand their businesses and improve their operations with minimal expense. Despite OGD being free, data mining and analytics need funds to make OGD valuable. Lastly, DDOs can *add value to data in various ways* by making public data accessible to customers and the public, fostering services/product innovation, and enhancing data culture.

To conclude, government agencies and DDOs publish and utilise OGD for fulfilling their objectives and motivations. They comprehend the demands and concerns of constituents better. This could improve public services and operations, as these actors are crucial to the development and maintenance of an ecosystem for OGD initiative.

Furthermore, a logic model was constructed to describe the logical linkages between government agencies' and DDOs' motivations and objectives that were described above, resulting in motivational factors for OGD ecosystems linked to value-creating and value-capturing roles. The logic model for motivational factors of government agencies and data-driven organisations (Figure 5-55) hypothesised the answer to research question RQ2. The logic model hypothesises that the New Zealand Government's OGD initiative has aimed to promote openness and accountability across government agencies over the past twelve years by publishing large volumes of government data. In turn, DDOs have begun to leverage OGD to produce new services and products for the public. This model shows mutually reinforcing motivational factors between the two sets of actors in the New Zealand OGD ecosystem.

*Research question RQ3 "**How does one design new ecosystem business models for an ecosystem that is not mature yet?"***

There is a high correlation between the activities of the actors and the desired benefits of OGD. Central actors strengthen their responsibilities by contributing innovative activities to the overall ecosystem performance. The interrelationships and supporting elements are crucial for designing an ecosystem that has not matured yet. The in-depth framework summarises the study's findings (Table 6.1) and then will be used to construct a model for designing business models for an OGD ecosystem that has not yet been developed. The framework presents the internetworking among eight elements in a comprehensive list consisting of Input, Actors, Activities, Outcomes, Impact, Feedback, Enabling and Disabling conditions.

The *Input*, datasets such as city imagery and geographical data, as well as traffic and statistical data, play an essential element in deciding the eventual impact of the OGD initiative. Collecting and distributing government data by government agencies is crucial to the New Zealand OGD initiative. The next element, *Actors*, revealed that the OGD initiative in New Zealand has not yet reached full maturity, although numerous actors contribute to the initiative's openness and use. The demand side of OGD is the largest and most distinct sector of OGD users. A stronger collaboration between demand-side actors, such as data-driven organisations and government agencies, could be advantageous. Thus, the *Outcomes* of open data for the government are improved

quality datasets, social and economic advantages, and Māori policies and strategic assets. DDOs may utilise OGD to establish new platforms for innovative services or to create new products and services. Groups such as the media and academia benefit from data journalism and collaborative research by using OGD.

The outcomes of the New Zealand OGD initiative have diverse impacts on the ecosystem. However, a few *Impacts*, as one of the elements, stand out as exceptionally significant. For example, it raises the government agencies' profile and increases citizen engagement and participation. Thus, the Open Data Charter's participation in this ecosystem can foster economic growth and enhance public service. In addition, DDOs can benefit from monetising open government data, whilst meeting groups and researchers have an impact through encouraging change and distributing knowledge. According to the *Feedback* element, an OGD feedback mechanism helps the New Zealand Government decide what data users need, improve data quality and prioritise data to boost data consumption. Users can submit their feedback via an online form in the open data portal, to which the authorised agencies should respond to maximise the benefits mentioned above. In addition, the element of the *enabling and disabling conditions* are hypotheses to be tested as open data in developing countries grows and evolves. Since evidence of OGD's effects differs, I do not consider enabling and disabling elements to assess ecosystem performance. Data about the enabling conditions were extracted from Figure 5-55's logic model for motivational factors, while data for the disabling condition elements were retrieved from the coding map of all case studies in Chapter 5 linked to the category of the challenges and obstacles in publishing and using OGD.

To complement the aforementioned explanation to address research question RQ3, I developed an extended logic model based on the model that was developed to summarise the framework's of the ecosystem of the New Zealand Open Government Data initiative. The model is an iterative process that helps the government determine if its data gathering and opening activities match OGD's goals to build business models for an immature ecosystem. The logic model shows that government actors supply data, publish with IT company support, and deliver OGD. The logic model generates hypotheses about how the ecosystem affects business model development. It helps find gaps, organise new sections of each component, and convey the strategy to present

future actors and other interested parties. The model allows for complicated ecosystem evolution. This is a dynamic document that can be modified as the ecosystem of this OGD initiative matures and the actors' understanding of how it affects the ecosystem changes.

*Research question RQ4 "**How does one design ecosystem business models for Data-Driven Organisations using Open Government Data to unlock open data potential benefits for all actors?"***

This study mapped DDO ecosystem business models using Osterwalder and Pigneur's Business Model Canvas (Osterwalder & Pigneur, 2010, 2013). The BMC Business Model Canvas is a template for building ecosystem business models. The elements are drawn from Figure 5-52's numerous case studies, Table 5.25's actor/role description, Figure 5-57's collaborative model, and Figure 6-1's logic model. As elaborated in Chapter 4, the BMC consists of nine elements to identify a client-attractive value proposition that differentiates the company's offers from competitors.

Referring to the findings and analysis of the multiple case studies in Chapter 5 and the ecosystem business models provided in section 6.1, a clearly defined set of beneficial interactions must exist among the participants to develop an OGD ecosystem. I created the Ecosystem Business Model Canvas (EBMC) as an extended version of the BMC template with three additional elements: networks and relationships, customer motivation, and customer requests and feedback. The EBMC can help DDOs analyse their ecosystems and development potential to make smarter business decisions. The three extra factors help it uncover new opportunities and optimise existing ones. The EBMC was developed to enable New Zealand OGD actors to assess their ecosystems, growth potential, and customer/client impact. The EBMC assists DDOs analyse ecosystems and development potential to make smarter business decisions with the three additional elements. The EBMC, as shown in Figure 6-2, helps New Zealand OGD actors examine their ecosystems, growth potential, and customer/client impact. The EBMC comprises three additional elements: Networks and Collaborations, Motivation, and Requests and Feedback. As depicted in the BMC ecosystem, the elements are organised into four sides to distinguish elements generated to develop a robust ecosystem and organise all components into a vast network. The additional three

elements are designated as the Ecosystem side. Another side, the Organisation side, groups the Key resources, Key activities, and Network partners elements, while the Product and services side includes the Offering. Thus, the Customer side incorporates the Customer relationships, Customer segments, and Channels elements: the Financial side manages the Revenue source and Cost and fee elements. Each element is discussed below.

Customer segments. Customers/clients drive the competitiveness of DDOs as they prioritise customer expansion and retention. DDoS must sort clients based on their behaviour and needs, while Creative platforms have increased customer retention. Integrating data facilitates consumer segmentation, such as banks categorising clients based on their business needs, like morning briefings. Due to their technological nature, several services are only available for wholesale clients.

Customer relationships. DDOs provide outstanding customer service and attend to customer demands to preserve customer/client relationships. DDOs value client loyalty since it increases referrals and service, being attentive to consumer needs and offering quality services contribute to customer loyalty. Public data can assist data-driven businesses, such as banks, in establishing client relationships.

Channels. This ecosystem creates and captures value via channels. The channels provide OGD for free. The Department of Internal Affairs maintains the centralised OGD portal data.govt.nz, while LINZ, NZTA, StatsNZ, and local governments offer data APIs. Data.govt.nz provides free public datasets. A data portal makes OGD accessible, usable, and valuable.

Offering. Value propositions are products or services. DDOs must offer unique, enticing products or services to develop a successful OGD value proposition. The property-data provider designed a user-friendly application/web service platform to grab more of the property market. The banking industry uses OGD data, such as traffic and statistics, with data from other providers to give clients updated economic insights. Value-added services create indirect economic benefits and networked marketplaces.

Key resources. DDOs require both financial and nonfinancial resources to carry out their activities. Significant resources include big data and analytics technology, business

strategies, guidance and a framework for data-driven strategies and business rules, and customised services and solutions for maximising OGD's value for customers. OGD value demands ICT literacy and value-capturing competencies, whereas expert analysis requires human skills that a machine or robot cannot replicate.

Key activities. To provide value to their customers/clients, DDOs should engage in the key activities outlined under the collaborative ecosystem model (Figure 5-57) . Thus, using OGD may involve transforming it into a format that facilitates decision making. For instances, integrating OGD data with data from other sources produces novel outcomes. Furthermore, feedback to the data supplier enhances OGD quality and matching of OGD supply and demand.

Network partners. To fulfil their strategic business plan, DDOs in this network must maintain long-term partnerships. For example, LINZ, NZTA, StatsNZ, communities, and web developers are ecosystem partners in the banking industry. In contrast, partners in property-data service include local governments, LINZ, real estate brokers, the media, communities, and software firms. Therefore, integrating key resources and partners is required for value proposition creation.

Revenue source. To fulfil their strategic business plan, DDOs in this network must maintain long-term partnerships. For example, LINZ, NZTA, StatsNZ, communities, and web developers are ecosystem partners in the banking industry. In contrast, partners in property-data service include local governments, LINZ, real estate brokers, the media, communities, and software firms. Therefore, integrating key resources and partners is required for value proposition creation.

Cost and fee. Compared to its benefit, the expense of utilising OGD would be low. Instead of receiving council data for free, like with open data, the provider of property data paid for it. The banking industry examines data exploitation expenses, which include the database system, data analytics tools, and human capital. The corporation also paid for a Roy Morgan poll of consumers, which required precision to deliver meaningful results. Economic insights were offered to the public and customers based on a study of survey data and OGD traffic statistics.

