

NEW ZEALAND  
DATA FUTURES PARTNERSHIP

# Exploring different approaches to data sharing



## Executive Summary

The Data Futures Partnership's aims are to create the right environment for trusted data use in New Zealand and increase the value being generated by New Zealand's data. One work stream "diagnose and fix" has been established to review the unique barriers to data sharing in New Zealand and what solutions we can draw from to ameliorate those barriers (as distinct from other work to review current activities across New Zealand to address these barriers). This report examines potential solutions from Denmark, Estonia, and Singapore.

New Zealanders have cultural expectations with respect to data sharing. Kiwis expect a fair go, meaning we are suspicious of data sharing or reuse which may disproportionately benefit a few people or if we have little knowledge of how it's being utilised. Maori culture also provides us with the concept of rangatiratanga (self-determination) over our data, meaning that we want to be given an active participation and leadership role in decisions around data sharing and reuse when that data pertains to us.

Against this backdrop of cultural expectations, a number of barriers to data sharing, integration and reuse emerge:

- Funding models that encourage data hoarding
- Each agency creating its own processes for data sharing
- Agencies (and NGOs) fearing that sharing data will expose poor practices
- Managing and developing shared data is a complex task
- Lack of trust in data misuse/abuse
- Lack of communication between organisations
- Concerns around data security, quality and privacy

It's clear that a **national identification system** such as that adopted by Singapore and Estonia may not be acceptable in the New Zealand context. That said, by looking at international examples of data sharing initiatives, we can find solutions that may be adapted to the New Zealand context, encouraging new ways of thinking about data sharing, reuse and integration:

Successful international approaches surveyed in Estonia, Singapore and Denmark have reported a heavy investment in **communicating the benefits** of data sharing to the public as well as participants in the data ecosystem. By sharing benefits and positive stories, we may be able to ameliorate the barriers of trust and privacy concerns.

Perhaps by taking an active role in **deriving value from data** (as the Singaporean government does) the New Zealand government (or a suitable state owned enterprise) may be able to provide better quality data to more interested parties. Perhaps data can be open in that reuse, readability and rights are maximised, while still not necessarily being free of cost?

By increasing overall education in **data literacy** and digital literacy in both schools and in our public organisations, we may be able to reduce privacy, security and data quality concerns.

Through the use of emerging technology such as blockchain, we may be able to produce an **open ledger** which would allow any interested party to verify that data sharing and use can be trusted.

We have developed a theoretical model of solutions to barriers to data sharing in New Zealand which can now be tested either empirically or theoretically to develop the audience of this report's understanding of data sharing in New Zealand.

## Introduction

The purpose of this document is to capture findings from research into approaches for overcoming barriers to data sharing in New Zealand. This research is funded by the Data Futures Partnership as a part of an on-going “diagnose and fix” work stream of inquiry into overcoming the barriers to data sharing [1].

The Data Futures Partnership’s terms of reference are to create the right environment for trusted data use in New Zealand and increase the value being generated by New Zealand's data [2].

Previous research as a part of this “diagnose and fix” stream of inquiry has identified a number of barriers to data sharing. This paper seeks to understand those barriers and assess to what extent several international approaches to data sharing could overcome these barriers. This work is distinct from other work to review current activities across New Zealand to address these barriers.

This research is important because the prosperity and productivity of our country will be governed by our ability to make good quality decisions now and in the future. Good quality decisions require good quality data. Furthermore, there are measurable financial benefits to treating data as a strategic resource. For example, a 2015 study into data sharing in New Zealand estimated that \$2.4 billion of value was produced in 2014 by harnessing data to make smarter decisions and develop new products and services [3].





In performing this research, we have selected three international approaches (Singapore, Estonia and Denmark), because these approaches pose interesting insights into the potential solutions that are available to overcome barriers to data sharing in New Zealand.

## Different Countries, Different Approaches

The following section outlines the three countries which are the scope of this research (Denmark, Estonia and Singapore) and reviews their approaches to data sharing.

