

Creating New Knowledge through Open Data: New Zealand's Open Data Strategies

Emily Neo

Corporate Services Group, Energy Efficiency and Conservation Authority, Wellington, New Zealand

E-mail address: emily.neo@eeca.govt.nz

Dan Dorner

School of Information Management, Victoria University of Wellington, Wellington, New Zealand

E-mail address: dan.dorner@vuw.ac.nz

Keitha Booth

New Zealand Open Government Information and Data Programme, Land Information New Zealand, Wellington, New Zealand

E-mail address: kbooth@linz.govt.nz



Copyright © 2014 by Emily Neo, Dan Dorner and Keitha Booth. This work is made available under the terms of the Creative Commons Attribution 3.0 Unported License:

<http://creativecommons.org/licenses/by/3.0/>

Abstract:

This paper provides details of how the New Zealand Government has launched a successful set of strategies to encourage government agencies to make their data open for public and private sector organisations and for individual citizens to reuse to create new knowledge. New Zealand recently was ranked 4th among 77 countries in the 2013 Global Open Data Barometer, released in London by the World Wide Web Foundation and Open Data Institute. Other countries can learn from the New Zealand example.

Through a discussion of the New Zealand Government's open data strategies and three case studies, this paper illustrates how the Government is capturing, distributing and effectively using its knowledge by breaking down data silos and encouraging the reuse of its open data by public and private sector organisations and individuals. The case studies illustrate how the re-use of the open government data is leading to new knowledge that is generating economic and social benefits for all New Zealanders.

The content of this paper will be of value to government agencies, private sector institutions, as well as to the public at large.

Keywords: Open government data, New Zealand, Knowledge management, Mashups

Introduction

The theme of the IFLA World Congress 2014 is “Libraries, Citizens, Societies: Confluence for Knowledge.” This paper addresses the theme through its focus on the New Zealand government’s open data strategies. These strategies are aimed at encouraging members of New Zealand society, whether in the public or private sector, to reuse datasets of government information stored in virtual data libraries to create new knowledge, as well as to ensure transparency within the government. And while much of government information can be made accessible to the wider world through these strategies, they also emphasize that personal and classified information must be protected.

The New Zealand Context

New Zealand is a small country with just over 4.4 million people (Central Intelligence Agency, 2014). The small population means that the average citizen is not far removed from those who hold power.

The proximity of the average citizen to those in power may be one of the reasons why New Zealanders place a relatively high degree of trust in the government. The Better Life Index compiled by the Organisation for Economic Co-operation and Development (OECD) says that "in New-Zealand, 54% of people say they trust their national government, more than the OECD average of 39%" (2014). And at the international level, the New Zealand government has a very strong reputation as being trustworthy. The Transparency International Secretariat (TIS) in Berlin ranked New Zealand number 1 (tied with Denmark) when comparing 177 countries in its annual Global Anti-Corruption Perceptions Index (TIS New Zealand, 2013), and it has consistently ranked New Zealand among the least corrupt countries in the world. Thus, both within New Zealand and beyond its borders, the New Zealand government and its various agencies are perceived to be highly trustworthy.

Given this high level of trust, information generated by and provided by the New Zealand government, if made accessible for reuse, has a high potential to be used by members of the public and private businesses.

In 2010 the New Zealand government launched the New Zealand Government Open Access Licensing Framework (NZGOAL). On 8 August 2011, the Cabinet approved *The Declaration on Open and Transparent Government* and released the *New Zealand Data and Information Management Principles*. The first two initiatives have very similar objectives, that is: (1) to make government data open and accessible; (2) to encourage public and private sector organisations and individuals in New Zealand to reuse the data for economic as well as social benefits; and (3) to make the workings of government more transparent. The aim of the third initiative is "to ensure high quality management of the information the government holds on behalf of the public" (New Zealand, 2013).

These strategies are paying off because in 2013 New Zealand was ranked fourth out of 77 countries (after the United Kingdom, the United States and Sweden) in the Global Open Data Barometer released by the World Wide Web Foundation and Open Data Institute. According to the Open Data Institute:

The Open Data Barometer aims to uncover the true prevalence and impact of open data initiatives around the world. It analyses global trends, and also ranks countries and regions via an in-depth methodology that considers: readiness to secure the benefits of open data; actual levels of implementation; and the impact of such initiatives. (Davies, 2013, p. 3)

In this paper we examine the Open Government Open Data Strategies and a range of projects employed by the New Zealand government that are aimed at developing new knowledge to foster economic and social benefits through the reuse of government information. More specifically we look at three case studies in which government data in New Zealand has been made available as open data and reused to generate economic and social benefits to businesses, individuals and government.

Definitions of Key Concepts

In this section we provide definitions to ensure there is a consistent understanding of the meanings of the key concepts used in this paper.

Most definitions of *knowledge* focus on the idea that knowledge is in the minds of individuals and is, among other things, obtained through experience and from information (See, for example: Orna, 2005; and, Davenport and Prusak, 2000). For our paper, we have chosen a broader definition of knowledge because we are focusing on data and information from the government, as well as content that is the result of the reuse of that data. The definition we use is the one provide by Open Definition:

The term knowledge is taken to include:

1. Content such as music, films, books
2. Data be it scientific, historical, geographic or otherwise
3. Government and other administrative information. (Open Definition, 2011)

Knowledge management (KM) has been defined many times. Some definitions consider KM to be at the organisational level as can be seen in Duhon (1998) and Liu and Palmer (2002). Both of these definition also consider KM to be related to a discipline such as library science or information systems. Duhon (1998) says that KM "is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets." Liu and Parmelee (2002) say that KM "refers to a multi-disciplined approach to achieving organizational objectives by making the best use of knowledge." They go on to say that "KM focuses on processes such as acquiring, creating and sharing knowledge and the cultural and technical foundations that support them."

We prefer a definition of KM that is neither limited to the organisational level nor to the notion that KM is a discipline - hence we have chosen the simple definition proffered by Davenport (1994, as cited in Koenig, 2012): "knowledge management is the process of capturing, distributing, and effectively using knowledge."

For our definition of *open government data* we start with the definition of *open data* provided by Creative Commons Aotearoa New Zealand. It states that:

Open data is data that is free to access and reuse. Truly open data can be viewed, cut, cropped, mashed or otherwise re-purposed — without any technical, legal or price barriers. This means that it is available in open formats and is openly licensed or copyright-free. (Creative Commons Aotearoa New Zealand, 2013)

Therefore for *open data* to be *open government data* it merely must be open data generated by government, i.e., government data that is free to access and reuse without technical, legal or price barriers.

Also relevant to this paper is the definition for "high value public data" provided by the New Zealand Government in its *Toolkit* for open and transparent government. It says that it is government data "which when re-used contributes to economic, social, cultural or environmental growth, illustrates government's performance, and contributes to greater government efficiencies through improved information sharing" (New Zealand, 2014e).

By using the above definitions, the readers will understand the key concepts as they are used in this paper.

The New Zealand Government Open Data Strategies

In this section we provide brief details of the New Zealand Government's key open data strategies.

As noted earlier, the New Zealand Government introduced NZGOAL in 2010, and in 2011 it approved *The Declaration on Open and Transparent Government* and it released the *New Zealand Data and Information Management Principles*. The aim of NZGOAL is "to standardise the licensing of government copyright works for re-use using Creative Commons New Zealand law licences" and it "recommends the use of 'no-known rights' statements for non-copyright material" (New Zealand, 2014b).

NZGOAL is relevant to both copyright and non-copyright material held by government agencies. In the *Quick Guide for Agencies* web pages about NZGoal (New Zealand, 2014d), the copyright material listed is quite broadly based and includes:

- geospatial datasets
- commissioned research reports
- scientific datasets
- collections of official statistics
- datasets on government performance (financial and otherwise)
- photographic images
- educational resources
- archive film.

The non-copyright material referred to in the *Quick Guide* includes out-of-copyright images and other material for which there is no legal copyright, including most of the country's legislation.

NZGoal is based on wide ranging set of policy principles that includes, among others: open access to copyright works with Creative Commons Attribution (by) licence as default;

ensuring copyright ownership or right to sub-license; provide open access to non-copyright material; and ensuring restrictions when, for example, access to material would be contrary to law, breach privacy, be contrary to the public interest or threaten the integrity of Maori traditional knowledge (New Zealand, 2014b).

On 8 August 2011, the Cabinet of the New Zealand Government approved the *Declaration on Open and Transparent Government* (New Zealand, 2014a), stating that "building on New Zealand's democratic tradition, the government commits to actively releasing high value public data". In the *Declaration*, the Government stated that it is releasing the data that it holds on behalf of the New Zealand public "to enable the private and community sectors to use it to grow the economy, strengthen our social and cultural fabric, and sustain our environment. We release it to encourage business and community involvement in government decision-making." The Government also emphasized that "through this commitment New Zealand citizens and businesses can expect a more efficient and accountable public sector, more services tailored to their needs, and a greater level of participation in shaping government decisions." It also stressed that "personal and classified data and information must be protected."

After launching NZ Goal and approving *The Declaration on Open and Transparent Government*, the Cabinet

directed all Public Service departments, the New Zealand Police, the New Zealand Defence Force, the Parliamentary Counsel Office, and the New Zealand Security Intelligence Service; encouraged other State Services agencies; and invited State Sector agencies to commit to releasing high value public data actively for re-use, in accordance with the Declaration and Principles, and in accordance with the NZGOAL Review and Release process. (New Zealand, 2014a)

On the same day it approved the Declaration the government introduced the *Principles for Managing Data and Information held by the New Zealand Government* which replace a 1997 *Policy Framework*. There are seven principles for managing government information; it should be: (1) open; (2) protected; (3) readily available; (4) trusted and authoritative; (5) well managed; (6) reasonably priced; and (7) reusable (New Zealand, 2014c).

An example of a previously implemented open government data strategy in New Zealand is the New Zealand Geospatial Strategy 2007 which is aimed at making the country's geospatial information open for reuse (LINZ, 2007, p. 14). The government initiated the strategy because it realised that many government agencies as well as private sector groups were becoming increasingly reliant on geospatial information and that there were opportunities for efficiencies in the collection, management and provision of that information" (LINZ, 2013b). As will be seen in the example of LINZ Data Service case study which follows, geospatial information is clearly a significant component of New Zealand's open government data.