Requests and feedback. "Requests and feedback" is a new element of the EBMC designed to accommodate the ecosystem perspective based on the findings and analysis of the study. A feedback system assists the New Zealand Government in identifying the needs of DDOs and other users, ensuring data quality, and enhance OGD. As depicted in Figures 5-57 and 6-1 of the New Zealand OGD initiative ecosystem, the feedback mechanism keeps the cycle of the OGD ecosystem in a state of ongoing evolution. It also assists the data provider in minimising the OGD supply-demand gap. DDOs have multiple options for communicating with government agencies, such as most local governments provide email accounts to enhance the OGD experience for the public. Especially the "request datasets" feature on the open data portal (data.govt.nz) enables anybody to submit a request and track the status of their query, including responses from government agencies. DDOs can also request OGD data from their key partners in the government agencies.

Motivation. This EBMC element describes why DDOs utilise OGD. Sustainable ecosystems necessitate motivations that reinforce one another, particularly between government agencies and DDOs (Figure 5-55). The interests of DDOs in capturing OGD must be balanced with the objectives of government agencies to provide relevant datasets to DDOs as users. Other factors are that free government data assists in creating cost-effective products and services, and accessibility is crucial. A platform for open data facilitates access to government data to accelerate value creation for data-driven companies and to develop social and economic benefits.

Networks and collaborations. The three new EBMC components emphasise the contribution of the ecosystem in developing business models. "Networks and collaborations" assist in identifying actor gaps and, if necessary, constructing separate components for each ecosystem component. The newly added element is introduced into the EBMC because the creation and capture of OGD value within the ecosystem depend on continual collaboration and interdependencies among the actors. The OGD collaboration and partnership aims to facilitate the development of value through connecting resources, individuals, organisations, and communities.

This section addresses the answer for research question RQ4, in which DDOs and agencies need OGD enablers to improve quality, accessibility, and value. DDOs should

identify a helpful OGD. OGD earn benefits, answer problems, and promote DDO use. Lack of maintenance OGD can hinder communication between data sources and users, disrupt relationships, and lose potential benefits. DDO must maintain strong communication, connections, and competitiveness with OGD initiative actors.

The New Zealand OGD initiative needs ecosystem business strategy. Business model representations can encourage New Zealand's OGD ecosystem to gain value. This allowed theories regarding the study's findings and business model judgments. The Ecosystem Business Model Canvas for DDOs to use OGD resulted in the following section, which displays DDOs as the ecosystem's key OGD actors to address further explanations to Research question RQ4.

Based on the EBMC that was explained preceding, different types of DDOs' ecosystem business models and value-stream diagrams were defined to enable sustainable collaboration and partnership in the OGD initiative ecosystem. All ecosystem business models require all participants to work with DDOs. The types of ecosystem business models are:

1. **Service integrator business model.** The service-integrator business model capitalises on OGD value provided when many services are integrated into a single offering for customers and the public. DDOs benefit through brand agreements and advertising, not selling services.
   Service integrators engage with LINZ, local councils, the NZTA, software developers, real estate brokers, communities, and numerous property-related sectors and media outlets to meet client needs.

2. **Enriched-value aggregator.** The business model enrich-value aggregators acquire OGD and other data from providers to extend and improve software and real estate agent services. It offers users more services than data providers. The aggregator, like DDOs, collects OGD and other data from numerous sources relevant to software and real estate agent services. They display company data on their website, app, or other platforms. A DDO might collect data from many real estate agents in a specific area and post it online for house hunters. DDOs do not charge customers for access to their upgraded services; instead, they make money through advertising and brand

deals. DDOs collect data from public organisations about recreation, culture, and event facilities and post it online. This improves buyer-seller and landlord-tenant matches. This information can also assist consumers to search for a property and learn about the neighbourhood, which informs their decision.

3. **Unit-service loyalty**. DDO's unit-service loyalty business model allows them to manage the business and individual clients. Unit-service loyalty's value propositions are data-rich services that provide insights, business reports, and additional services. This business approach empowers regular, commercial, wholesale, and very important customers by delivering business data. Thus, unit-service loyalty prioritises customer service.

   Local councils, the NZTA, non-governmental data services, people, media, researchers, and IT developers are unit-service loyalty's network partners. Infrastructure and segment partners are also involved. As this business model gives free service to its consumers, no revenue is earned from OGD or related matters, despite DDOs earning cash from other products, services, and facilities.

4. **Value-creation collaborator**. Value-creation collaborator is a business model that collaborates data-driven organisations and OGD ecosystems to open, deliver, capture, and exploit OGD. I designed a collaborative value-creation business concept (de Man & Luvison, 2019; Jonikien et al., 2020). Jonikien et al. (2020) defined collaborative value creation as temporary and permanent gains through ecosystem interactions. Immediate and long-term benefits.

To conclude, the ecosystem business model elaborates how DDOs capture the created open data within the ecosystem of the OGD initiative to unlock the benefits. One important factor is all actors work together to pursue common goals by maintaining long-term partnerships within the ecosystem of the OGD initiative. Furthermore, the ecosystem's networking activities led to cost-effective services/products, data integration, and unique customer value. Ecosystem partners coordinate value-creating and value-capture network models by creating innovated products and services on top of the OGD value.

7.3.2. Revisiting the Research Aims

As defined in Chapter 1, this study aims to integrate academic and practitioner perspectives on several ecosystem business models to determine each actor's roles and the necessary services and functions. Another aim is to construct ecosystem business models illustrating how DDOs may affect OGD.

The case studies: characteristics and context

To provide this study with empirical findings and analysis, Open Government Data Initiative participants, their affiliated organisations, and key partners investigated a broad range of designated topics for each case study. Three case studies highlight how multi-case studies provide different perspectives to address research questions, objectives and aims. Each case study produced a hierarchical thematic map. Each case study focuses on OGD supply and demand concerns addressed by government agencies and DDOs in partnership with IT companies. Each case study includes three recurring themes: first, organisational capacity and capability; second, people skills and knowledges to deal with OGD; and third, strategies to exploit the value of OGD. The third cycle of the multiple cases studies (Chapter 6) revealed the connected concepts among the case studies' themes by finding the commonalities and relationships among them.

Case studies exposed government data to assist in identifying user data, and then DDOs combined open and internal data. This strategy was also utilised in case study C, which demonstrated how IT companies assisted the government in establishing an open data platform so departments could publish data, and data-driven companies could utilise it. Agencies created OGD value through sharing data with IT firms, as data's highest value is derived from its use. C is the result of the participation of IT companies in open data projects and their assistance with licensing, privacy, and technical issues. Each topic contains relevant, unconnected information. Despite similarities and correlations in comprehending how participants' organisations acquire and use data, it was impossible to consolidate common themes to simplify case study themes. Because supply and demand sides of OGD had diverse organisations, participants, and functions, they are not a single ecosystem.

Case studies' triangulation

The OGD initiative in New Zealand established a strategy to publish data, as opening data is the most effective way to increase OGD adoption proactively. In data publication, quality should not be the primary consideration. Participants in three case studies suggested that authorities should publish more data as long as they are sufficient to aid customers in decision making and to create new products and services unless consumers risk making incorrect decisions. This empirical synthesis triangulates with the findings of dataset increments released on the open data portal (data.govt.nz). The open data portal, data.govt.nz, published 5,900 datasets from 152 government agencies and 25 organisations in August 2018. The number of datasets has doubled since 2018. In January 2022, there were approximately 31,000 datasets on the open data platform, an increase of 2,400 in seven months.

These results support the construct validity of empirical findings from multiple case study analyses using secondary data from screenshots describing how the government published datasets over nearly four years and encouraged other agencies to participate in this OGD initiative.

According to the thematic findings of the case studies, prioritising users' requests for government data is one of the objectives of the New Zealand Government's open data initiative. Users were required to be aware that the government intended to release personal data owned by the government. With this form of interlinking, government agencies as supply-side entities become more adept at enhancing the capacity of open data portals to publish datasets.

Another data source triangulation was performed and the OGD initiative of the New Zealand Government uncovered various themes. The most important themes are the capacity to assess OGD availability and progress, to successfully utilise data's potential value, and to comprehend the nature and value of data. To triangulate the empirical findings with the secondary data of the 'data request' feature of the open data portal, users can obtain datasets in keywords into the catalogue to discover the required datasets. If they cannot locate it, they can fill out a form to request non-personal, non-secure government information.

Theory triangulation was conducted by examining the empirical findings with the framework of the open data competitive capability (Zeleti & Ojo, 2017). The adapted framework was derived from the thematic cluster of case study B and the conceptual frameworks of topics, as shown in Figures 5-17 and 5-18. 5-19 and 5-20. Four capabilities in the context of OGD are presented in the adapted framework as Business, Infrastructure, Offering and Relational rent.

By integrating their data with OGD, data-driven companies can produce product/service innovation thanks to essential sources such as experienced humans, an online database system, and significant datasets. DDOs have pioneered service customisation to give customers unique products and services. To simultaneously produce and collect value, organisations must comprehend the roles of all OGD ecosystem actors. In the digital age, data integration is vital to the success of both public and commercial organisations. The advantages of OGD enable data-driven businesses to increase sales-driven innovation and establish a foundation for service innovation. According to IGI worldwide, relational rent is a higher return jointly in an exchange agreement. The open data portal (data.govt.nz) is the main interface between the OGD provider, the public, users, and IT infomediaries and intermediaries. Integrating OGD with other data to deliver insights strengthens client interactions in a priceless manner. As a final review, data-driven organisations are companies that use data and analytics to make strategic decisions and enhance the performance of their products and services.