### Summary Statistics

The table below presents some relevant summary statistics comparing New Zealand to the three countries of interest.

	<b>New Zealand</b> 	<b>Estonia</b> 	<b>Singapore</b> 	<b>Denmark</b> 
Population (millions) [4]	4.6	1.3	5.6	5.7
GDP (billion USD) [4]	185	23	297	306
Open Data Barometer Rank	7	44	23	13
Human Development Index Rank [5]	13	30	5	5
Confidence in Government	57%	34%	N/A	47%
Democracy Index Rank [6]	4	29	70	5
Human Freedom Index Rank [7]	22	25	77	1
Global Open Data Index [8]	68%	N/A	56%	65%

*Table 1 - Summary statistics of in scope countries*

It is noteworthy that at time of writing, of the four countries, only New Zealand were signatories to the Open Data Charter [9].

Estonia, Singapore and Denmark were identified in the Sapere report [10] as countries which have interesting approaches to data sharing worthy of further investigation. New Zealand is by no means lagging behind the selected countries in terms of data sharing or open data [8]. We have, however, recognised pockets of uniqueness in international approaches which bears further inquiry. Of particular interest is:

- Denmark – for their centralised approach to openly sharing basic land and address data
- Estonia – for their aggressive stance on e-government
- Singapore – for their MyInfo portal for controlling how personal information is shared



## Estonia

Estonia is a high income democratic parliamentary republic with a population of 1.3 million [4], bordering on the Baltic Sea, Latvia and Russia.

After gaining independence from the Soviet Union in 1991, the small Eastern European country struggled to establish its identity and the basis of its economy [11, p. 18]. Since Estonia has limited natural resources, Information Technology (IT) was identified early on as a means to economic prosperity.

Estonia's approach to data sharing started in the early 2000's with the roll-out of an electronic tax filing system in 2000.

Both public and private data sharing initiatives in Estonia connect via a data exchange layer known as "X-Road", developed by Cybernetica and launched in 2001 by the Estonian government to facilitate data sharing.

**Building shared platforms** was part of an intentional strategy by the Estonian government to support data sharing from the "bottom-up" by providing these platforms. By centralising these activities, they were also able to centralise the definition and adoption of common standards and procedures (**top-down governance**) for data interchange.

Also in 2001, Estonia introduced a national digital ID sporting 2048-bit encryption. Multiple sources [12] [11] claim this **national identification system** is the critical component of Estonia's success in e-Government.

In 2005, Estonia was the first country to offer online voting, leveraging the aforementioned digital ID.

In 2008, Estonia adopted **blockchain** to secure its "data supply chain" using technology from a company called GuartTime. Blockchain is a cryptographic technology which provides a distributed ledger of transactions that is independently verifiable.

At the same time, utilising the X-Road platform, Estonia turned every citizen's health records over to the individuals.