Today there is a wide ranging set of New Zealand government data available for reuse. The data.govt.nz website provides links to 22 categories of open government data, including: Agriculture, forestry and fisheries; Commerce, trade and industry; Health; Justice; Land; Māori and Pasifika; Science and research; and Transport. While the links on the data.govt.nz website provide access to a very wide range of open government data, we provide three case studies to illustrate how partner organisations are working together to reuse government information innovatively to create new knowledge.

Case study 1 – Tongariro Alpine Crossing Pocket Ranger

Introduction

Our first case study demonstrates how two organisations, a government department and a community-based organisation, have worked together to reuse open government data to develop a smartphone application called the *Tongariro Alpine Crossing Pocket Ranger* for people hiking in the volcanic mountains of New Zealand.

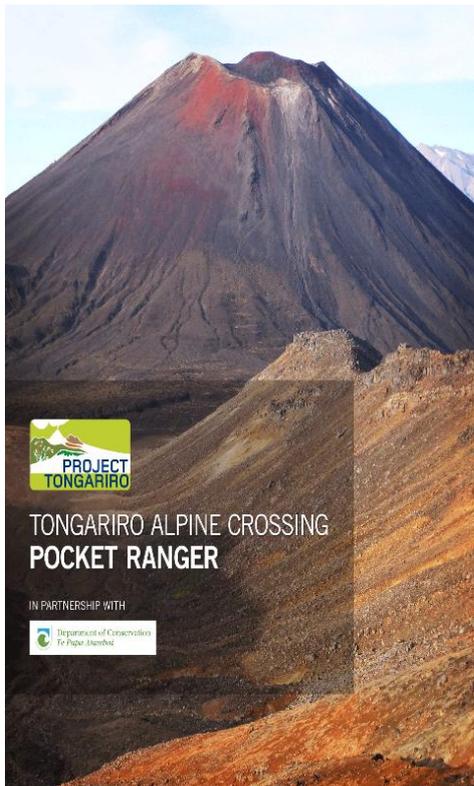


Figure 1: Screen Dump of Tongariro Alpine Crossing Pocket Ranger from Smartphone taken 24/05/2014

Key Players

The two organisations involved in developing the The Tongariro Alpine Crossing Pocket Ranger are the Department of Conservation (DOC) and Project Tongariro.

DOC is responsible for "promoting conservation of the natural and historic heritage of New Zealand on behalf of, and for the benefit of, the present and future generations" (DOC, 2013, p. 8). Its primary responsibilities come from the Conservation Act 1987, but it also has functions from a range of other Acts such as the National Parks Act 1980, the Marine Reserves Act 1971, and the Wildlife Act 1953. Its main functions include: managing New Zealand's natural locations and historic sites for conservation purposes; encouraging recreation on conservation lands and waters by providing facilities for visitors such as walking tracks, huts, campsites and visitor information centres; protecting native wildlife; advocating for conservation of natural and historic resources, and providing policy and legal advice to the Minister of Conservation (DOC, 2013, p. 8).

Project Tongariro is a Turangi based community group and registered charity. Turangi is at the north end of Tongariro National Park on the south edge of Lake Taupo. Project Tongariro is the current name of the Tongariro Natural History Society, Inc., which was established in 1984 "to promote a wider understanding of the natural processes and human history of Tongariro National Park" (Project Tongariro, 2011b).

Project Tongariro has four key project areas: biodiversity, history, education and recreation (Project Tongariro, 2011b). These involve members in: environmental restoration work for the Park's forests, bush, and lakes; moving Kiwi bird eggs that are in danger to safe incubators for hatching and then release back to the wild; restoration of an historic ski lift; and of course, the Pocket Ranger. Many local businesses in and around Turangi and the National Park are contributors to Project Tongariro.



Figure 2: New Zealand's Volcanic Mountains
(Photograph from: <http://www.tongarirocrossing.org.nz/>)

Project Description

The Tongariro Pocket ranger is free smartphone application that provides information about the Tongariro Alpine Crossing. The Tongariro Alpine Crossing is 19.4 kilometre hiking track situated in the Tongariro National Park, a World Heritage site, in the centre of the North Island. Hikers along this track encounter "awe inspiring natural scenery" (Tongariro Crossing Organisation, 2014) including the peaks of three semi-active volcanic mountains, Ngauruhoe, Tongariro and Ruapehu. They also encounter steep terrain and unpredictable weather, but those who complete the trek say it is "worth it in every respect" (Tongariro Crossing Organisation, 2014). "The Tongariro Alpine Crossing is heralded as the best one-day trek available in New Zealand, while others say it ranks among the top ten single-day treks in the world." More than 80,000 tourists walk it each year.

The Tongariro Pocket Ranger operates on both iPhones and Android products. It offers "an interactive and multi-media experience that provides interpretation, maps and images of the unique natural features of the Tongariro Alpine Crossing while at the same time conveys important safety messages" (Project Tongariro, 2011a).

Purpose of Project

“Now people can download as much information as they want, right there on the track,” says Karen Williams, President of Project Tongariro. “It also allows visitors to research the area before they arrive and make sure they are prepared for the changeable weather conditions the region is known for” (Project Tongariro, 2011a).

Another feature of the Pocket Ranger is a Quick Response (QR) Code reader. There are QR codes installed on posts along the trail, which can be read by a smartphone with Pocket Ranger installed. QR codes are a type of barcode that can be read easily by smartphones and can be used to display text, connect to a wireless network, or open a web page on the phone's browser (Wikipedia, 2014). The QR codes on the Tongariro Crossing will bring up relevant information based on the user’s location (New Zealand, 2012a).

Today - Saturday 24 May
 Issued at: 11:50am Saturday 24 May 2014

Rain, heavy falls and possible thunderstorms this evening, easing to showers overnight.
 Gale or severe gale northwesterlies.

Freezing level			
09:00	15:00	21:00	03:00
2800m	2450m	2650m	2550m

Tongariro National Park Visitor Centre (1160m)			
Time	Wind	Precipitation	Wind Chill
09:00	NW 60km/h	16mm	4°C
15:00	NW 65km/h	26mm	4°C
21:00	NW 70km/h	32mm	4°C
03:00	W 40km/h	31mm	2°C

Figure 3: Screen Dump taken on 24/05/2014 at 12:42 pm from link from Pocket Ranger to DOC then to the Met Weather Service

Sources of Data

According to the Case Study information (New Zealand, 2012a), the application is based primarily on open data made available by DOC. However, on using the application we found links to the New Zealand Meteorological Service for up-to-date weather forecasts. Given the changeability and possible severity of the weather in the Tongariro National Park, this feature can be critical for anyone planning to walk the Tongariro Crossing track. A check of the weather on 24 May 2014 showed (See Figure 3 above) that it probably was not a good day for doing the 19.4 km trek!

Project Tongariro managed the development of the application, engaging an Auckland based software developer. The cost of the app's development was covered by the inclusion of information about local services, such as accommodation, food, transport, and other activities in the area of interest to tourists. To have their services included in the app and in a sense advertised to tourists, local businesses have had to pay a fee, thereby funding the development costs.

Economic and Social Benefits

Local businesses are benefitting from having their services made known to tourists. Tourists are benefitting from safety information including advice about the clothing and footwear required. The hikers are benefitting from the QR codes which provide location specific information about the natural and historical features along the track. DOC and Project Tongariro are benefitting from the QR codes which eliminate the need to place large signs along the track, and reduce the need to produce books and pamphlets, thus the track has less impact on the natural environment and the costs of maintaining the track is reduced. Project Tongariro, has the potential to benefit by owning the intellectual property for the application template.

According to the Case Study (New Zealand, 2012a) these are:

- a community group has developed the application benefiting the public (national and international travellers)
- revenue earnings are gained through sales of the application template
- revenue earnings are gained through advertising local services
- the application provides an innovative new advertising channel for local businesses
- improved public safety through travellers being better informed about local conditions and equipment required
- there is less impact on landscape through use of QR codes on posts instead of big information signs

Efficiency Impacts

The Case Study lists the following efficiency impacts:

- the costs of publishing information about the Tongariro Alpine Crossing are reduced
- search and rescue costs are potentially reduced
- the template can be applied to other walkways and cycle routes

We now move on to the second case study.

Case study 2: Energy Efficiency and Conservation Authority

Introduction:

The second case study demonstrates how one government agency is working with a second government agency and is reusing the second agency's open data to generate greater value for the general public.

Key Players

The main player in this case study is New Zealand's Energy Efficiency and Conservation Authority (EECA). EECA is one of several government agencies working on aspects of the government's energy policy, and has specific responsibility for implementing "policy in the areas of energy efficiency and conservation and renewable energy" (EECA, 2014b). New Zealand has legislation, the Energy Efficiency and Conservation Act 2000, that "requires that there is a national energy efficiency and conservation strategy in force at all times" and EECA's programmes are guided by this strategy (EECA, 2014b).

EECA has two main programmes to foster energy efficiency and the use of renewable energy, (1) Energywise, and (2) EECA Business. The names of both of these programmes are trademarked. Energywise is a "consumer programme that provides information and funding for householders so they can make the most of energy efficiency, energy conservation and renewable energy" (Energywise, 2014). EECA Business provides advice and funding support to help businesses "invest in new energy-efficient technologies or system upgrades" (EECA Business, 2014). These programmes concentrate on various aspects of energy-use but primarily on energy efficiency relating to buildings (e.g., power use for heating and lighting) and to transportation (e.g., fuel use in cars and trucks).

Through the Energywise programme EECA offers consumers energy-efficiency advice in three main areas relating: (1) to their homes; (2) to products and appliances; and, (3) to vehicles. In this case study we examine the open government data used in the information EECA provides to consumers and the tools it has developed to assist with purchasing energy efficient vehicles, driving efficiently (economically and safely), and maintaining vehicles (for fuel efficiency and reducing carbon emissions). For some of the information, tools and support for consumers, EECA is using open government data from the New Zealand Transport Agency (NZTA).