The multiple case study's themes

Themes for the multiple case studies were elaborated using three triangulation methods to evaluate the consistency of findings, then integrated with existing themes from three case study thematic analyses. The themes are explained as:

- Theme 1A "**Competencies and process-driven abilities in publishing data**" relates to a set of skills, knowledge, and attitudes required of government officials who work with OGD. It drives the process strictly and consistently doing the OGD activities to enhance the data quality and value.

  Different agencies reveal previously unavailable data through OGD, making government information more accessible. As agencies become more familiar with the

process-driven nature of publishing OGD, the skills required to manage it has expanded. The government is committed to modernising its intricate data publication process with ICT. ICTs have transformed top-down, unidirectional communication into interactive, multi-directional communication. Thus, government agencies require adequate resources, instruments, and capabilities.

- Theme 2A "**Government capacities to undertake OGD activities**" elaborates that strong leadership and a culture transformation help the government's ability to execute OGD rules, regulations, structures, and standards. The capability has helped the government overcome OGD implementation challenges and obstacles.
  The government must adopt OGD with advice, regulation, structure, and standards. This requires a culture shift and capable leadership. Government agencies are transforming as they view data as public assets whose release may stimulate innovation, improve knowledge, and create new value. Before and during data publication, there are many challenges. Government agencies encountered technology demands, OGD quality challenges, and internal and external agency impediments to publish government data.
- Theme 3A "**Value created through OGD innovation**" describes the value provided by releasing high-quality data to the public, including the potential for citizen-driven data innovation and the value-creating roles that may be designed to enable the public to access and build data value.

  The participants assessed the quality of government information and explored a relationship-related component of government information. They observed that OGD portals use site analytics to gather crucial information about who visits their websites, which data sets are downloaded, and how frequently those data sets are downloaded.

- Theme 1B" **Competencies and data-driven culture in using OGD"** explains the capabilities, expertise, and mindset of a company to capture, analyse, and use OGD to their organisation's strategic goal, pertaining to a data-driven culture to obtain OGD benefits.

  A user who visualises data may need different abilities than one who develops an app to improve OGD programme efficiency. Each OGD user needs a specific set of skills,

including ICT literacy. The themes also described DDOs' roles as users, key partners, and actors. Government agencies publish OGD and produce value, while DDOs capture that value.

- Theme 2B "**Organisation capacities to drive OGD innovation**" related to how the organisation has the capacity to deploy creative ideas by prioritising investments in its core capabilities, such as its people, data, and innovation-driving activities.

  The first step in maximising the usefulness of OGD is for the government to make it accessible and comprehensible to the public. OGD is complex; however, it offers a great deal of data that can be used to make informed decisions, allowing DDOs, as users, to benefit from the availability of analytic tools and business strategies. The organisational capabilities needed to facilitate innovation in OGD. The capabilities require the DDOs to develop strategies that increase their innovation ability, enabling the implementation of the New Zealand OGD

- Theme 3B "**Capturing OGD value for business and service innovation**" describes that OGD use can create goods, services, and businesses because they can produce economic and social value. To maximise its potential, however, data quality must be evaluated appropriately.

  The social and economic benefits of OGD are mentioned, such as how a connected company supplied economic indicator information using OGD data. OGD has business value to monetise, such as online property sales and cross-outside marketing for real estate agencies. OGD benefits are not just revenue and service benefits; they also improve user data literacy, the essential economic indicator, and an organisation's competence and performance.

- Theme 4B "**OGD collaboration and partnership**" emerges based on building relationships between government agencies and DDOs to capture the value of OGD and utilise it by removing impediments to developing a data-driven culture.

  Government agencies and DDOs must build relationships to capture the value of Open Government Data (OGD) and utilise it by removing impediments to developing a data-driven culture. For this to happen, both sides must be committed to developing

the capabilities required for such a partnership. Furthermore, the data landscape is constantly evolving, which means that these relationships and capabilities must be constantly nurtured and developed to stay relevant. The participants discussed the difficulties and barriers when OGD data are frequently not regularly published, which hinder their efforts to identify the data's usefulness. They require effort for data pruning, lack of metadata standards, and various formatting difficulties. Those problems related to data quality need to be settled with the partnership with IT infomediaries and intermediaries.

- Theme 1C "**Competencies to provide IT support for OGD implementation**" discusses a company's IT skills and knowledge that support the government by designing and publishing software to publish OGD. IT companies assist the government agencies implement OGD more efficiently and effectively.

  The participant-affiliated companies' ICT skills and experience play a vital role in supporting the government in transitioning government-held information into open data. The process of transformation marked the start of OGD's value generation. The participants' responded how their skills as software developers and their involvement in supporting the value generation of OGD provide vital help to government agencies executing OGD implementation, such as assisting client projects and software.

- Theme 2C "**Company's capabilities to support OGD value creation**" emerges based on how the IT company's technology and data analytics helped integrate OGD across government agencies, comprehend and manage data and realise the government agencies' potential for data analytics.

  The IT company helped publish OGD by using software to derive data value. As a software provider, they knew OGD value by adopting the company's policies and processes, organisational structure, and work culture to establish a strategic plan to help the government with the OGD project. The participant said the guidelines meant the client decided which data to open and owned all work results.

- Theme 3C "**Accelerating OGD release to maximise value**" based on the examination that IT companies maximise OGD value speeding the release of high-

quality and accessible data. OGD publishing not only accelerates the pace of data value creation, but also ensures data is fit for purpose.

IT companies address disseminating good data in which their goals for OGD implementation include earning credibility by assisting successful open data initiatives. They indicated handling licensing, privacy challenges, and technological constraints supporting government agencies. Furthermore, IT firms quantify their OGD support by customer satisfaction. The company was also satisfied since agencies published big data, which has tangible use and benefits and may be valuable for data scientists.

- Theme 1D "**Strengthening a network of interrelationships and communications among different OGD actors**" explains how OGD value can be created, delivered, and captured by government agencies and data-driven companies, taking into account all sources and forming excellent partnerships with all network actors. This theme and theme 2D are new themes emerged for the cross-case analysis, that were developed and combined with existing themes from three case study thematic analyses.
- Theme 2D "**Building OGD ecosystem to leverage organisations' competitive capabilities**" was derived from an in-depth analysis that revealed the need for the OGD implementation network to emphasise actors' roles in their organisations' technology-advanced capabilities. The OGD ecosystem model facilitates the identification of dynamic connections between actors and their affiliated organisations, as well as the dissemination of network successes and failures.

Based on the empirical research of how each organisation handled OGD implementation, coding analysis of participant transcripts from case studies A, B, and C created themes. The latter two themes connect case study themes to construct an OGD ecosystem inter-organisational network.

The emerging collaborative model of the New Zealand OGD ecosystem

According to secondary data taken from StatsNZ online document, the New Zealand Government continues its goal of releasing more non-sensitive government data to the public domain to benefit the communities, environment, economy and wellbeing.

Creating value from data is essential to the government's digital transformation. The central government and local councils utilise their data to produce value for New Zealanders. NGOs, the commercial sector, ministries, the media, academics, Iwi/Maori, and citizens all use open data, official statistics, and government in diverse ways. Consequently, the data has a diverse range of uses and potential value. Using the principle of the New Zealand data system map (Figure 5-44) and the framework of value-creating and value-capturing roles (Figure 5-41), I present a high-level representation of the New Zealand OGD ecosystem's network of actors, relationships, and value creation and capture.

Government agencies, IT companies, DDOs, and intermediaries are the four key players in the New Zealand OGD ecosystem. The collaborative approach explains how OGD empowers government agencies to be more transparent and responsive to the needs of citizens. By exploiting data, DDOs have developed competitive advantages, potentially developing new ecosystem business models. The OGD ecosystem in New Zealand is a dynamic setting that can influence the context in which OGD value is created and captured.

Data-driven organisations are the key users of OGD in the collaborative model, and their involvement in the ecosystem is crucial to collecting data value and ensuring the ecosystem's sustainability. Another actor in this ecosystem, IT companies' experience in data storage, technology, and software-assisted government agencies, satisfies the New Zealand OGD objective. On the other hand, these intermediary collaborations result in configurations from multiple organisations aligned to give public value but without the same expertise.

7.4. Summary of Chapter 7

This chapter summarised, revisited, and reflected on the empirical study presented in Chapters 5 and 6, highlighted the study's validity and reliability, and addressed the research aim and questions by developing theoretical propositions and discussing their implications for the Open Government Data initiative and ecosystem. Collaboration, triangulation, and numerous case study themes were presented. The next (final) chapter closes the study by noting its main outcomes, contribution, limitations, implications, and future research directions.

Chapter 8 Conclusion

In the final chapter of this thesis, I provide my concluding thoughts and observations on the stages involved in the research process. This includes sections on the study's contributions, limitations, implications, and discussion of the implications for future research.