Figure 1 - Map of Estonia

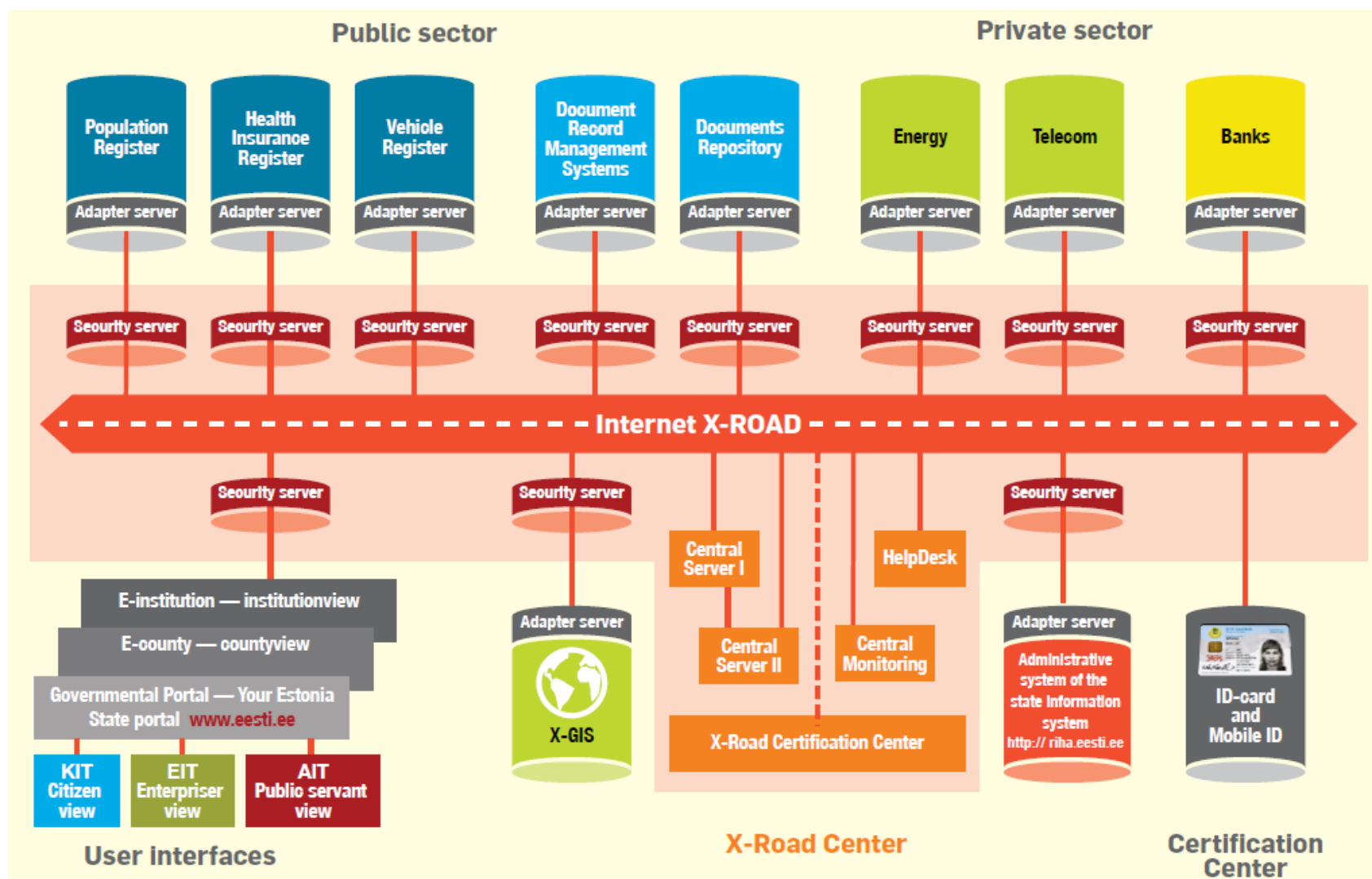
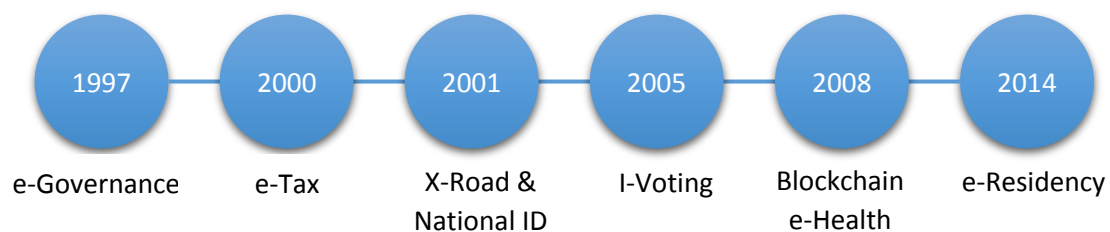


Figure 2 – X-Road, Estonia's data sharing backbone [11]

Because of the cryptographically independently verifiable blockchain, Estonia is able to afford citizens a great deal of control and transparency as to the use of their data through a **consent management** system within X-Road. For example, patients can limit access to electronic medical records to specific named individuals and citizens can see a complete audit history of who has accessed those records [11].