NZTA is the government agency "responsible for contributing to an affordable, integrated, safe, responsive and sustainable land transport system" (NZTA, 2014b). Its responsibilities, roles and authorities are set out in a variety of laws and regulations including the Land Transport Management Act 2003, the Land Transport Act 1998 and the Transport Services Licensing Regulations 1989 (NZTA, 2014a). This responsibility involves NZTA in a wide range of activities including: the planning, building, maintenance and funding of land transport systems; operating the vehicle registration and licensing system as well as the system for managing drivers' licenses; and maintaining the system of technical standards that vehicles must meet before they are allowed into the country (nearly all of the vehicles in New Zealand are imported) and are used on the roads.

The information that NZTA has generated for the system of technical standards for vehicles and the non-private information from the registration of vehicles are made available to or

through EECA for its Energywise programme, as well as by NZTA on its website. NZTA also has a close relationship with the Ministry of Transport, and has used information generated by that Ministry in some its vehicle and road related tools (Webstruxure, 2014b; and see, for example: NZTA, 2005).

Project Description

EECA's vehicle information for consumers in the Energywise programme has three components that are all linked to data from NZTA.

Component 1: The Vehicle Fuel Economy Tool

The first component is the "compare your vehicle fuel economy" tool which is a website tool that links to the Fuelsaver data made available by NZTA.

A video on EECA's website provides a useful example of the fuel savings information that EECA provides to consumers (see [Episode 7 :: Vehicle choices | EECA Energywise](#))

The data used in the Vehicle Fuel Economy Tool enables EECA to provide information to the public relating to the economy (and safety) of vehicles. This tool helps consumers compare vehicles by showing them a star rating along with their average yearly fuel costs, thus seeing which vehicle offers them the best fuel economy. Below are screen shots from the Tool with the licence plate number AAF 324 entered into the box on the right side of the screen.

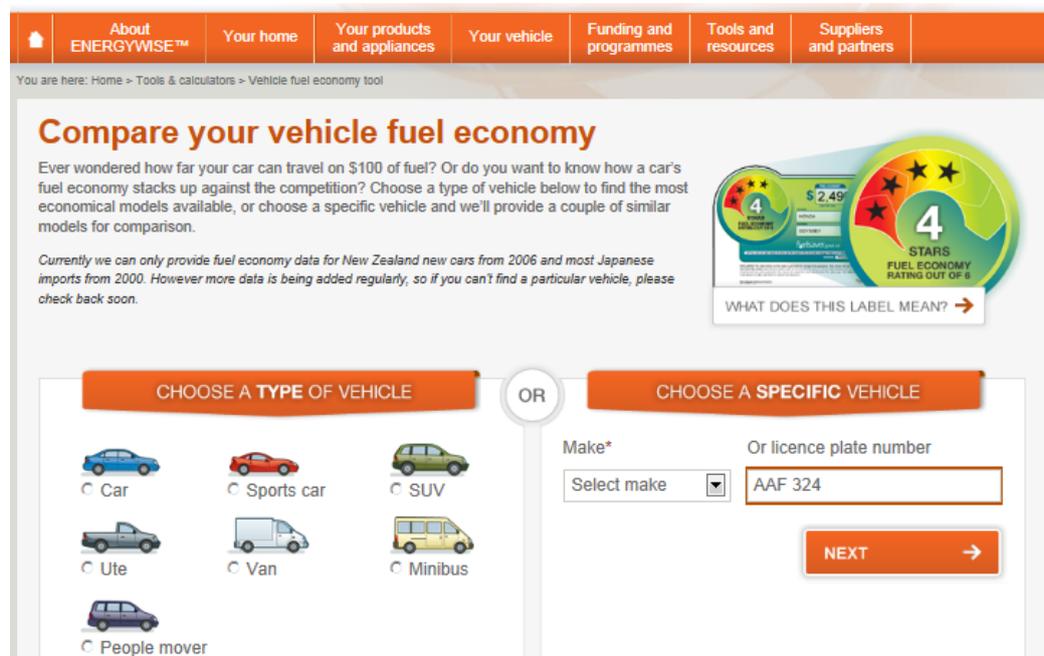


Figure 4. Entering Details in the Vehicle Fuel Economy Tool (<http://www.energywise.govt.nz/tools/fuel-economy>)

When "NEXT" is clicked, a new screen opens with three cars on the left side, one on each line. The top car with license plate number AAF 324 is a 2001 Honda Civic. At this point, when the "START DRIVING" button is clicked, the three cars travel the distance they could

go on \$100 worth of fuel - and the average yearly running costs based on 14,000 km and \$2.00 per litre (this amount can be adjusted) appears on the right.

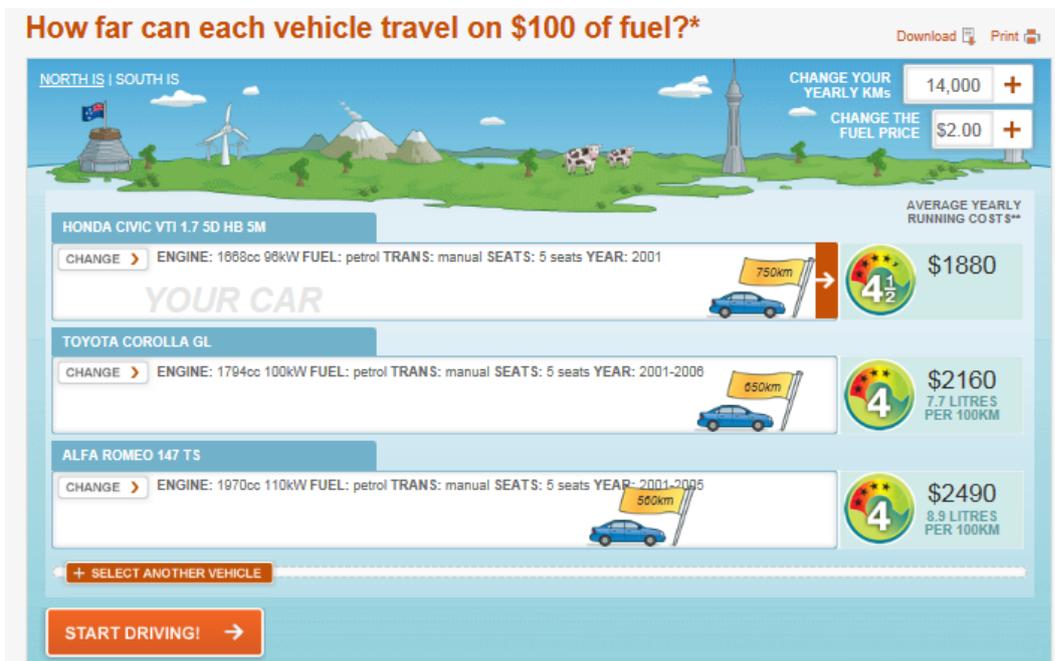


Figure 5. The Results on the Vehicle Fuel Economy Tool

Of the three cars, the Honda Civic is the least expensive to operate, travelling 750 km on \$100 petrol, with fuel costing \$1880 for the year. It is rated at 4 ½ stars out of 6.

Component 2: the Fuel Economy Label Generator Tool

The second component is the Fuel Economy Label Generator Tool. This component is for the benefit of consumers through vehicle vendors rather than for individual consumer use. It is not directly available through Energywise, but is closely related to it. Since 2008, commercial vendors of new and used vehicles in New Zealand are required to provide fuel economy information when offering a vehicle for sale on a website (Fuelsaver, 2009).

EECA's Fuel Economy Label Generator Tool allows owners of commercial web sites to "access the vehicle data held by the NZ Transport Agency to meet their obligations under the regulations" (Fuelsaver, 2009). The EECA Fuel Economy Label Generator Tool is available at no cost on the EECA website and allows commercial vendors to "retrieve fuel economy star rating and information as text for display alongside a vehicle being sold online [and] generate fuel economy labels to be printed and displayed with a vehicle" (Fuelsaver, 2009).

Fuel economy label generator

We've moved the label generator to a new home, but you'll still find everything you need to print fuel economy labels for your vehicle.

More about the website move [?](#)



STEP 1. Enter vehicle details

Only enter one option at a time. Use VIN or registration plate if the car was first registered in New Zealand more than two weeks ago (the database is updated with VIN data fortnightly) - otherwise try Chassis number

VIN [?](#)

Registration plate

Or, for other vehicles, use:

Chassis number [?](#)
If the car is a used import

Model code [?](#)
If it's a new car direct from the manufacturer

Figure 6. The Fuel Economy Label Generator tool (<http://www.eeca.govt.nz/vehicle-fuel-economy-labels/label-generator#970>)

Component 3: The Tyre Pressure Tool

A third component of EECA consumer information relating to vehicles that uses open data is the Tyre Pressure Tool. This Energywise tool emphasises to consumers that making sure their tyres are correctly inflated will help them use less fuel and be safer on the road, and their tyres will last longer.

There is a box to enter your vehicle's license plate number, and after clicking on "GO" details of your vehicle appear on the screen along with the appropriate pressure for tyres for your vehicle.

Tyre pressure tool

Find your car's tyre pressure

Making sure your tyres are correctly inflated will help you use less fuel and be safer on the road, and your tyres will last longer.
[Find out more »](#)



ENTER YOUR REGISTRATION PLATE

GO ↓

Your vehicle

Registration AAF324	Model CIVIC
Year 2001	Colour BLUE
Make HONDA	

How to find your tyre size

Tyre size can be found on your tyres sidewall - roll your mouse over the tyre markings below to find out more.



Tyre pressure for your vehicle

Our records show there are several possible tyre sizes for your car. Find your tyre size in the left hand column then check out the recommended tyre pressure below.

Display units as:

TYRE SIZE	FRONT P SI	REAR P SI
185/70R14 88 H	30 PSI	30 PSI
195/60R15 88 H		
205/50R16 87 H	33 PSI	32 PSI

Figure 7. Tyre Pressure Tool (<http://www.energywise.govt.nz/tools/tyre-pressure>).

The optimum air pressure for the front and rear tyres are provided - and this example also demonstrates that there can be more than one option for the size of tyres for a car.

Purpose of Project

The purpose of EECA's Energywise programme is to encourage energy efficiency by "informing consumers on the choices that are available to them" (EECA, 2009). EECA discovered through research that "a lack of information for the public on energy efficiency, energy conservation and renewable energy ... is a major barrier to the uptake of energy efficiency" (Energywise, 2014). It then set up the Energywise information programme to target this gap. Through the Vehicle Fuel Economy Tool and the Tyre Pressure Tool, consumers can obtain information to help them become more energy efficient.