8.1. Summary of the study

This study was done to assess how selected organisations deal with OGD to enhance the benefits and value of their services, as given in the four research questions. The reliability and validity investigation were done in accordance with the study design developed at the onset of this investigation. Participants, locations, session methods, organisation types, and industry sectors were gathered in New Zealand as primary data. Additionally, secondary information was collected in combination with the primary data. Moreover, the accumulated data were analysed, the study's hypotheses were verified, and synthesis and conclusions were produced.

Figure 8-1 depicts this study's results when seen from the perspective of the three main stages of data analysis: case study analysis, cross-case analysis, and design of ecosystem business models. The case study and cross-case analysis were conducted as part of a multiple case study analysis. The design and analysis of multiple case studies were presented in Chapter 5, whereas the design of ecosystem business models was developed in Chapter 6. Regarding the three case study analyses, empirical data from each case study were analysed thematically through rigorous data coding and themes in two cycles. The first cycle of the deductive technique with In Vivo coding produced the deductive coding cluster. In contrast, the second cycle of the inductive method with Pattern coding yielded the inductive coding cluster. In this cycle, each case study's inductive coding cluster was studied in greater detail to develop conceptual framework themes, resulting in the thematic map as the final outcome of each case study analysis.

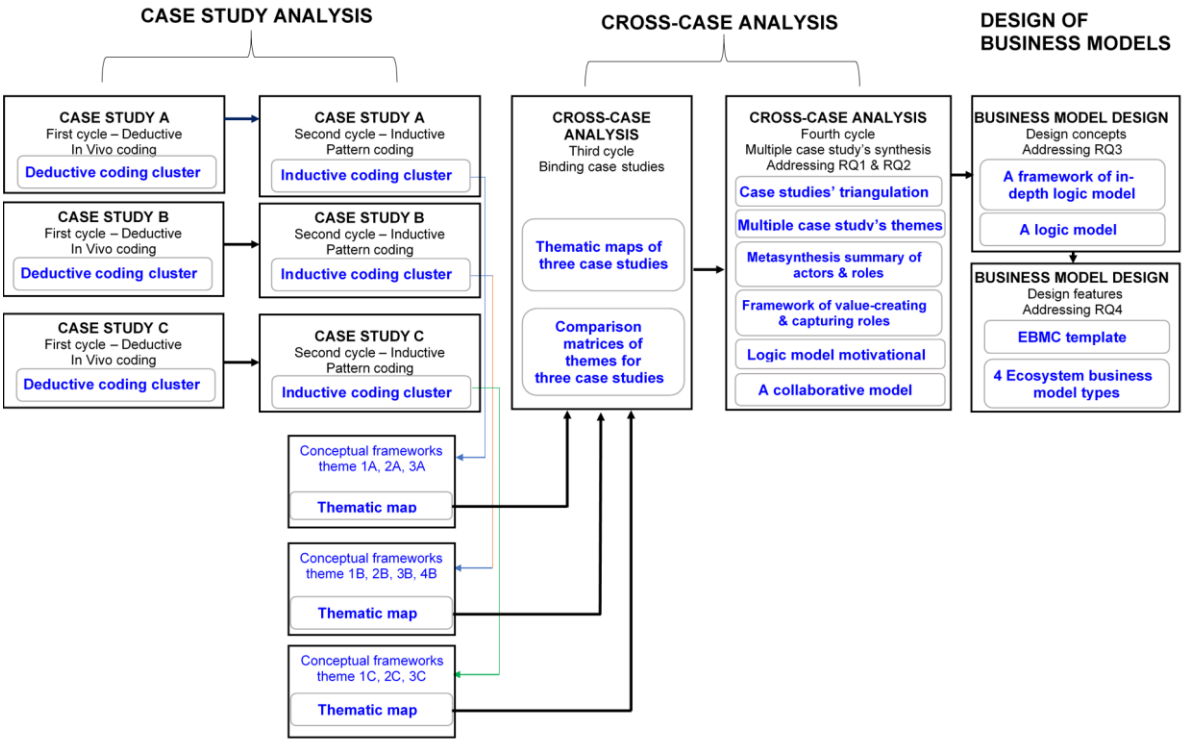

Figure 8-1 Study Outcomes

The subsequent phase of the multiple case study was the cross-case analysis, which focused on drawing inferences from specific cases by recognising commonalities and inconsistencies across cases and significant aspects from various criteria mentioned in the interview protocols. The cross-case analysis analysed the thematic maps with themes and codes of three case studies to produce comparison matrices of the themes of the three case studies. The most significant outcomes resulted from the fourth cycle of the multiple case study as the final cycle of the cross-case analysis since it addressed research questions RQ1 and RQ2 and delivered the fundamental concept for the next stage, the design of ecosystem business models for DDOs. The coding clusters and thematic maps as case study findings were systematically represented as a collection of emerging themes based on linkages among codings and themes resulting from the triangulation of the case studies. The answer to research question RQ1 was also the primary outcome addressed by the meta-synthesis summary of actors and roles and the framework for value-creating and -capturing roles.

Examining the coding cluster of case studies A, B, and C related to the motivation and objectives of the key actors to publish and use OGD, the thematic map and logic model for motivational elements were further studied to address the specific research question RQ2. Furthermore, the collaborative model representing the New Zealand OGD ecosystem's network of actors, relationships, and value creation and capture is another essential output of this cycle. This model serves as a foundational framework for the subsequent phase of building ecosystem business models.

The framework of in-depth analysis and logic model of the New Zealand OGD initiative's ecosystem is the primary outcome for addressing research question RQ3 as a dynamic model that is updated in conjunction with ecosystem development. Designing the Ecosystem Business Model Canvas as an expanded version of Alexander Osterwalder's BMC is the primary outcome I developed in response to research question RQ4. Following the ecosystem business model types, the EBMC was created for data-driven organisations to analyse their strategy for utilising OGD within the OGD initiative's ecosystem.

8.2. Contributions to Research

Three domains can be used to position a study's contribution, which is applicable whether the research approach is qualitative or quantitative. More specifically, the substantive domain refers to the outcomes of context-specific studies that depict an improved understanding of the phenomena that make up the research context. The conceptual domain refers to the study's findings that have the potential to be more applicable (Creswell, 2018; Patton, 2002). It also contributes to a better explanation of the phenomenon that is the subject of the investigation. The term "methodological domain" refers to the processes and methods others are free to adapt to investigate other phenomena in contexts relevant to this one.

8.2.1. Research Contributions to the Substantive Domain

This study contributes to the existing body of knowledge in the substantive domain by providing a comprehensive explanation of how the OGD initiative in New Zealand affects the government's and data-driven organisations' ability to create, deliver, and capture the value of open data using two distinct strategies. To begin, to maximise the value that

the OGD delivers to the predetermined organisations that worked on its implementation, it is necessary to analyse the essential aspects of the OGD Initiative. The strategy was performed by conducting an empirical investigation by analysing the different multiple case studies thematically. Second, to establish ecosystem business models that empower DDOs to enhance their strategy for exploiting the OGD value supported by other key actors and their key success aspects as the possible source of impact. These models were developed so that DDOs can construct business models for ecosystems. In order to design the business models, I created the Ecosystem Business Model Canvas, an extended version of the original model BMC by Osterwalder and based on the thematic themes and codes derived from the multiple case studies.

Chapters 5 and 6 detail these substantive contributions. These contributions are novel because similar investigations have not been undertaken. Moreover, the contributions provide a reliable and valid study for future research.

8.2.2. Research Contributions to the Conceptual Domain

By "conceptual domain", I refer to the research outcomes that offer an in-depth description of the phenomenon being investigated and are potentially more relevant. The results of the multiple case studies provide significant contributions and implications to the overarching conceptual domain.

8.2.2.1. OGD Value-creation and Value-capture

The findings of the multiple case study reveal that the most important aspects of the OGD initiative ecosystem depend on how government agencies open data to create value and how data-driven organisations capture this value to reap the benefits. While each value-creating role has been the subject of past research, this study highlights the critical value creation and value capture roles, actors, and operational contexts backed by the meta-synthesis analysis and framework derived from the findings of multiple case studies. These results contribute to body knowledge in several ways:

- First, the study identifies the network across organisations and actors, consisting of their interdependent resources, skills, capabilities, and activities. The notion of actors' exchanges' values within the OGD network according to their interdependent responsibilities. This finding is significant because it gives the fundamental concept

for constructing a network in which government agencies as the data supplier and publisher conduct the value creation process and DDOs as the value capture process.

- Secondly, the study reveals how the actors of the OGD initiative fulfil their responsibilities along the data-value process, from production to impact, highlighting the contribution of value-creating and value-capture roles along the OGD ecosystem's chain. This finding implies that each value-creating and value-capturing role is responsible for a specific set of responsibilities, from data production, publication, and utilisation to action and feedback along the logical path of data availability leading to accountability.
- Thirdly, this study demonstrates how to minimise the gap between data sharing and processing as the interaction point among actors with value-creating roles and with value-capture roles. This research suggests that the supply-demand actors of the OGD ecosystem establish co-creation to maximise OGD value by maintaining interaction according to the framework presented to identify gaps.

8.2.2.2. Motivational Factors of the Key Actors Dealing with OGD

Government agencies and data-driven organisations have different motivations and objectives for publishing and utilising OGD, which have hindered their capacity to realise the value of their data, as determined by the thematic analysis. The findings of this study were derived from each case study's thematic cluster that corresponded to the category that classified the motivations and objectives of the key actors. Motivations are how government agencies and DDOs become willing to engage in their operations and accomplish their objectives. Moreover, their objectives illustrate the expected consequences in detail.