In 2014, Estonia launched e-Residency, allowing those people not physically resident in Estonia to acquire an Estonian ID and full access to Estonia's e-Services.

There is no question that Estonia has had remarkable success in implementing its vision of e-Governance. Estonia's success is in part due to its unique cultural and political context. One commonly reported reason is Estonians have a high level of trust in their government and less in business entities [11] but this is belied by the fact that Australia (for example) has a higher trust in government but has failed to introduce a national ID card [13]. Another explanation is that the degree of "democracy" or degree of involvement citizens have in decision making is what determined the success of centralised systems such as a national ID.



*Figure 3 – Estonia's data sharing timeline*

## Denmark

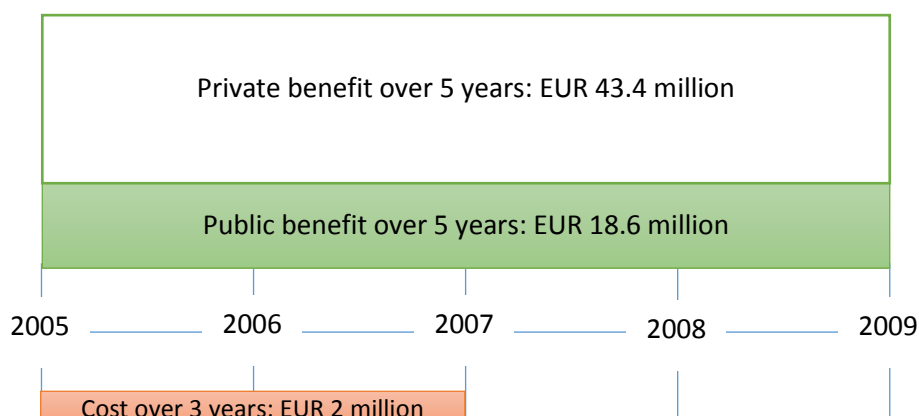
Denmark is a high-income constitutional monarchy in northern Europe with a population of 5.7 million in 2016 [4]. It is ranked 5<sup>th</sup> on the United Nations Human Development Index, compared to New Zealand's 13<sup>th</sup> [5]. The country is divided into five regions, which are further subdivided into 98 municipalities, reduced from 270 in 2007 [14].

Denmark's data sharing journey starts with address data. In 1996, the "Danish National Survey and Cadastre" organisation began a pilot project to collect all address data into one central repository. Prior to this, address information had been captured and managed by each of the 270 municipalities separately. Data submission started out voluntary but some financial support was offered to help with compliance [14].



Figure 4 - Map of Denmark

By 2001, the data was fully centralised with shared ownership by 300 local authorities, each enabled to sell that data for their own purposes and each with their own charging models. In 2005 (delayed by 2 years due to legal reasons<sup>1</sup>) Denmark made this information available publicly, free of charge, thus providing **free open data**. The municipalities were compensated EUR 1.3 million for loss of income from sales of data [14].



The resulting benefit was estimated to be EUR 62 million from 2005 – 2009, through improved efficiency. This compares with the EUR 2 million cost to implement (most of which was the compensation to local municipalities for lost revenue). Approximately 30 percent of the benefit was to the public sector, with the remainder to the private sector – including, notably the nongovernment "Post Danmark", which saw major efficiency increases based on access to the data [14].

Given the documented benefits of opening Danish address data, the Danish e-Government strategy from 2011-2015 expanded the program with Good Basic Data<sup>2</sup> for All, commonly known as the "Danish Basic Data Program" [15].

<sup>1</sup> The law governing the Public Data Server had to be amended to remove legal restrictions on the distribution of address data to third parties, as well as the fee for distribution.