The Fuel Economy Label Generator Tool supports the Energywise programme by helping to ensure that commercial sellers of vehicles place fuel economy labels online and with the vehicles offered for sale. The labels then help consumers understand a car's fuel efficiency, and allow them to compare it to similar models, leading to decisions in which energy efficiency becomes a criterion for vehicle purchasing.

Sources of Data

The main source of data for EECA's tools is NZTA. For the Vehicle Fuel Economy tool and the Fuel Economy Label Generator Tool EECA contracted the services of Webstruxure, a private company that specialises "in web applications, databases, and website content management" (Webstruxure, 2014a). For the Fuel Label Generator Webstruxure's role was to build a system for fuel label creation which is now freely available on EECA's website. Webstruxure also was contracted to create and manage EECA's provision of fuel economy information to consumers, including the Vehicle Fuel Economy Tool. Webstruxure was already providing related services to NZTA for its Fuelsaver tool. Fuelsaver is a tool on NZTA website that helps drivers determine the amount they are spending on fuel per year and to obtain tips on reducing their fuel consumption (Webstruxure, (2014b).

Webstruxure provides some background details on its website about how EECA's vehicle comparison tool relates to other tools.

In 2005, we [i.e., Webstruxure] had developed a database of vehicle fuel consumption for the Ministry of Transport. Fuelsaver was the first product built on top of this, and the work done on Fuelsaver subsequently led to the development of sites such as [RightCar](#) and the Energy Efficiency and Conservation Authority's [Compare your vehicle fuel economy](#) tool. (2014b)

EECA's Tyre Pressure Tool was also created in partnership with NZTA. However this tool also involved DriveRight, "an independent fitment data provider to the wheel and tyre industry" (DriveRight, 2014a). The Tyre Pressure Tool cross-references the NZTA vehicle registration database with information from the DriveRight database of "tyre sizes and legally permitted tyre pressures", allowing drivers to check the tyre size and pressure for their vehicles (DriveRight, 2014b).

Impacts

Economic Benefits

By requiring products to meet minimum energy performance standards before they can be sold, and by informing consumers about how to choose the more efficient products, EECA provides an incentive for vehicle manufacturers to constantly improve energy efficiency and for vehicle importers to select more efficient vehicles for the New Zealand market.

More than 50% of consumers are being influenced by vehicle fuel economy labels (EECA, 2013, p. 54), leading to greater vehicle fuel efficiency in the country and therefore reductions in the importation of petrol products, savings for vehicle owners, and less impact on the environment. The savings to the NZ economy from 2008 to 2038 from the labelling is estimated to be \$356 million (EECA, 2009, p. 13).

There are also economic and efficiency benefits to the vehicle vendors through the Fuel Economy Label Generator Tool. "A seller only has to enter the vehicle plate number or chassis number or VIN number for the information to be automatically populated onto an advertisement. This demonstrates a practical low cost solution to fuel economy labelling ..." (International Energy Agency, 2012, p. 20).

Social Benefits

Because New Zealand consumers are becoming better informed about vehicle fuel economy for purchasing and operating their vehicles, they are capable of making better decisions - thus saving money that they can use for other purposes.

Environmental Benefits

Less fuel consumption also means less damage to the environment. The amount of fuel used by a vehicle is generally speaking directly related to the amount of carbon dioxide (CO²) it produces (RightCar, 2011). Thus by providing information to consumers to help them choose more fuel efficient vehicles, there is less fuel being used, cleaner air, and reduced CO² emissions, all of which are beneficial to the environmental.

Case study 3 – Land Info NZ (LINZ) Data Service

Introduction

In the third case study we illustrate how one government department has opened up access to an extensive range of its data for reuse by the public and private sectors.

The Key Player

Land Information New Zealand is one of New Zealand's government agencies whose primary role is to gather and provide access to information. LINZ "is a New Zealand government department responsible for land titles, geodetic and cadastral survey systems, topographic information, hydrographic information, managing Crown property and a variety of other functions" (LINZ, 2014a). Its purpose is to "maintain and build confidence in property rights in land and geographic information, and encourage land information markets to develop and mature" (LINZ, 2014a). The jewel in LINZ's crown is the LINZ Data Service which "provides free online access to core nationally significant location-based datasets held by LINZ" (LINZ, 2013a, p.7). LINZ data is also made available through other organisations who mix and mash it to provide the public with information in more useful aggregations. One such example is the Greater Wellington GIS Viewer.

LINZ has not worked alone on developing the LINZ Data Service's online tools. In 2010, LINZ put out a tender for a partner to help it make its data more accessible via the World Wide Web, and it accepted a tender from Koordinates (LINZ, 2010). Koordinates is a New Zealand company that provides free online access to geographic datasets, include many of the LINZ datasets and land datasets from New Zealand local government councils. As noted on the Creative Commons Aotearoa New Zealand website, "Koordinates often relies on, and indeed encourages providers of its geographic datasets to be published under a Creative Commons licence to streamline reuse" (2010). The website also comments that when accessing geographic data online via Koordinates platforms, "map layers are visualised online and can be downloaded as professional data in a way that has been described as 'Google Earth for professionals'".

Wellington city's mayor, Celia Wade-Brown, commented: "Whether it's a government organisation, community group, businesses or individuals using it – this information aids decision-making and it will allow many projects or initiatives to be completed more quickly, cheaply and effectively" (cited in MGregor, M., 2013).

Project Description

The LINZ Data Service is a website that allows users to easily find, access and use LINZ data. The Service "uses Creative Commons licensing and provides data in a choice of open, standards compliant formats" (LINZ, 2013a, p. 7). LINZ describes its Data Service as "Free, online access to pure, unadulterated data" and says "we don't do anything fancy with the data – we leave that to you and your imagination..." (LINZ, 2014d).

LINZ states that one of its core goals to be "to improve the way New Zealanders find, use and share geospatial information" and to achieve this goal it is "making our own land and seabed information more accessible, and ensuring it is reliable, up-to-date and fit for purpose" (LINZ, 2010). The New Zealand Geospatial Strategy, which LINZ coordinates and leads for the New Zealand government, is a foundational component of LINZ's open data strategy. It "aims to better coordinate and manage the use of New Zealand's geospatial resources across all tiers of society" (LINZ, 2013b). According to a press release from LINZ in 2010, "geospatial information added \$1.2 billion in productivity-related benefits to the New Zealand economy in 2008." However, LINZ felt that more could be achieved and moved to increase the reuse of its geospatial information, stating that "this figure could be much higher if New Zealand's datasets are more freely available and accessible" (LINZ, 2010).

Sources of Data

LINZ Data Service provides access primarily to LINZ's own geospatial data but it also provides access to some non-geospatial data (data without a location-based component).

There are seven types of datasets provided:

- topographic data (information about the features of the land, e.g., on maps)
 - hydrographic data (information about the features of the seabed used for navigation)
 - geodetic data (basic information about LINZ's official geodetic mark network)
 - cadastral, title and electoral data (information about roads and addresses, and property ownership and boundaries)
 - Crown pastoral land data (used for the management of pastoral leases on behalf of the government)
 - place names data (view official and unofficial place names)
 - aerial imagery data (photographic representation of the earth's surface and the features on it)
- (LINZ, 2014d)

Examples of Open Government Data from LINZ Data Service

Here we provide several examples of uses of open government data from the LINZ Data Service.

New Zealand Property Titles

Access to the LINZ Data Service is open to everyone through: <https://data.linz.govt.nz/>. However, the data sets are often extremely large, even when zipped for downloading. For example, New Zealand Property Titles dataset can be downloaded or ordered from LINZ. Given that the full dataset is 341 GB, and even when zipped is 3 GB, the option of ordering this dataset could well make much more sense. Note that it is necessary to register with LINZ when downloading or ordering data.

It is possible, though, to be quite specific when gathering information. For example, you can use a cropping tool to eliminate areas of map of no interest to you and thus reduce the amount you download (LINZ, 2014b).

LINZ Aerial Photographs and the Greater Wellington GIS Viewer

One of the interactive LINZ Data Service datasets is the aerial photographs. On the right side of your screen you will have a map of all or a part of New Zealand, and you can open to a full screen and zoom in on specific locations. The LINZ aerial photographs have also been used by local councils, as you will see in the following example of the Greater Wellington GIS Viewer. This example shows how one LINZ dataset can be overlaid with additional data to provide more detailed information. The first of each of the pairs of images below is from the LINZ Data Service while the second is from the Greater Wellington GIS Viewer. These have been cropped slightly.

The last of these images includes the property boundary lines, which are extremely important to people who are interested in, for example, purchasing a property, doing upgrades (e.g., building a retaining wall), or for insurance purposes (though for legal purposes, it is necessary to use the Landonline data service).

Information about the Greater Wellington GIS Viewer is included in the LINZ Annual report for 2012- 2013.

This viewer allows residents to overlay a range of Wellington-specific property, services and recreational information on top of bird's-eye view maps, using land boundary, street address and road centreline data from the LINZ Data Service. A monthly automatic update of this data has been built into the viewer to keep property owners up with the latest developments. Frequent updates are possible because LINZ Data Service data is freely available for use and re-use through Creative Commons licensing under the Government's open data policy. (LINZ 2013a, p. 14)

As can be seen from the example, data which is available through the LINZ Data Service has been mixed and mashed to create more valuable information in the Greater Wellington GIS Viewer.