An empirical thematic map for categories of the motives and objectives to access and utilise OGD was developed to investigate the motivational factors. This study contributes to the substantive domain by illustrating the logical relationships between the motivations and objectives of government agencies and DDOs, resulting in motivational factors for the OGD ecosystems related to the value-creating and value-capturing roles performed by these two sets of actors.

8.2.2.3. Collaborative Network of the OGD Initiative in an Ecosystem

This study created and presented a novel collaborative model that illustrates the network of New Zealand OGD ecosystem actors, relationships, value creation, and capture. The model is built on the topics of the multiple case studies and the cyclic diagram of the New Zealand data system map. The high-illustration model provides a way to construct ecosystem business models and offers novel insight into the complex process of implementing the OGD ecosystem.

In a previous study derived from the StatsNZ online publication of the NZ data system map, the potential impact of government data on people's lives and how people interact due to OGD implementation was described. The diagram represents the data movement from the central government and local councils to various groups, such as NGOs, private sectors, ministries, media, academics, Iwi/Maori, and citizens. Their efforts to capture the value of OGD positively impact multiple domains, including the environment, business, community, and cultural wellbeing. This study expands the network of interrelationships between OGD initiative participants by arguing that the four critical actors in the New Zealand OGD ecosystem are government agencies, IT businesses, DDOs, and intermediaries and by identifying DDOs as the primary OGD users. In this collaborative approach, DDOs and their function in the ecosystem are essential for extracting data value and contributing to the ecosystem's sustainability. By exploiting data, DDOs have developed competitive advantages, potentially developing new ecosystem business models. In addition, the study contributes to collaboration aspects, including strategic competence, the technological sector, competitive advantage, feedback mechanism, and network actors.

8.2.2.4. Ecosystem Business Models and their Dimensions

This study proposes that ecosystem business models can provide a sustainable and valuable solution for data-driven organisation collaboration and partnership across OGD project ecosystem actors. The results related to ecosystem business models included all of the multiple case study and business model design stages. This study develops Verhulst and Young's (2017) advanced logic model to analyse ecosystem actors, activities, outputs, and impacts based on the cross-case analysis and primed by the collaborative model. The logic model framework extends Verhulst and Young's model

(2017), summarising the framework's components that impact the study and collecting evidence on the New Zealand OGD programme's ecosystem in establishing new ecosystem business models for the immature system.

OGD and value-stream diagrams are used to map DDO ecosystem business models. The Ecosystem Business Models template contains networks and relationships, customer motivation, and customer requests and feedback. Four ecosystem business models for DDOs collaborating in the OGD ecosystem were designed to facilitate sustainable and beneficial collaborations in the ecosystem. All study findings contribute to designing ecosystem business models for DDOs that promote value-creation by interlinking resources, people, organisations, and communities within OGD collaboration and partnership.

8.2.3. Research Contributions to the Methodological Domain

The purpose of this study is to develop a technique for collecting qualitative data that is reliable. To that end, this strategy has been properly documented and prepared for further analysis. In doing so, this study contributes to the body of knowledge in the methodological domain. Furthermore, the results of this study will provide insights that can be used to improve upon existing techniques for collecting qualitative data.

Regarding the investigation of a phenomenon of research interest in the substantive domain, the methodology is comprehensive since it includes a set of methods encompassing all aspects of the analytical approach, from data collection to data coding in thematic analysis. This indicates that the methodological investigation of a phenomenon of research interest in the subject domain is accomplished. Second, the process ensures that In Vivo and Pattern coding have been coded to the point where no additional codes can be generated to meet the data saturation criteria. Thirdly, the approach employed can be extended to diverse contexts and research topics requiring equivalent data collection, semi-structured interviews, and data analysis using multiple case studies. In addition, the thematic analysis approaches utilised by the coding clusters and emerging themes resulted in the production of reliable and valid coded data.

8.3. Implications for practice

This study aimed to identify and explore the roles of each actor, the required services and significant roles that must be defined and implemented. Moreover, this study aimed to design ecosystem business models for selected DDOs that use OGD to improve their services' benefits and value. Although the Open Government Data initiative has many important facets, one of the most important is the need for an ecosystem of interrelated organisations with specific roles. This is because the initiative would be difficult to sustain without one. The ecosystem needs these organisations to play a role in ensuring that the OGD Initiative is successful. Therefore, this study is essential for organisations that deal with OGD Initiatives to know the characteristics of their roles, their motivation and objectives from their perspectives and from their key partners to build an established ecosystem.

To improve the effectiveness of collaboration and partnerships that use OGD, a wide variety of OGD actors, including government agencies, DDOs, IT companies, the public, and communities, all have a part to play. The findings, the logic models and frameworks for the ecosystem of the OGD initiative, have substantial implications for value-creating and value-capture activities and for making use of the datasets made available by the government. This research can also help understand how different organisations interpret value-creating and value-capture activities with OGD. Furthermore, this study gives pathways of study for further research into collaboration with other organisations with different roles.

The findings of this study, the Ecosystem Business Model Canvas and ecosystem business model types for DDOs, can help DDOs better understand the dynamics of their ecosystems and their potential for growth by analysing these relationships and making better decisions about how to grow their business. The Ecosystem Business Model Canvas was designed to help Data-Driven Organisations engage with their partners and better understand their ecosystems, growth potential, and how they impact their customers/clients. The EBMC and four types of ecosystem business models resulting from this study are living documents. It is hoped that governments will use the findings of this study as they evaluate their OGD programme and try to understand their key

users. Moreover, DDOs across different industry sectors can use these findings to develop their plans related to OGD.

8.4. Study Limitations

Consistent with the pattern that emerges in multiple case studies of this nature, the findings of this study, which was done in New Zealand, reflect local contextual factors, particularly those of social, legal, cultural, and economic factors. Use the evidence accessible from organisations' websites and official documents to generalise the findings of this study as much as possible and to meet the research reliability and validity criteria. At the same time, extensive efforts have been made in this study to obtain a variety of expert perspectives from participants affiliated with organisations that deal with OGD.

By using qualitative methods to collect data, this study aims to gain a better understanding of the perspectives of those involved in the New Zealand OGD initiative. It can be more difficult to understand the experiences of the participants when using quantitative methods for this study, but other researchers may use quantitative or mixed methods.

This study purposes to identify and explore the roles played by each OGD actor, as well as the services and significant roles that must be formed and implemented. Following this, the ecosystem business models for DDO were developed. Governments across the world have implemented OGD initiatives, which are receiving a growing amount of attention in the academic literature. There is neither a systematic nor a comparative analysis of how DDOs use OGD in various countries. This leads to a restricted understanding of what is effective, for whom, and under what circumstances.

8.5. Directions for Further Research

The findings and outcomes of the study provide many possible directions for future research. First, one such benefit would be the ability to study different types of organisations as OGD users. This could be accomplished by conducting multiple studies at the same time. Another benefit would be more reliable findings achieved by adopting the same design for the study.

Second, because gaining knowledge of and insight into the perspectives of participants in the ecosystem of the OGD initiative is one of the objectives of this study, the data gathering adopted in this study was limited to qualitative methods only. However, some researchers may employ quantitative or mixed methods to conduct their investigations. A quantitative approach is not appropriate because it is difficult, if not impossible, to grasp a phenomenon from the participant's point of view when using exclusively numerical approaches.

Third, further study needs to be carried out to examine the applicability of the Ecosystem Business Model Canvas in different DDO industry sectors and to identify the different types of business models of DDOs. This investigates the possibility of adopting the EBMC in various circumstances and settings.

Furthermore, the interpretive epistemology was used for this study to understand how the participants construct their understanding of their environment. However, other researchers may use a critical realism epistemology to investigate the roles of each actor in implementing OGD Initiatives.

8.6. Summary of Chapter 8

This chapter wrapped up the thesis by summarising the study's most important findings and discussing its contributions, limits, and implications for practice. In addition, the chapter provided some suggestions for conducting further research connected to the topic.

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Appendices

Appendix A: The interview protocols

The Interview Protocol Refinement Framework

The protocol to conduct sessions with participants affiliated with government agencies

(Researchers' document: the guidelines for conducting interview sessions)

Research title: Ecosystem Business models of Open Government Data and Data-Driven Organisations

Researcher(s): Jairo Gutierrez, Novy N.R.A Mokobombang, Krassie Petrova
AUT School of Engineering, Computer and & Mathematical Sciences

1. BACKGROUND AND GUIDELINES

The case studies are a set of interviews with stakeholders and selected experts. The interviews are demographic questions and semi-structured, open-ended interviews. The list of potential questions for all type of organisations in the Questionnaire Document. For each kind of government agencies and data-driven organisations a minimum set of participants should be interviewed:

- Representatives from OGD officers at NZ central Government
- Representatives from OGD officers at Local Governments

The purpose of the interviews is to enable the participants to be as informative as possible in their answers. The participants as the interviewees are the experts in the field related to Open Government Data in their organisations. During the interview, the emphasis will be on obtaining narratives in the interviewee's terms. The interview protocol will serve as primary guidance, but the interviewer has the flexibility to extend the question based on the responses heard. For that reason, the protocol below gives some extended questions to some follow-up questions that probably can accommodate for revealing further information when investigations do not result in covering the areas.