<sup>2</sup> In this context, basic data consists of real estate, people, addresses, companies, climate and geospatial data



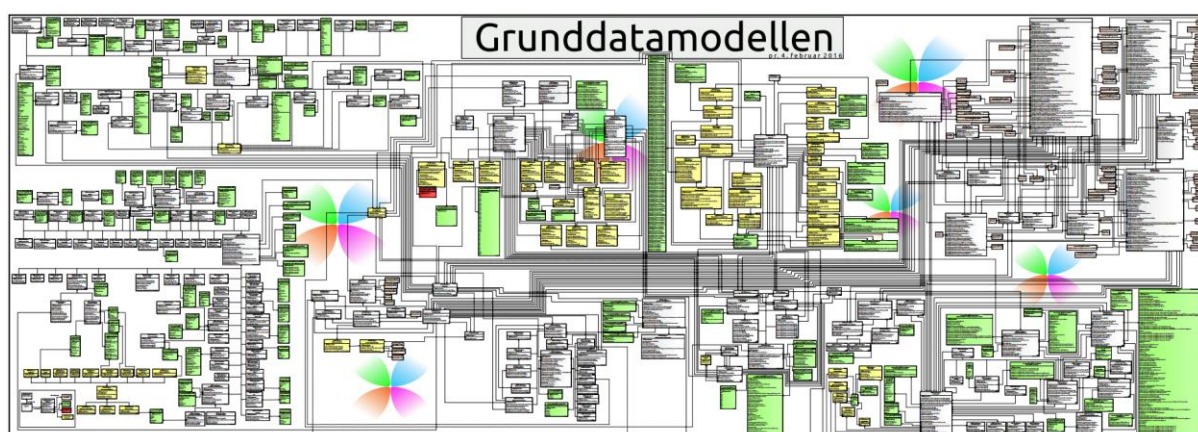


Figure 5 - Denmark's draft Basic Data Model

From January 1, 2013, Denmark gave this basic data away for free to public and private entities. As a part of this effort, Denmark embarked on a process to arrive at a **centralised data model** and to build a **shared platform** for distributing Basic Data. This shared platform would allow for the transfer of basic data to a number of agencies with much the same intent as Estonia's X-road. At the time of writing, work was still underway scheduled to be completed in 2018.