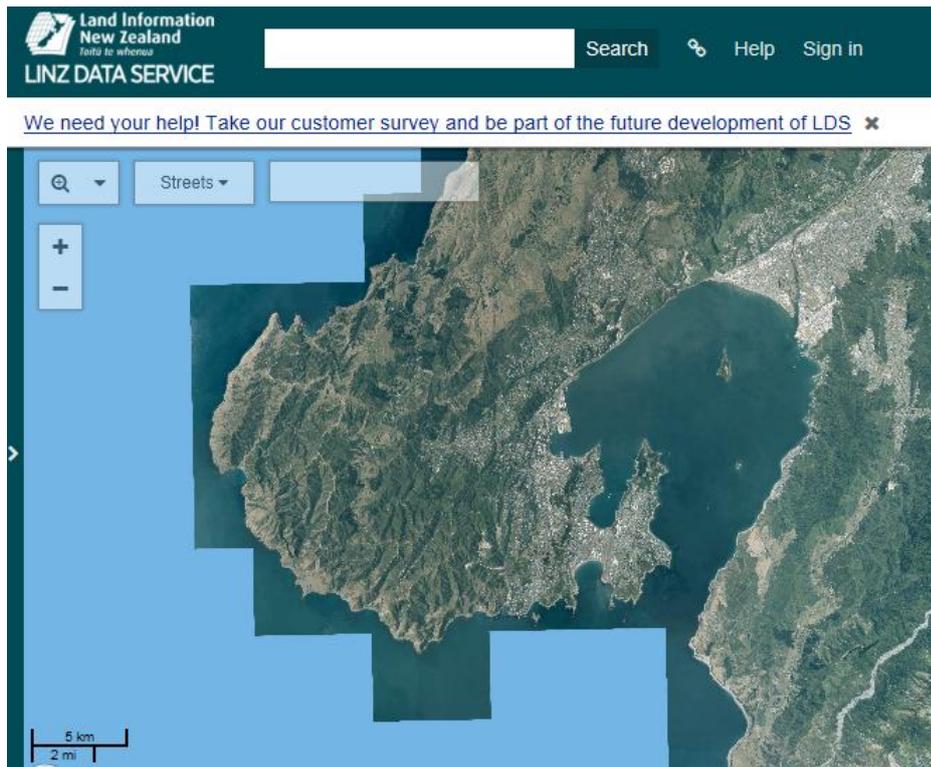


Figure 8. Wellington Region from LINZ Data Service (<https://data.linz.govt.nz/layer/1870-wellington-03m-rural-aerial-photos-2012-2013/>)

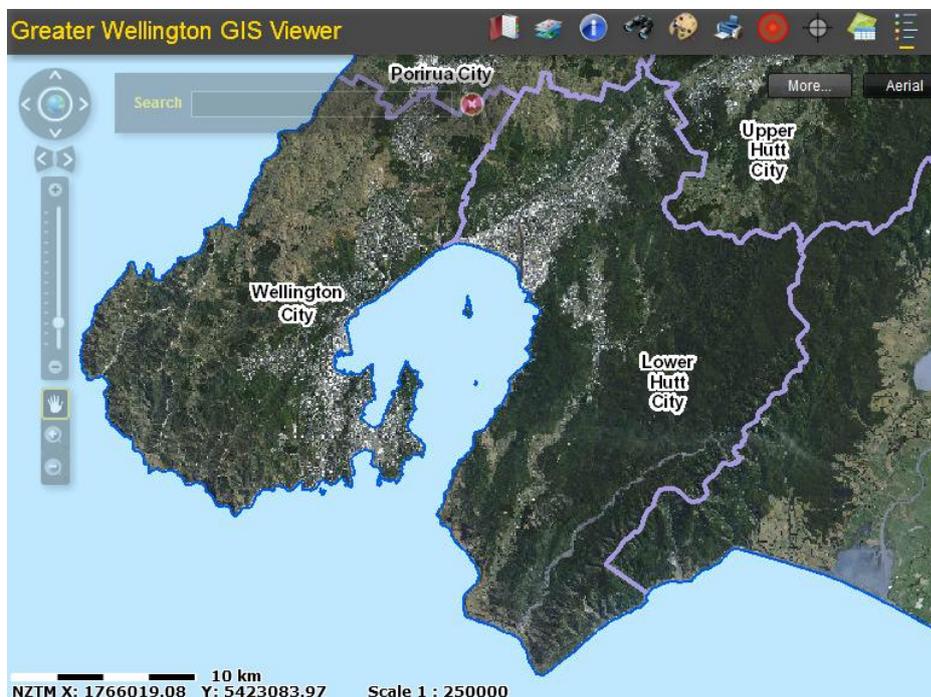


Figure 9. Wellington Region from Greater Wellington GIS Viewer (<http://mapping.gw.govt.nz/gwrc/>)

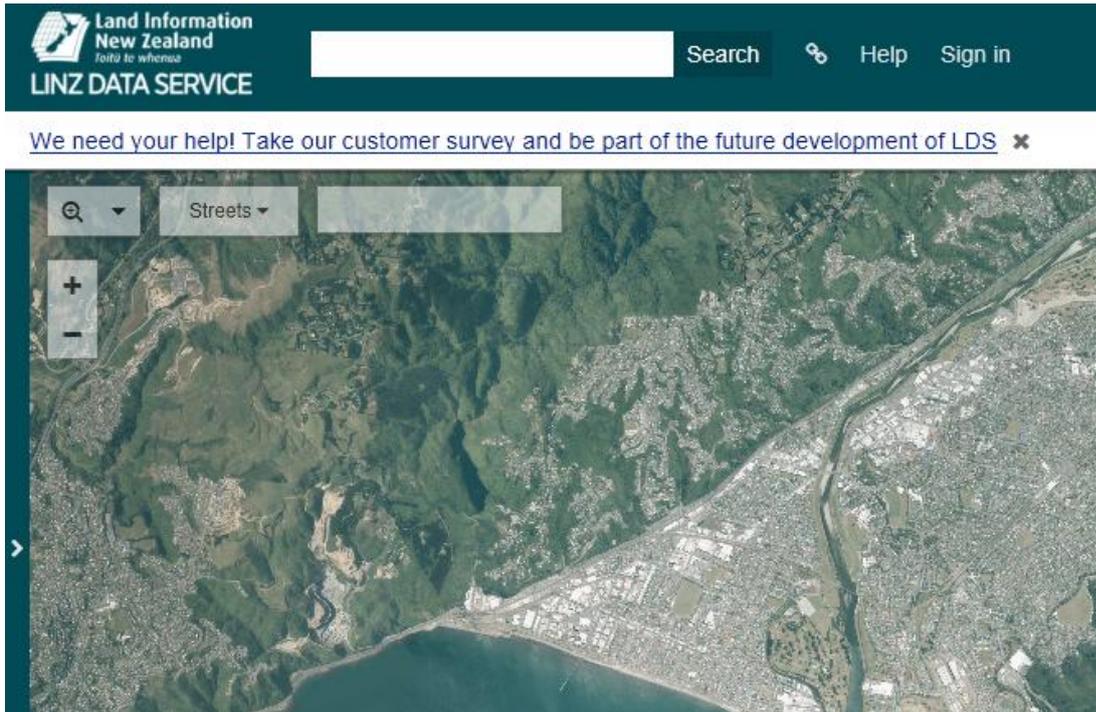


Figure 10. Petone, Lower Hutt and Northern Hills from LINZ Data Service

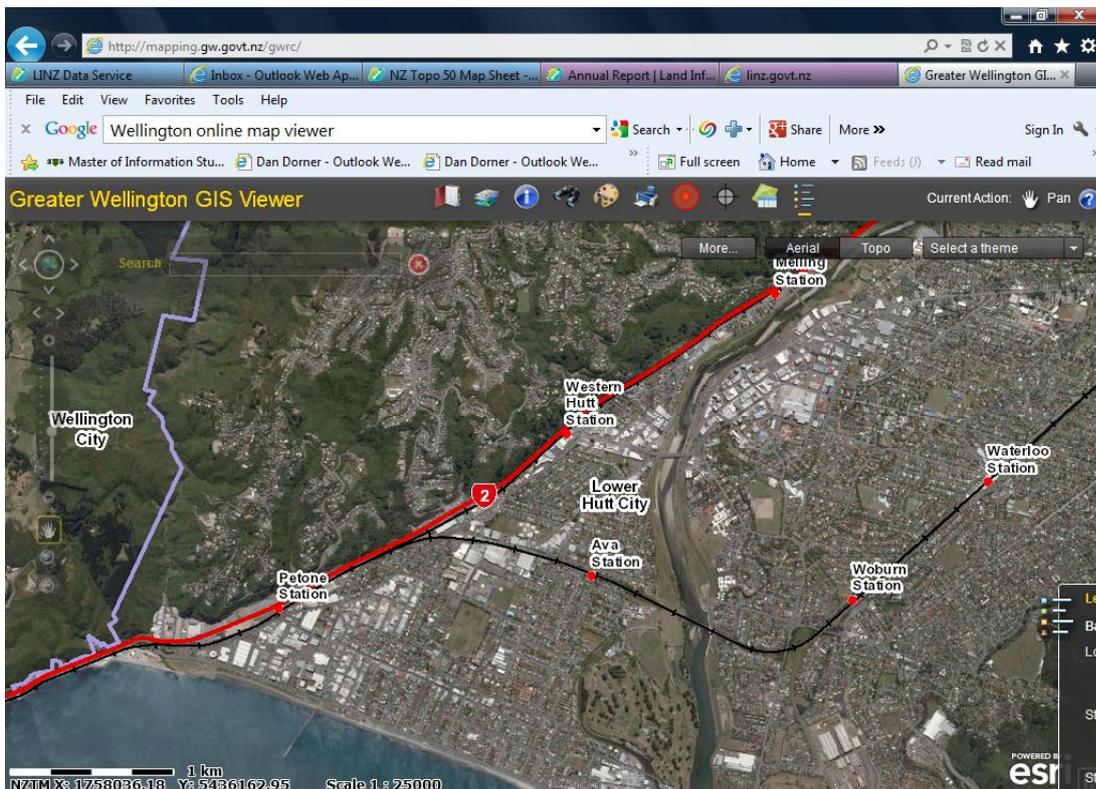


Figure 11. Petone, Lower Hutt and Northern Hills from Greater Wellington GIS Viewer