2. OPENING

a) Establishing Rapport by greeting interviewees and introduce the interviewer
b) Obtaining signed consent forms, giving participants the Participant Information Sheet to explain:
   - the research aim, goal and purposes
   - Purpose of conducting the interview session with the participant
   - Motivation on how to use this information to help the New Zealand government and communities make better use of OGD.
c) Confirming participants for their availability and detail procedures since the time line of the interview should take about 60-90 minutes.
d) Maintaining ethical standards during the sessions.

3. BODY: INTERVIEW QUESTIONS

To ensure interview questions align with research questions (CRQs) with attention to the contexts shaping interviewees' work practices/roles including their employer's goal.

a) SECTION 1: Demographic questions

Those questions will be raised to all of interviewees.

Male/Female

1. What sector do you represent? (select all that apply)
   - ☐ Private Sector
   - ☐ Government / Public Sector
   - ☐ Civil Society Organizations
   - ☐ Bilateral/Multilateral funding agencies / Foundation
   - ☐ Academia / Researcher
   - ☐ Other (please specify)
2. How long have you dealt with your current role?
3. How would you describe your duties in your organisation?
4. Have you ever heard about "Open Government Data"?

   If yes, please specify what your understanding of Open Government Data is.

b) SECTION 2: Semi-structure, open-ended interview

Observations and In-depth interviews with single interviewee for approximately 1-1.5 hour per session. Most of the questions are open questions.

A. Questions related to (CRQ1): How to identify and develop an in-depth description of which actors engage, and what roles each actor should be needed to create the value of Open Government Data?

Questions for all interviewees

A.1. Could you please tell me some information about your background and role in your organisation related to OGD?

A.2. How satisfied the current availability of OGD in NZ ? (from 1 = not satisfied to 4 = very satisfied). Please provide a short explanation for your response.

Questions for interviewees' from government agencies/OGD providers

A.3. Do you think NZ citizens (generally) are well informed about OGD? How can people's awareness of the potential uses of OGD be improved? (question for government agencies)

A.4. Are there any control, rules, regulations, licensing governing the performance of using OGD?

B. Questions related to (CRQ2): How to understand what is the motivation of data-driven organisations to use Open Government Data for improving the processes for publishing open data?

Questions for interviewees' from government agencies/OGD providers :

B.1. To what extent is a commitment from top-level decision makers for opening up government data?

B.2. To what extent has the NZ government officially committed to OGD programs (such as the Open Government Partnership)?

B.3. Do you face any barriers or concerns in providing OGD? (e.g. data formats, quality). How might it be solved?

C. Questions related to (CRQ3): How to design new ecosystem business models for an ecosystem that is not mature yet?

Questions for all interviewees'

C.1. Do you use any tools to plan your business/objectives or to draw the direction in which your organisation is heading? If YES, which one?

C.2. Would you explain who your users/customers are?
C.3. Who are the key players in your organisation dealing with OGD?
C.4. What are the key factors you take into consideration when building an action plan related to OGD?
C.5. Talk to me about the effectiveness of the current OGD datasets, and how do you measure their effectiveness?
C.6. How your organisation manage the privacy of personal data information?

Questions for interviewees' from government agencies/OGD providers:

C.7. How do you plan the objectives of your organisation to provide OGD?
C.8. How do you measure OGD benefits to users?

D. Questions related to (CRQ4): How to design ecosystem business models for open government data and data-driven organisations to unlock open data potential benefits for all actors?

Questions for all interviewees'

D.1. Who are your key partners in the OGD community?
D.2. Does your organisation have a framework in place that includes consistent guidance and procedures for OGD capture and management? Please explain your response.
D.3. What do you think the challenges /obstacles would be, either in publishing data or challenges that could users face using these data?

Questions for interviewees' from government agencies/OGD providers:

D.4. Have you faced any obstacles in providing OGD? E.g. with technical, licenses, etc.
D.5. Whom are the stakeholders involved in providing OGD?
D.6. Is the quality monitoring for OGD in place? Is OGD sufficient to deal with your other data? Please explain your responses.
D.7. How is OGD helpful in achieving your performance/target?
D.8. Who are the key actors in the OGD program, and what activities do they perform?

The Interview Protocol Refinement Framework

The protocol to conduct sessions with participants affiliated with data-driven/private organisations

(Researchers' document: the guidelines for conducting interview sessions)

Research title: Ecosystem Business models of Open Government Data and Data-Driven Organisations

Researcher(s): Jairo Gutierrez, Novy N.R.A Mokobombang, Krassie Petrova
AUT School of Engineering, Computer and & Mathematical Sciences

1. BACKGROUND AND GUIDELINES

The case studies are a set of interviews with stakeholders and selected experts. The interviews are demographic questions and semi-structured, open-ended interviews. The list of potential questions for all type of organisations in the Questionnaire Document. For each kind of government agencies and data-driven organisations a minimum set of participants should be interviewed:

- Representatives from data-driven private sectors from a different type of organisations using OGD
- Representatives from private companies of different type of organisations using OGD

The purpose of the interviews is to enable the participants to be as informative as possible in their answers. The participants as the interviewees are the experts in the field related to Open Government Data use in their organisations. During the interview, the emphasis will be on obtaining narratives in the interviewee's terms. The interview protocol will serve as primary guidance, but the interviewer has the flexibility to extend the question based on the responses heard. For that reason, the protocol below gives some extended questions to some follow-up questions that probably can accommodate for revealing further information when investigations do not result in covering the areas.

2. OPENING

a) Establishing Rapport by greeting interviewees and introduce the interviewer
b) Obtaining signed consent forms, giving participants the Participant Information Sheet to explain:
   - the research aim, goal and purposes
   - Purpose of conducting the interview session with the participant
   - Motivation on how to use this information to help the New Zealand government and communities make better use of OGD.
c) Confirming participants for their availability and detail procedures since the time line of the interview should take about 60-90 minutes.
d) Maintaining ethical standards during the sessions.

3. BODY: INTERVIEW QUESTIONS

To ensure interview questions align with research questions (CRQs) with attention to the contexts shaping interviewees' work practices/roles including their employer's goal.

a) SECTION 1: Demographic questions

Those questions will be raised to all of interviewees.

Male/Female

1. What sector do you represent? (select all that apply)
   - ☐ Private Sector
   - ☐ Government / Public Sector
   - ☐ Civil Society Organizations
   - ☐ Bilateral/Multilateral funding agencies / Foundation
   - ☐ Academia / Researcher
   - ☐ Other (please specify)
2. How long have you dealt with your current role?
3. How would you describe your duties in your organisation?
   Have you ever heard about "Open Government Data"? If yes, please specify what your understanding of Open Government Data is.

b) SECTION 2: Semi-structure, open-ended interview

Observations and In-depth interviews with single interviewee for approximately 1-1.5 hour per session. Most of the questions are open questions.

A. Questions related to (CRQ1): How to identify and develop an in-depth description of which actors engage, and what roles each actor should be needed to create the value of Open Government Data?

Questions for all interviewees

A.1. Could you please tell me some information about your background and role in your organisation related to OGD?

A.2. How satisfied the current availability of OGD in NZ ? (from 1 = not satisfied to 4 = very satisfied). Please provide a short explanation for your response.

Questions for interviewees' from data-driven organisations

A.3. Have you ever used government data? (e.g. weather forecasts, transport timetables) Please explain what datasets you use.

A.4. Apart from the aforementioned, please specify any other government data that you are interested in?

B. Questions related to (CRQ2): How to understand what is the motivation of data-driven organisations to use Open Government Data for improving the processes for publishing open data?

Questions for interviewees' from government agencies/OGD providers :

B.1. To what extent is a commitment from top-level decision makers for opening up government data?

B.2. To what extent has the NZ government officially committed to OGD programs (such as the Open Government Partnership)?

B.3. Do you face any barriers or concerns in providing OGD? (e.g. data formats, quality). How might it be solved?

C. Questions related to (CRQ3): How to design new ecosystem business models for an ecosystem that is not mature yet?

Questions for all interviewees'

C.1. Do you use any tools to plan your business/objectives or to draw the direction in which your organisation is heading? If YES, which one?

C.2. Would you explain who your users/customers are?

C.3. Who are the key players in your organisation dealing with OGD?

C.4. What are the key factors you take into consideration when building an action plan related to OGD?

C.5. Talk to me about the effectiveness of the current OGD datasets, and how do you measure their effectiveness?

C.6. How your organisation manage the privacy of personal data information?

Questions for interviewees' from data-driven organisations :

C.7. How do you plan the objectives of your organisation to use OGD?

C.8. Are there any services/product offered directly depend on the availability of OGD? Please explain your response.

C.9. How do you measure your output by using OGD as one of your source/input?

C.10. How your organisation manage the privacy of personal data information?

D. Questions related to (CRQ4): How to design ecosystem business models for open government data and data-driven organisations to unlock open data potential benefits for all actors?

Questions for all interviewees'

D.1. Who are your key partners in the OGD community?

D.2. Does your organisation have a framework in place that includes consistent guidance and procedures for OGD capture and management? Please explain your response.

D.3. What do you think the challenges /obstacles would be, either in publishing data or challenges that could users face using these data?

Questions for interviewees' from data-driven organisations :

D.4. Do you customise your service for different areas or segments?

D.5. What are the key open data sources?

D.6. What other resources do you use to provide your service?

D.7. Have you faced any obstacles in employing OGD? E.g. with technical, licenses, etc.

D.8. Are there some data sources you would like to use, but which are unavailable or under too strict license? Please explain your responses.

D.9. Who are the key actors in your business network, and what activities do they perform?