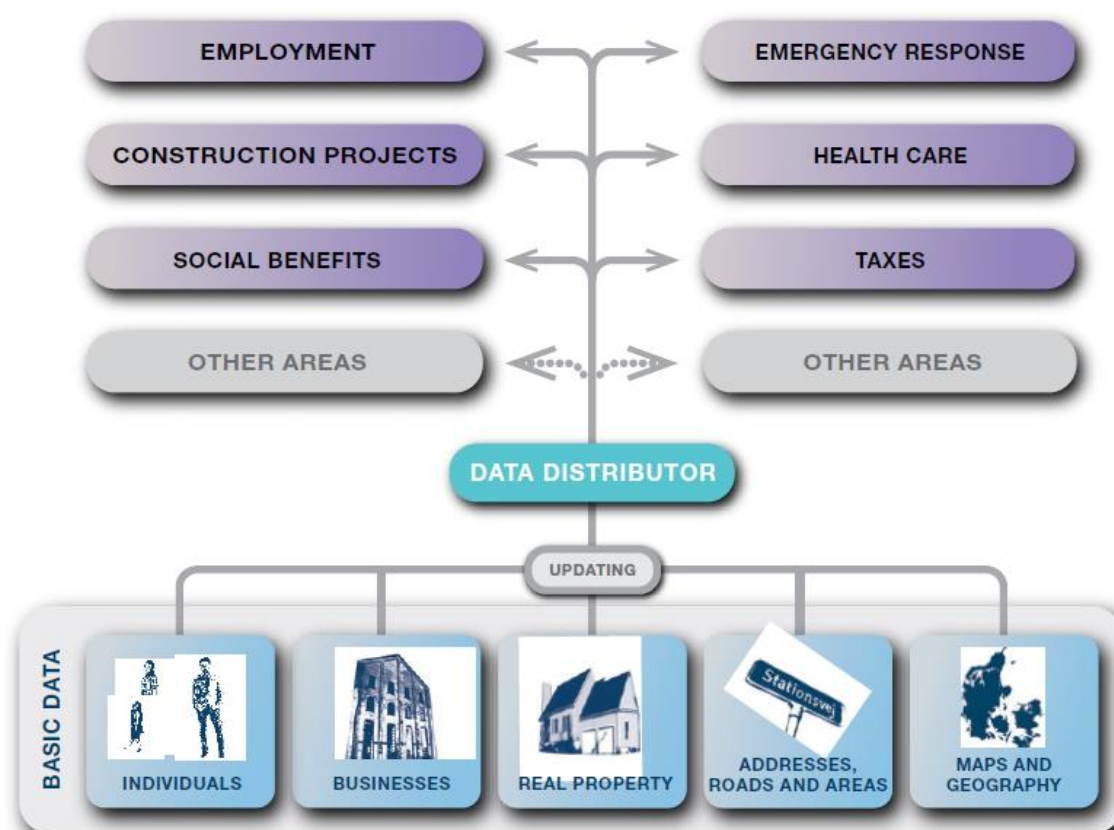
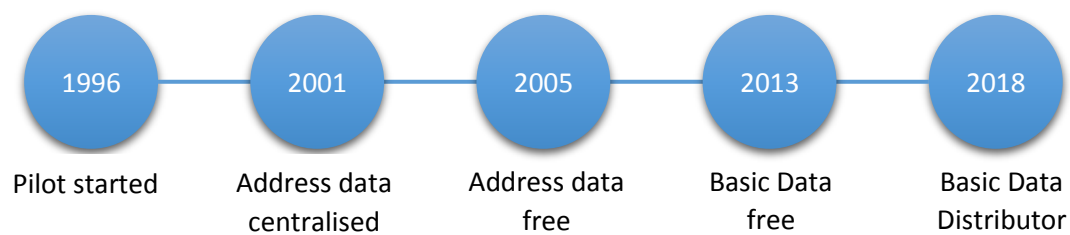


Table 2 - Denmark's Basic Data Distributor Architecture [15]

A number of key learnings are available from Denmark's experience, taken from [14]:

- Data quality is highest when there is a financial incentive for the data to be accurate. For example, data captured for taxation purposes was the most accurate.
- Securing long term funding is challenging but essential for a data sharing project's survival due to potential changes in political will and the long duration of such projects.
- The benefit of sharing data (62 million EUR) far outweighed the cost (2 million EUR), and the majority of that benefit (70%) was realised in the private sector.
- Developing the data collection / **data literacy** skills of public sector workers was identified as a gap to be addressed in future.
- Some **top-down governance** is required and cannot be achieved purely through consensus or communication between parties.



*Figure 6 - Denmark's data sharing timeline*

## Singapore

Singapore is a high-income unitary multiparty parliamentary republic in Southeast Asia with a population of 5.6 million. In 2003, Singapore launched Singapore Personal Access (Singpass), which is a **national identification card** along with a web based authentication mechanism. Singpass incorporates 2-factor authentication for sensitive transactions. In 2007, Singapore Customs launched TradeXchange, which is a government hosted system designed to facilitate the exchange of information between trade and logistics organisations.



Figure 7 - Map of Singapore

In 2011, Singapore released data.gov.sg. This is the **free open data** portal for Singapore, which allows anyone to access statistics available from the government for free. According to [16], the portal is “to serve as a first-stop portal where publicly accessible government data can be found”. For a start, over 5,000 datasets from across 50 government agencies were made available through the portal to be used for research or development of applications.