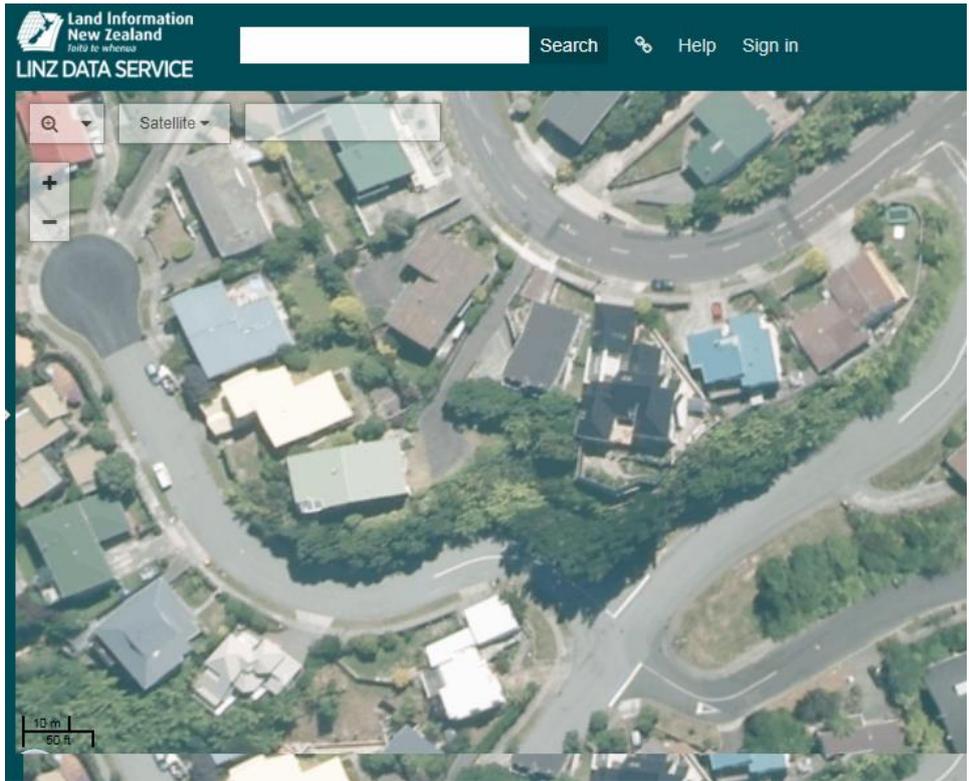


Figure 12. Some properties in Maungaraki, Lower Hutt from LINZ Data Service

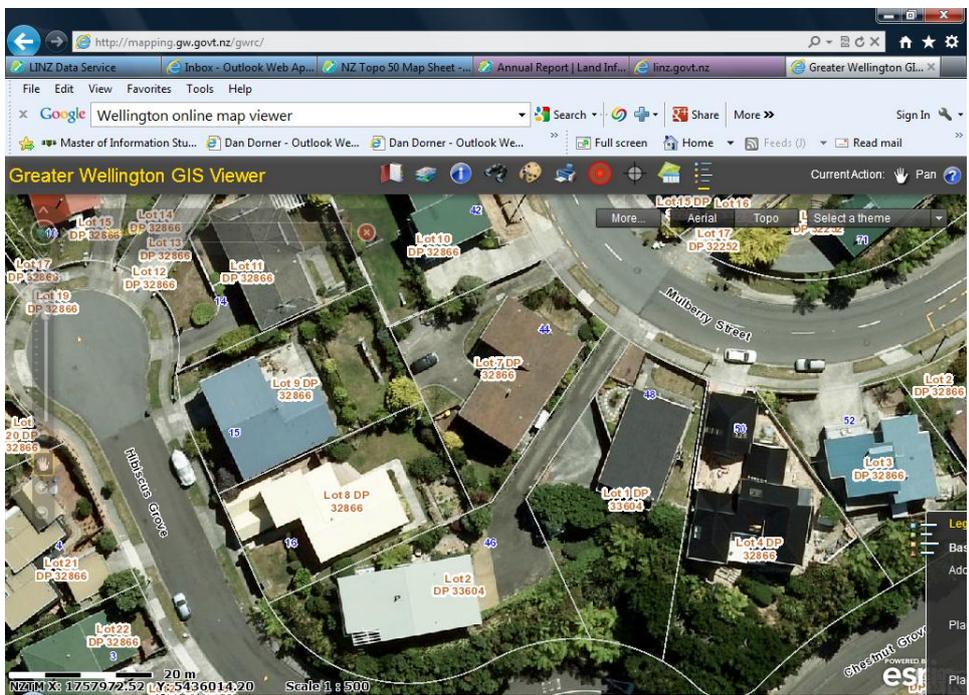


Figure 13. Some properties in Maungaraki, Lower Hutt with boundaries from Greater Wellington GIS Viewer

LINZ Christchurch Post-Earthquake Aerial Photographs

The second LINZ aerial data set used as an example here is available on the LINZ Data Service (<https://data.linz.govt.nz/layer/1932-christchurch-post-earthquake-01m-urban-aerial-photos-24-february-2011/metadata/?type=dc>) as well as via the Koordinates' website (<https://koordinates.com/layer/3185-christchurch-post-earthquake-aerial-photos-24-feb-2011/>). The aerial photographs were taken two days after the devastating earthquake of 22 February 2011. With more than 95,000 views and almost 11,000 downloads, the LINZ aerial photography of the February 2011 Christchurch earthquake is the most popular Koordinates' layer.

The Christchurch post-earthquake aerial photographs were taken two days after the tragedy and originally were being used by the Police, Civil Defence and other emergency services. Some have appeared in newspapers and in other media - and there no doubt were many other uses by government and non-government organisations, and individuals. Of greater value for legal purposes, though less dramatic than the aerial photography, is the LINZ data made available via Landonline, a charged-for service for information professionals such as surveyors and lawyers. Of critical importance to these professionals is the accuracy of the information, and Landonline data has been updated "to reflect the movements that occurred in the four major Christchurch earthquakes" (Landonline, 2014).

The figures below provide interesting images of central Christchurch two days after the big earthquake. Upon opening, the viewer's first image of the from a very high level - and the zooming in on specific areas.

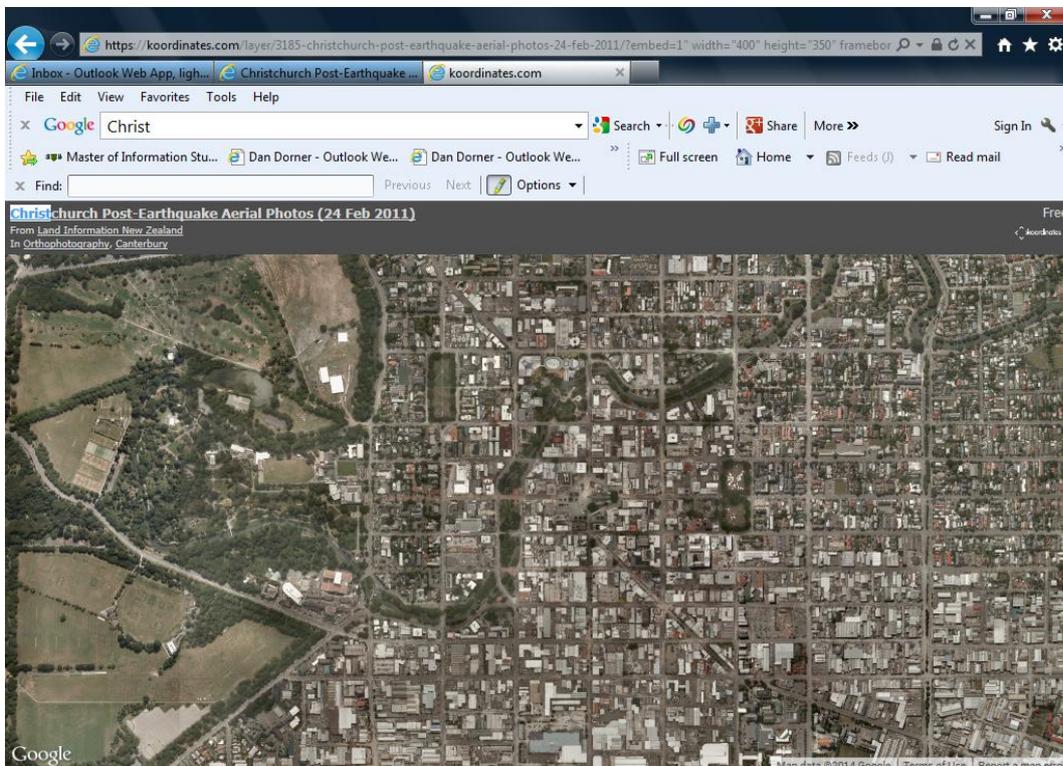


Figure 14: Mid-range Post-Earthquake Aerial Photograph of Christchurch on LINZ Data Service

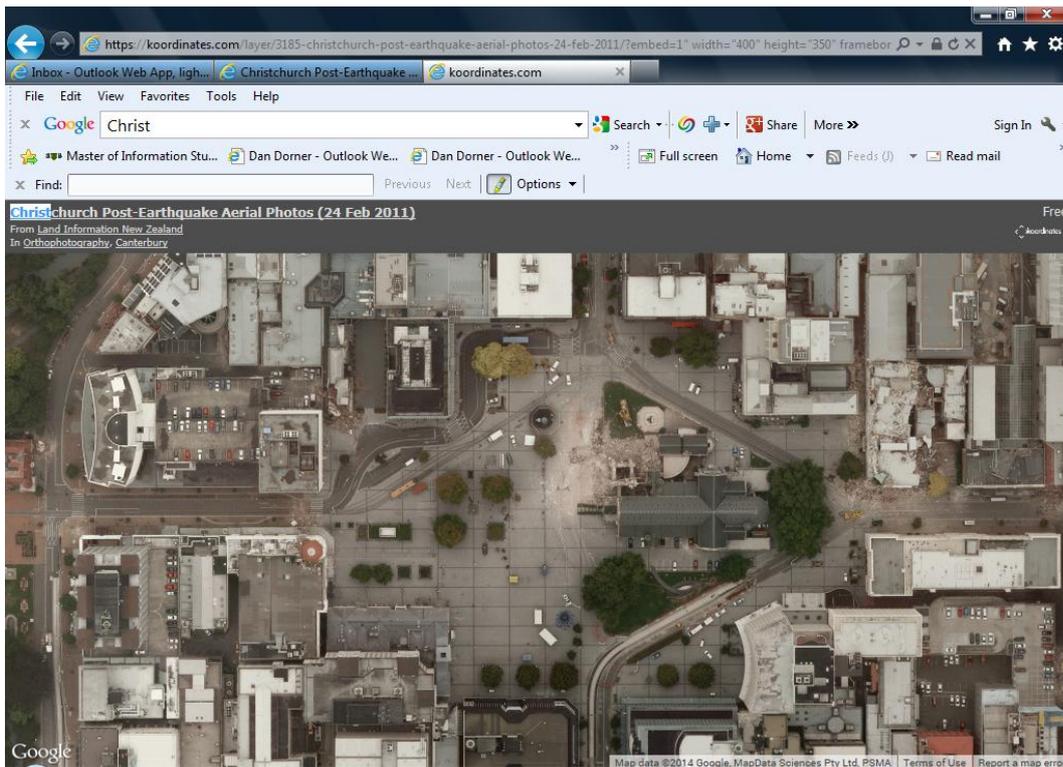


Figure 15. Close-range Post-Earthquake Aerial Photograph of Christchurch Cathedral Square on LINZ Data Service