D.10. From whom/what do you get the revenues?

D.11. How (on what basis) is the service offered?

D.12. Have you considered other potential revenue/service you could earn/produce in the future?

D.13. Whom are the stakeholders involved in creating products/ services by using OGD?

D.14. Do you integrate OGD with other non-government data or your data? if yes, do you face difficulties with open data licensing? Please explain your response.

D.15. Is the quality monitoring for OGD in place? Is OGD sufficient to deal with your internal data? Please explain your responses.

D.16. How is OGD helpful in achieving your business revenue/target?

Appendix B: The Participant Information sheet

AUT
TE WĀNANGA ARONUI O TĀMAKI MAKAU RAU

Participant Information Sheet

Date Information Sheet Produced:

01 October 2018

Project Title

Ecosystem Business models of Open Government Data and Data-Driven Organisations

An Invitation

Hello, and thank you for your interest in this interview session. My name is Novy N.R.A. Mokobombang, and I am a PhD student with the School of Engineering, Computer and Mathematical Sciences. Currently, I have been involved in research titled "Ecosystem Business models of Open Government Data and Data-Driven Organisations" which will enable me to pursue a PhD degree at AUT. I wish to invite you to participate in this research and support me in my data collection.

What is the purpose of this research?

This research investigates how selected organisations use Open Government Data (OGD) to improve the benefits and the value of their products and services. Today's open data form a highly interconnected network of government agencies, organisations, and citizens. The concept of mutual networking among actors of open data is needed to build an environment in which actors will be able to interact with each other symbiotically. Data-driven organisations are developing rapidly using open data for reasons related to cost-effectiveness. Therefore, the business of data-driven organisations depends on the quality of Open Government Data (OGD).

However, the crucial question of the business models has less attention in current research. This could be attributed to the fact the studies predominantly adopt focal-firm perspective business models and no comprehensive business models designed for data-driven organisations in different sectors using Open Government Data exists. The research aims to bridge this gap by designing ecosystem business models for selected data-driven organisations that use OGD to improve the benefits and the value of their services. The research addresses this problem by investigating how selected organisations use Open Government Data (OGD) to enhance the benefits and the value of services in their organisations. The findings may be used for academic publications and presentations.

How was I identified and why am I being invited to participate in this research?

You are invited to participate in this research because you are a key person in your organisation that deals with Open Government Data. To find potential participants, like you, we obtained a list of the private and government organisations that use Open Government Data and emailed the respective managers/leaders to seek suitable participants for this research. You may choose to decline this invitation as your participation is voluntary.

How do I agree to participate in this research?

You will be asked to accept an interview session schedule via email and sign the Consent form — no onus for you to participate in this research. You may withdraw from the study without penalty at any time during the interview and up to one month after the session by emailing one of the researchers. However, once the findings have been produced, removal of your data may not be possible.

What will happen in this research?

The session will be held through face-to-face or Skype-chat interviews using a demographic questionnaire followed by a semi-structured, open-ended interview held in your office or online chat at a mutually agreed upon time. However, the interview process can be extended through the email to ask further questions, and to comment on the preliminary interpretation report. The interview sessions will generate large volumes data that will be managed in a systematic organisation. Triangulation for each case study will be implemented to validate research findings by comparing all audio-recordings, researcher/interviewer notes and interpretation of interview results.

If you agree, I will be tape-recording our conversation or keep the chat history and also taking notes. Thus I will be able to get all the details while carrying on an attentive discussion with you. I assure you that all your information will remain confidential as stated below.

What are the discomforts and risks?

There will be no personal questions to maintain participants' comfort level. Your privacy and confidentiality will be guaranteed, therefore no ways that could be possible to put you in risks.

How will these discomforts and risks be alleviated?

Not applicable as stated above.

What are the benefits?

Expected benefits to the participants are gaining an insight into relevant business models related to Open Government Data use or provide in their organisations. Moreover, it is intended to provide practical insight into the organisations using and providing OGD to evaluate their ecosystems.

The researcher will gather the data needed for her PhD research and benefit from the skills acquired and experience gained for any future OGD and its business model research.

The findings of this research will be shared to the wider community such as research groups and network collaborators that would be potentially benefitted for involvement in research commons.

How will my privacy be protected?

This research protects participants' confidentiality by identifying, classifying and coding the data based on type of organisations, job types and roles. Researchers will remove identifiers to create a clean data set that not contain information that identifies you, such as a name, occupation, city, and employer identity.

What are the costs of participating in this research?

At the maximum about 1.5 hour's interview session of your time will be the cost of participating in this research.

What opportunity do I have to consider this invitation?

You may take up to one month to respond to this invitation. You may refuse to participate in this research and do not have to give a reason for this.

Will I receive feedback on the results of this research?

A two-page summary of findings will be available to you. You need to provide contact details at the Consent form if you would like to receive the summary. Your contact details will not be shared with any third parties, nor will they be used to identify you personally.

What do I do if I have concerns about this research?

For any enquiries you may have about this study or your participation, please approach my primary PhD supervisor Associate Professor Jairo Gutierrez, jairo.gutierrez@aut.ac.nz, 921 9999 Ext. 5854.

For any queries regarding ethical concerns, you may contact the Executive Secretary of AUTEC, Kate O'Connor, *ethics@aut.ac.nz* , 921 9999 ext 6038.

Whom do I contact for further information about this research?

Please keep this Information Sheet and a copy of the Consent Form for your future reference. You are also able to contact the research team as follows:

Researcher Contact Details:

Name: Novy N.R.A. Mokobombang

Email: novynra.mokobombang@aut.ac.nz

Mobile phone: 0223 893 551

Project Supervisor Contact Details:

Name: Jairo Gutierrez

Email: Jairo.gutierrez@aut.ac.nz

Work phone: +64-9-921 9999 Ext. 5854

We look forward to your cooperation and hope you find it an interesting experience.

Approved by the Auckland University of Technology Ethics Committee on *June 24, 2019* AUTEC Reference number *18/398*.

Appendix C: The Consent form

AUT
TE WĀNANGA ARONUI O TĀMAKI MAKAU RAU

Consent Form

For use when interviews are involved.

Project title: ***Ecosystem Business models of Open Government Data and Data-Driven Organisations***

Project Supervisor: ***Jairo Gutierrez***

Researcher: ***Novy N.R.A. Mokobombang***

- ○ I have read and understood the information provided about this research project in the Information Sheet dated 01 October 2018.
- ○ I have had an opportunity to ask questions and to have them answered.
- ○ I understand that notes will be taken during the interviews and that they will also be audio-taped and transcribed.
- ○ I understand that taking part in this study is voluntary (my choice) and that I may withdraw from the study at any time without being disadvantaged in any way.
- ○ I understand that if I withdraw from the study then I will be offered the choice between having any data that is identifiable as belonging to me removed or allowing it to continue to be used. However, once the findings have been produced, removal of my data may not be possible.
- ○ I agree to take part in this research.
- ○ I wish to receive a summary of the research findings (please tick one): Yes○ No○

Participant's signature: .....

Participant's name: .....

Participant's Contact Details (if appropriate):

.....

.....

.....

.....

Date:

Approved by the Auckland University of Technology Ethics Committee on 24 June 2019 AUTEC Reference number 18/398

Note: T

Appendix D: The Ethical approval from AUTEC

AUT
TE WĀNANGA ARONUI O TĀMAKI MAKAU RAU

Auckland University of Technology Ethics Committee (AUTEC)

Auckland University of Technology
D-88, Private Bag 92006, Auckland 1142, NZ
T: +64 9 921 9999 ext. 8316
E: ethics@aut.ac.nz
www.aut.ac.nz/researchethics

24 June 2019

Jairo Gutierrez
Faculty of Design and Creative Technologies

Dear Jairo

Re Ethics Application: **18/398 Ecosystem business models of open government data and data-driven organisations**

Thank you for providing evidence as requested, which satisfies the points raised by the Auckland University of Technology Ethics Committee (AUTEC).

Your ethics application has been approved for three years until 24 June 2022.

Standard Conditions of Approval

1. The research is to be undertaken in accordance with the Auckland University of Technology Code of Conduct for Research and as approved by AUTEC in this application.
2. A progress report is due annually on the anniversary of the approval date, using form EA2, which is available online through http://www.aut.ac.nz/research/researchethics.
3. A final report is due at the expiration of the approval period, or, upon completion of project, using form EA3, which is available online through http://www.aut.ac.nz/research/researchethics.
4. Any amendments to the project must be approved by AUTEC prior to being implemented. Amendments can be requested using the EA2 form: http://www.aut.ac.nz/research/researchethics.
5. Any serious or unexpected adverse events must be reported to AUTEC Secretariat as a matter of priority.
6. Any unforeseen events that might affect continued ethical acceptability of the project should also be reported to the AUTEC Secretariat as a matter of priority.

Please quote the application number and title on all future correspondence related to this project.

AUTEC grants ethical approval only. If you require management approval for access for your research from another institution or organisation then you are responsible for obtaining it. If the research is undertaken outside New Zealand, you need to meet all locality legal and ethical obligations and requirements. You are reminded that it is your responsibility to ensure that the spelling and grammar of documents being provided to participants or external organisations is of a high standard.

For any enquiries, please contact ethics@aut.ac.nz

Yours sincerely,

Kate O'Connor
Executive Manager
Auckland University of Technology Ethics Committee

Cc: novynra.mokobombang@aut.ac.nz; krassie.petrova@aut.ac.nz

Appendix E: The sample use of NVivo for case study's thematic analysis – the first cycle

Case study A

Name	Files	References
Top level government commitment	7	18
Target and achievement plan of OGD programme	5	30
Satisfaction of OGD from Government perspectives	6	21
Privacy and personal information Protection	6	37
People's awareness	6	34
what data people want	1	1
varies hugely	1	1
usually well informed	1	1
try and promote information	1	1
to release open data	1	1
to interchange of data	1	1
tick industries	1	1
the shared data ecosystem	1	1
restricted what we can actually advertise	1	1
releasing particularly high resolution data	1	1
proper data from the city	1	1
Probably not.	1	1
Probably no	1	1
people still stumble	1	1
people are encounters	1	1
partially due to the location	1	1
on the links to our site	1	1
on email signatures	1	1
not sure we've done that	1	1
not actively promoting	1	1
No measurement on how much and how often was accesse	1	1
my colleagues would be aware	1	1
much more transparent	1	1
maintain quite a large shared data ecosystem	1	1
lobbied for machine-readable datasets,	1	1
leaves a lot to be desired	1	1
Know who goes to data.govt.nz	1	1
Have no problem from their communities	1	1
different communication channels	1	1

Case study B

Name	Files	References	
Tools	2	6	
Services and products dependency	2	7	
Service customisation	2	11	
Satisfaction on OGD	3	12	
quality assesment	2	6	
Privacy & personal information	2	8	
Potential revenue and benefit	2	14	
Participant demograph	2	15	
Output measurement	1	2	
Other resources	0	0	
Organisations's stakeholders	0	0	
Open portals & datasets	2	11	
We get the core Property Data	1	1	27/0
they just gave me a log in to the online Traffic Management	1	1	28/0
they also publish a monthly traffic report	1	1	28/0
the public record all what's mortgage instruments and owne	1	1	27/0
the location of bus stops	1	1	27/0
modeling around the city	1	1	27/0
location of amenities	1	1	27/0
I have APIs to access that	1	1	27/0
consume it from the LINZ data service	1	1	27/0
Commute time	1	1	27/0
aerial imagery, they have parcel boundary, so the boundary	1	1	27/0
OGD effectiveness	1	2	
OGD benefit	2	12	
Objectives to use OGD	2	4	
Motivation to use OGD	2	13	
Key sources	2	3	
Key players	2	7	
Key partners	2	3	
Key actors	2	6	
Inquiries & feedbacks	3	20	
Guidance and framework	2	20	
Desired outcomes	2	9	

Case study C

Name	Files	References
Challenges and obstacles	1	5
Contractual issues between AT and operators	1	1
Licensing issues	1	1
Not aware of other problems	1	1
Not scalable and usable data in public IPs	1	1
privacy and commercial concerns	1	1
Company's Guidance and Procedures	1	8
Customers of IT companies	1	5
Feedback about OGD programme	2	9
Government motivation	1	2
Key factor to support OGD	1	2
Data value in the use of software	1	1
Derive value	1	1
Key partners of IT companies	3	8
Key players in IT companies	2	3
OGD effectiveness	1	2
OGD quality	1	4
Organisation structures	1	1
output by supporting OGD implementation	2	11
Participant demograph	1	8
Satisfaction of OGD	1	7
Service customisation based on customer needs	1	2
Adopting different approach for start up and enterprise clients	1	1
Service customisation based on clients' needs	1	1
Source of Revenue	1	3
Supporting role	2	9
An interim thing for Knowledge Auckland.	1	1
Do not own the data, clients have the governance	1	1
Ideas on using open data	1	1
Opening up useful data without sensitive or privacy concern	1	1
Software developer	1	1
supports AT lab project for open innovation	1	1
To support clients make their data opened	1	1

Appendix F: The sample use of NVivo for case study's thematic analysis – the second cycle

Case study A

Name	Files	References
THEME 1A COMPETENCIES AND PROCESS-DRIVEN ABILITIES IN PUBLISHING	7	29
COMPETENCIES IN PUBLISHING OGD	7	123
Government agencies' Supporting tools	6	21
DATABASE AND OPEN SOURCE TOOLS	2	3
PROJECT MANAGEMENT TOOLS	4	8
DESIGN AND PLANNING TOOLS	1	2
DO NOT HAVE SPECIAL TOOLS FOR OGD	1	1
SPECIAL SOFTWARE PACKAGE FOR DATA TOOLS	5	7
Necessary Skills to implement OGD	6	27
Objectives to open data	6	39
Government commitment	6	20
Top level government commitment	7	16
DRIVING FACTORS OF OGD INNOVATION	7	170
THEME 2A GOVERNMENT CAPACITIES TO UNDERTAKE OGD ACTIVITIES	7	28
GOVERNMENT LEADERSHIP AND CULTURE	7	178
Guidance and procedure deal with open government	7	58
Target and achievement plan of OGD programme	5	29
Government Policies and regulations	7	55
Government agency structures	6	36
OGD BARRIERS,ISSUES AND CHALLENGES	7	106
THEME 3A CREATING VALUE THROUGH OGD INNOVATION	7	30
OGD VALUE-CREATING ROLES	7	230
Key actors for OGD programme	4	24
Key partners deal with OGD	7	44
Government Key players	4	8
Participant demograph	7	90
OGD Stakeholders	2	5
OGD Users	7	59
OPENING GOOD QUALITY DATA	7	72
Privacy and personal information Protection	6	37
VERY LITTLE DATA ACTUALLY SECRET AND PRIVACY	2	2

Case study B

Name	Files	Reference	
THEME 1B - COMPETENCIES AN DATA-DRIVEN CULTURE IN USING OGD	2	61	
ICT LITERACY SKILLS IN USING OGD	2	29	29
Data integration	2	13	26
DATA IMPORT ENGINE	1	2	27
DISCOVERY RELEVANT OPEN DATA	1	2	27
INTEGRATE INTO ANALYTICS FORM	1	1	27
COMBINE OGD WITH OTHER GOVERNMENT DATA	1	2	27
INTEGRATE OGD WITH NON-GOVERNMENT DATA	1	3	27
AGGREGATE OGD WITH INTERNAL DATA	2	2	27
INTEGRATE ALL DATA USING POSTGRES DATABASE	1	1	27
Open portals & agency's websites	2	5	24
Key sources	2	3	25
Tools	2	8	24
OGD VALUE - CAPTURING ROLES	2	32	29
THEME 2B - ORGANISATION CAPACITIES TO DRIVE OGD INNOVATION	2	69	
ORGANISATION STRATEGY TO EXPLOIT OGD VALUE	2	33	29
EFFORTS TO UNLOCK OGD POTENTIAL	2	36	29
Customer segmentation	2	9	24
Motivation to use OGD	2	15	24
EASILY ACCESIBLE DATA	2	2	27
EARLY AND REGULARLY DATA	1	5	27
CORRELATION WITH GDP IS HIGH	1	2	27
UNRESTRICTED DATASETS TO CAPTURE POTENTIAL ECONOMIC V	1	3	27
OFFER A DATA-BASED SERVICE TO CUSTOMER	1	3	28
Objectives to use OGD	2	4	25
Desired outcomes	1	8	24
THEME 3B - CAPTURING OGD VALUE FOR BUSINESS AND SERVICE INNOVATI	2	57	
USING GOOD OGD	2	29	29
BUILD INNOVATION THROUGH OGD VALUE	2	28	29
THEME 4B - OGD COLLABORATION AND PARTNERSHIP	3	67	
OGD IMPEDIMENTS AND ISSUES UNDER DATA-DRIVEN CULTURE	3	33	29

Case study C

Name	Files	References
THEME 2C COMPANY'S CAPABILITIES TO SUPPORT OGD VALUE CREATION	1	21
COMPANY'S STRATEGY TO DEVELOP SOFTWARE FOR OPEN DATA	1	10
Organisation structures	1	1
Company's Guidance and Procedures	1	8
GOVERNANCE OPEN SOURCE	1	4
ALL WORK OUTCOMES AND DATA BELONG TO CLIENTS	1	3
NON-DISCLOSURE AGREEMENT	1	1
Work culture	1	1
EFFORT TO SUPPORT OGD PUBLISHING	1	11
Government motivation	1	2
DERIVE BETTER VALUE	1	1
MINING DATA VALUE	1	1
Customers of IT companies	1	5
OGD effectiveness	1	2
Key factor to support OGD	1	2
THEME 1C COMPETENCIES TO PROVIDE IT SUPPORT FOR OGD IMPLEMEN	4	33
ICT EXPERTISE TO ASSIST OGD PLATFORM	2	14
Supporting role	2	9
Service customisation based on customer needs	1	2
SERVICE CUSTOMISATION WITH CLIENT NEEDS	1	1
DIFFERENT APPROACH FOR START UP	1	1
Tools for supporting work	1	3
OGD VALUE CREATING ROLE TO SUPPORT GOVERNMENT	4	19
THEME 3C ACCELERATING OGD RELEASE TO MAXIMISE VALUE	2	39
ASSISTING TO PUBLISH GOOD OGD	2	18
OGD quality	1	4
Challenges and obstacles on supporting OGD implementation	1	5
Feedback about OGD programme	2	9
PROMPT RESPONSE FOR USER'S FEEDBACK	1	3
FEEDBACK ABOUT OGD PLATFORM	1	3