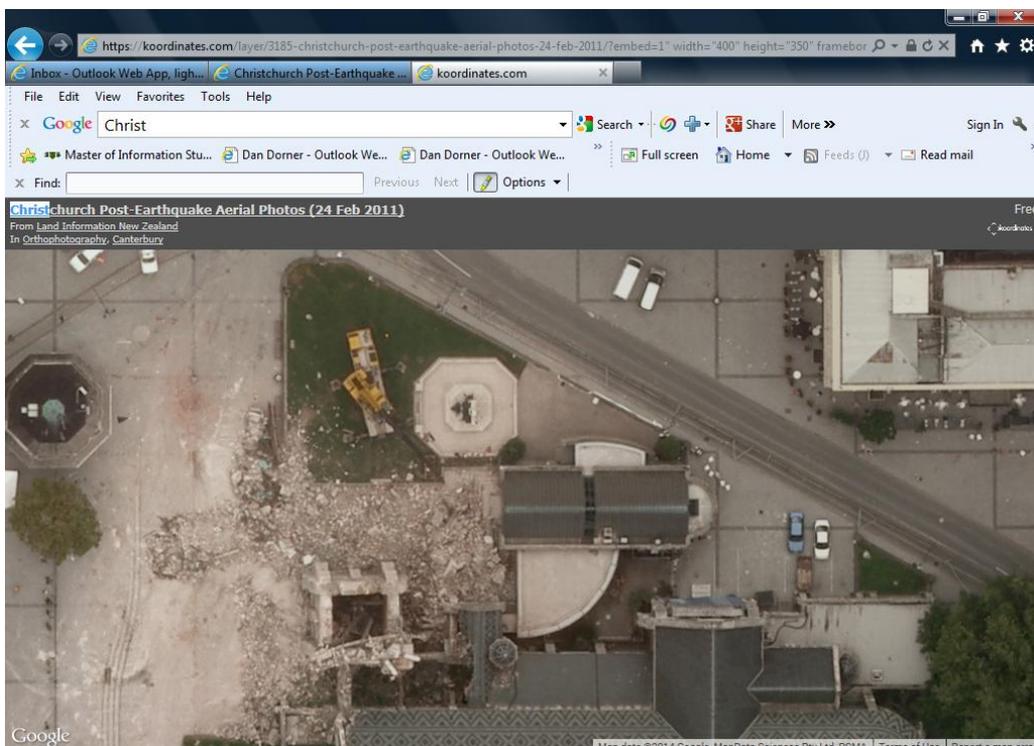


Figure 16. Very close range Post-Earthquake Aerial Photograph of Christchurch Cathedral on LINZ Data Service

Impacts

Social and Economic Benefits

The open government data available through the LINZ Data Service has produced a range of social and economic benefits. With respect to the social benefits, New Zealanders are able to access the data directly at no cost. The benefits are two ways - to the citizens in terms of no costs and to the government in that citizens feel more assured that their government is providing valuable services especially since the data being provided have already been paid for through taxes. New Zealanders are also able to see how government agencies, regardless of whether they are at the national or regional level, are cooperating to generate greater value from their data through mixing and matching - the example being the Greater Wellington Region GIS Viewer. Another social benefit is the use of the LINZ datasets in teaching and learning, which is occurring at the University of Canterbury. Students at the University of Canterbury are being taught "how to analyse & solve problems in forest management ... [which] will lead to more participation in policy development in the future" (New Zealand, 2012b).

The integration of LINZ's open data and making it available via a single website has enhanced accessibility, increasing access opportunities while reducing users' costs in terms of time spent. When LINZ was doing the preliminary research prior to setting up the service, it estimated that the costs to LINZ would be outweighed 10:1 by the savings to the 68 local and central government agencies which previously had to use third parties to access the LINZ information (Jackson, 2011). Thus, other government agencies have been able to improve their services at less cost. LINZ contends that the "estimated savings over the long term across government agencies are likely to be between \$680,000 and \$1.3 million annually" (New Zealand, 2012b). In terms of the economy as a whole, "use of location-based information contributes an estimated annual \$1.2 billion in economic benefits to New Zealand's economy."

Conclusion

These strategies are aimed at encouraging members of New Zealand society, whether in the public or private sector, to reuse datasets of government information stored in virtual data libraries to create new knowledge, as well as to ensure transparency within the government.

As noted earlier, New Zealand was ranked fourth out of 77 nations in the 2013 Open Government Data barometer. The New Zealand Government has three key open data strategies: the *Government Open Access and Licensing Framework*, the *Declaration on Open and Transparent Government*, and the *New Zealand Data and Information Management Principles*. These strategies are aimed at encouraging the nation's government agencies to manage their data effectively and efficiently, to license it for open access using the Creative Commons framework (while also protecting personal information), and to encourage public and private sector organisations and individuals in New Zealand to reuse the data to create new knowledge for economic as well as social benefits. They also foster transparency, contributing to New Zealanders' high level of trust in their government.

The three case studies demonstrate the variety of partners and approaches to the reuse of open government data and the forms of new knowledge created through its reuse. The first case study demonstrates how a government department (DOC) and a community-based

organisation (Project Tongariro) have worked together to reuse open government data to develop the Tongariro Crossing Alpine Ranger, a smartphone application for people hiking in the volcanic mountains of New Zealand.

The Energywise case study is an example of how one government agency (EECA) is reusing a second government agency's data (NZTA's) to help consumers find and use information about the energy-efficiency of vehicles they are considering for purchase, and to help the vehicle vendors to meet their requirement to provide fuel economy labels and information for the vehicles they are selling.

The third case study shows how open data from one government agency, LINZ, is being reused by a regional government council (the Wellington Regional Council) and by individuals and organisations through LINZ's own Data Service and through Koordinates, an externally contracted company that has developed the Data Service functionality.

While there are differences in the types of partners and the approaches to reusing open government data across the three cases, there are also two extremely important commonalities. First, all three cases demonstrate the breaking down of silos within government. As observed by Jay Liebowitz (2004) in the first ever article in the journal *Electronic Government*:

Within the government, there are many functional silos created by large, bureaucratic organisations. This would suggest the importance of integrating knowledge across these silos to break down the silo mentality. Knowledge management could be a useful approach to accomplish this task. (p. 5)

It is through the breaking down of the data silos within government that the second commonality occurs, that is, the creation of new knowledge. Liebowitz (2004) points out that

knowledge creation may take the form of new products or services, increased innovation, improved customer relationships and the like. In the government setting, knowledge creation has taken place in terms of improved organisational processes and systems, innovations, better customer relationship management practices and new ways of working together within and between government agencies. (p. 6)

In our case studies, we have shown how the breaking down of silos has led to knowledge being created in the forms mentioned by Liebowitz:

- new products (e.g., the fuel economy labels produced through the Fuel Economy Label Generator Tool),
- new services (e.g., the Christchurch Post-Earthquake Aerial Photographs, the Tongariro Alpine Crossing app and the Vehicle Fuel Economy Tool),
- increased innovation (e.g., by tailoring services that reuse government data to meet the needs of specific groups), and
- improved customer relationships (e.g., by making government information available to non-profit organisations, businesses, and individuals, and contributing to making the workings of government more transparent).

In 2013, the New Zealand Government unveiled the *Government ICT Strategy and Action Plan to 2017* (New Zealand, 2013). It is composed of four highly integrated focus areas, one

of which is "information is managed as an asset" (p. 7). To manage their information and data as an asset and leverage the value of this asset, New Zealand government agencies are breaking down the silos and are reusing open government data to create new information products and services for individuals and organisations. Those who are reusing the open government data are generating new knowledge, and the nation is receiving dividends in the form of economic and social benefits.

We have defined knowledge management following Davenport's (1994) "as the process of capturing, distributing, and effectively using knowledge." Our discussion of the open government data strategies and the three case studies has shown how the New Zealand government is capturing, distributing and effectively using its knowledge by making it available as open data for reuse by organisations and individuals. These organisations and individuals are now creating new knowledge for their own purposes which is leading to benefits for themselves and for the nation as a whole.

References

Creative Commons Aotearoa New Zealand. (2010). *Koordinates: the one place for geodata*. Viewed 24 May, 2014 at: <http://creativecommons.org.nz/2010/10/koordinates-the-one-place-for-geodata/>

Creative Commons Aotearoa New Zealand. (2013). *What is open data?* Viewed 23 May 2014 at: <http://creativecommons.org.nz/opendata/>

Davenport, T. (1994). Saving IT's Soul: Human Centered Information Management. *Harvard Business Review*, Vol. 72 (2), pp. 119-131.

Davenport, T., and Prusak, L. (2000). *Working Knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

Davies, T. (2013). *Open data barometer: 2013 Global Report*. London: Open Data Institute and World Wide Web Foundation. PDF retrieved 3 May 2014 from: <http://www.opendataresearch.org/dl/odb2013/Open-Data-Barometer-2013-Global-Report.pdf>

Department of Conservation. (2013). *Statement of Intent 2013-2017*. Wellington: The Department. Retrieved 24 May, 2014 from: <http://www.doc.govt.nz/Documents/about-doc/statement-of-intent-2012-2017/statement-of-intent-2013-2017.pdf>

DriveRight. (2014a). About. Viewed 30 May 2014 at: <http://wheelwizards.net/about/#quick-facts>

DriveRight. (2014n). DriveRight Supports Tyre Awareness Week with Online Tyre PressureTool. Press release viewed 30 May 2014 at: <http://wheelwizards.net/driveright-supports-tyre-awareness-week-online-tyre-pressuretool/>

Duhon, B. (1998). It's all in our heads. *Inform* 12(8), pp. 8-13.

EECA Business. (2014). Welcome to EECA Business. Viewed 30 May 2014 at: <http://www.eecabusiness.govt.nz/>

Energy Efficiency and Conservation Authority. (2009). Briefing to the Incoming Minister. PDF downloaded 20 May 2014 from:

http://www.beehive.govt.nz/sites/all/files/Energy_Efficiency_and_Conservation_Authority_BIM.pdf

Energy Efficiency and Conservation Authority. (2013). Annual report 2012-2013. PDF downloaded 30 May 2014 from: <http://www.eeca.govt.nz/sites/all/files/eeca-annual-report-web-2012-2013.pdf>

Energy Efficiency and Conservation Authority. (2014a). Compare your vehicle fuel economy. Viewed 30 May 2014 at: <http://www.energywise.govt.nz/tools/fuel-economy>

Energy Efficiency and Conservation Authority. (2014b). Energy policy and strategy. Viewed 30 May 2014 at: <http://www.eeca.govt.nz/central-and-local-government/central-government-energy-policy>

Energy Efficiency and Conservation Authority. (2014c). Fuel economy label generator. Viewed 30 May 2014 at: <http://www.eeca.govt.nz/vehicle-fuel-economy-labels/label-generator#970>

Energy Efficiency and Conservation Authority. (2014d). Tyre Pressure Tool. Viewed 30 May 2014 at: <http://www.energywise.govt.nz/tools/tyre-pressure>

Energy Efficiency and Conservation Authority. (2014e). Welcome to EECA. Viewed 30 May 2014 at: <http://www.eeca.govt.nz/>

Energywise. (2009). Episode 7: Vehicle Choices. Video viewed 30 May 2014 at: <http://www.energywise.govt.nz/energyspot/episode-7/vehicle-choices>

Energywise. (2014). About Energywise™. Viewed 30 May 2014 at: <http://www.energywise.govt.nz/about-energywise>

Fuelsaver. (2009). Fuel economy information for commercial websites. Viewed 30 May 2014 at: <http://resources.fuelsaver.govt.nz/>

International Energy Agency. (2012). Improving the Fuel Economy of Fuel Labels: A Policy Package. Paris: International Energy Agency. PDF downloaded 31 May 2014 from: http://www.iea.org/publications/freepublications/publication/PP5_Fuel_Economy_FINAL_WEB.pdf

Jackson, R. (2011). LINZ to invest millions in data service. *Computerworld* 30 March, 2011. Viewed 25 May 2014 at:

http://www.computerworld.co.nz/article/498026/linz_invest_millions_data_service/

Land Information New Zealand. (2007). Understanding our geographic information landscape: A New Zealand Geospatial Strategy. Wellington, N.Z.: Land Information New Zealand. PDF downloaded 25 May, 2015 from:

<http://www.linz.govt.nz/sites/default/files/docs/geospatial-office/nz-geospatial-strategy-2007.pdf>

Land Information New Zealand. (2010). Koordinates Ltd to Help Make LINZ Data More Accessible. Viewed 24 May 2014 at: <http://www.linz.govt.nz/about-linz/news-publications-and-consultations/news-and-notice/corporate/2010/1103-LINZ-data-more-accessible>

Land Information New Zealand. (2012). Increasing the productive use of location-based information. Viewed 25 May 2014 at: <http://www.linz.govt.nz/about-linz/news-publications-and-consultations/corporate-publications/increasing-the-productive-use-of-location-based-informat-0>

Land Information New Zealand. (2013a). *Annual Report 2012>2013*. Wellington, N.Z.: Land Information New Zealand. 100 p. PDF downloaded 24 May, 2014 from: http://www.linz.govt.nz/sites/default/files/placenames/about-geographic-board/annual-report/2012-2013/annual_report_2012-2013.pdf

Land Information New Zealand. (2013b). *New Zealand Geospatial Strategy*. Viewed 25 May 2014 at: <http://www.linz.govt.nz/geospatial-office/geospatial-strategy/index.aspx#section-header>

Land Information New Zealand. (2014a). *About*. Viewed 25 May 2014 at: <http://www.linz.govt.nz/about-linz>

Land Information New Zealand. (2014b). *Getting Started*. Viewed 25 May 2014 at: <http://www.linz.govt.nz/about-linz/linz-data-service/getting-started#extract>

Land Information New Zealand. (2014c). LINZ Data Service: Datasets. Viewed 25 May 2014 at: <http://www.linz.govt.nz/about-linz/linz-data-service/dataset-information>

Land Information New Zealand. (2014d). What is the LINZ Data Service? Viewed 25 May 2014 at: <http://www.linz.govt.nz/about-linz/linz-data-service/about-lds>

Landonline. (2014). *South Island coordinate update*. Viewed 25 June 2014 at: <http://www.landonline.govt.nz/landonline-system-updates/south-island-coordinate-update>

Liebowitz, J. (2004). Will knowledge management work in the government? *Electronic Government* 1(1), pp. 1-7.

Liu, S., and Parmelee, M. (2002). Introduction to Knowledge Management. Available at: http://www.unc.edu/~sunnyliu/inls258/Introduction_to_Knowledge_Management.html

McGregor, M. (2013). *New Zealand Local Government Data*. Blog entry from 17 July 2013, viewed 24 June at: <https://blog.koordinates.com/author/mattmcgregor/page/2/>

New Zealand. (2012a). *Open Government Case Study: Pocket ranger*. Downloaded 24 May 2014 from: http://ict.govt.nz/assets/Uploads/Documents/Pocket-ranger-Case-Study_1.pdf

New Zealand. (2012b). *Open Government Case Study: Land Information Data Service*. PDF downloaded 24 April 2014 from: http://ict.govt.nz/assets/Uploads/Documents/Visio-LINZ%20Data%20Service%20case%20study%20October%202012_0.pdf

New Zealand. (2013). *Government ICT Strategy and Action Plan to 2017: June 2013*. PDF downloaded 31 May 2014 from: <http://ict.govt.nz/assets/Uploads/Government-ICT-Strategy-and-Action-Plan-to-2017.pdf>

New Zealand. (2014a). *Declaration on open and transparent government*. Viewed 23 May 2014 at: <http://ict.govt.nz/programmes/open-and-transparent-government/declaration-open-and-transparent-government/>

New Zealand. (2014b). *New Zealand Government Agencies Open Access and Licensing (NZGOAL) Framework*. Viewed 25 May 2014 at: <http://ict.govt.nz/guidance-and-resources/open-government/nzgoal>

New Zealand. (2014c). *New Zealand Data and Information Management Principles*. Viewed 25 May 2014 at: <http://ict.govt.nz/guidance-and-resources/open-government/new-zealand-data-and-information-management-princi>

New Zealand. (2014d). *Quick guide for agencies*. Viewed 23 May 2014 at: <http://ict.govt.nz/guidance-and-resources/open-government/nzgoal/quick-guide-agencies>

New Zealand. (2014e). *Toolkit for agencies*. Viewed 23 May 2014 from: <http://ict.govt.nz/programmes/open-and-transparent-government/toolkit-agencies/#Definitions>

New Zealand Transport Agency. (2005). *Deficiency database prioritisation process*. PDF downloaded 31 May 2014 at: <http://www.nzta.govt.nz/resources/sms/deficiency-database/docs/ddpp-info-sheet-ed3.pdf>

New Zealand Transport Agency. (2014a). *Our legal framework*. Viewed 31 May 2014 at: <http://www.nzta.govt.nz/about/who-and-what/what-we-do/legal-framework.html>

New Zealand Transport Agency. (2014b). *Who we are and what we do*. Viewed 30 May 2014 at: <http://www.nzta.govt.nz/about/who-and-what/index.html>

Oh, J. (2013). *Literature review: open data in New Zealand*. Retrieved 26 April 2014 from: https://www.stat.auckland.ac.nz/~joh024/LitReviews/LitReview_NZOpenData.pdf

Open Data Handbook. (2012). *What is open data?* Retrieved 26 April 2014 from: <http://opendatahandbook.org/en/what-is-open-data/>

Open Definition. (2011). *Terminology*. Viewed 25 May 2014 at: <http://opendefinition.org/od/>

Organisation for Economic Cooperation and Development. (2014). *Better Life Index: New Zealand*. Viewed 23 May, 2014 at: <http://www.oecdbetterlifeindex.org/countries/new-zealand/>

Orna, E. (2005). *Information strategy in practice*. Aldershot: Gower, 2004.

Project Tongariro. (2011a). *Pocket Ranger: Tongariro Alpine Crossing Smartphone App*. Viewed 16 May 2014 at: www.tongariro.org.nz/pocketranger

Project Tongariro. (2011b). Welcome. Viewed 16 May 2014 at: <http://www.tongariro.org.nz/>

RightCar. (2011). CO₂ Emission Ratings. Viewed 30 May 2014 at: <http://rightcar.govt.nz/co2-ratings.html>

Transparency International Secretariat New Zealand. (2013). New Zealand Tops 2013 Global Anti-Corruptions Perceptions Index. Viewed 23 May 2014 at: <http://www.transparency.org.nz/Corruption-Perceptions-Index>

Tongariro Alpine Crossing. (2011). Tongariro Alpine Crossing, Tongariro National Park, Dual World Heritage Area, New Zealand. Viewed 16 May 2014 at: <http://www.tongarirocrossing.org.nz/>

Webstruxure. (2014a). Better Content, Better Solutions. Viewed 30 May 2014 at: <http://www.webstruxure.co.nz/home.aspx>

Webstruxure. (2014b). Fuelsaver. Viewed 30 May 2014 at: <http://www.webstruxure.co.nz/projects/fuelsaver.aspx>

Wikipedia. (2014). QR code. Viewed 24 May 2014 at: http://en.wikipedia.org/wiki/QR_code

Williamson, M. (2014). Aerial imagery now online for reuse. Press release on 28 April 2014, viewed 25 May 2014 at: <http://www.beehive.govt.nz/release/aerial-imagery-now-online-reuse>

Acknowledgments

The authors wish to acknowledge the Energy Efficiency and Conservation Authority, the School of Information Management at Victoria University of Wellington, and Land Information New Zealand for their support.