At the time of releasing the data, the Deputy Prime Minister of Singapore was careful to **communicate the benefits** of the open data initiative “this portal will encourage innovative individuals and businesses to stretch their imagination on how government data can be used together with other private (sector) data to create new services for citizens” [16].

In 2016, Singapore released MyInfo, a web based **consent management** solution, allowing citizens to provide consent to share data at the point of collection by both public and private entities. Users link MyInfo to their Singpass identity to share personal information captured by the government and can also add their own optional information. The consent management solution is billed as a means to save time filling in forms, allowing for better efficiency for the end user. Behind the scenes, the system is a consent management solution which allows the user to select which entity receives which verifiable information about them.

At time of writing, MyInfo supports the sharing of personal (e.g. sex, name, date of birth) contact (e.g. mobile), income (e.g. yearly assessable income), education & employment (e.g. occupation), family (e.g. date of marriage / divorce) and other information (e.g. property ownership) all from verifiable government sources. This information can be used when performing activities such as applying for accommodation, application for a lotteries permit, application for a pet license and application for a savings or current account at a bank [17].

In October 2016, the Singapore government spun off Govtech from a restructure of the Infocomm development authority. Govtech is in part tasked with making money off Singapore’s data by developing government services for local businesses [18]. GovTech is now in charge of Singpass and the MyInfo portal.

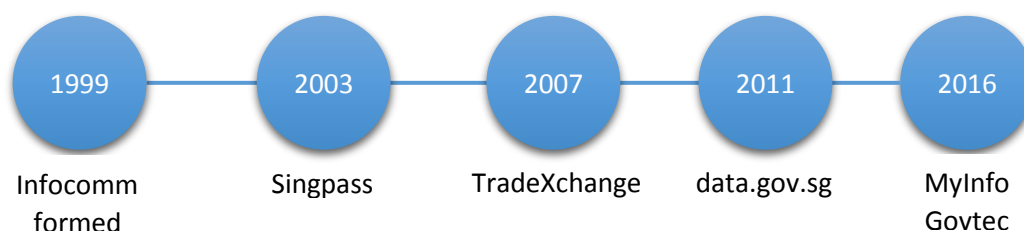


Figure 8 - Singapore's data sharing timeline

## Barriers

The table below details the barriers that have been considered within scope for this research.

Barrier	Abbreviation	Lenses	Sources
Funding models encourage data hoarding	Funding Models	Economical	[10, p. 6]
Each agency must create its own processes for data sharing	Silos	Institutional	[10] & [19]
Agencies fear that sharing data will expose poor practices	Fear	Political	[10, p. 6] & [19]
Managing and developing shared data is very complex	Complexity	Operational	[19]
Lack of trust in data misuse/abuse	Trust	Political Social	[20] & [19]
Privacy law limits data sharing	Privacy	Legal	[20] & [19]
Lack of trust and communication between organisations	Communication	Institutional	[20]
Security Concerns	Security	Technical Political	[20] & [19]
Poor data quality	Quality	Operational	[21, p. 7] (p. 7), [20], [19]

Figure 9 - Barrier Summary

### Funding Models Encourage Data Hoarding

The premise of the Data Futures Partnership itself is that data has inherent value. As such, some organisations have the sale of data as part of their funding model [10]. Given that data sharing can be perceived as open data sharing (which requires the data to be free from cost and royalties), there is at least a perception and likely a reality that data sharing runs counter to individual organisations profiting off data.

An example of this provided in the Sapere report [21] is the sale of property valuations data by the state-owned enterprise Quotable Value Limited (QV) and their commercial partner CoreLogic. Sharing this data for free would either require reimbursing QV and CoreLogic for their data or disrupting business models of these organisations as well as the Territorial Authorities (TAs) that in turn supply them with data. The estimated opportunity cost of this being in the order of \$5.8 million p.a. in lost net profit for QV and \$1.2 million p.a. in lost revenue for TAs. This was the approach taken by Denmark where municipalities were reimbursed for the lost revenue caused by data sharing to a value of 1.3 million EUR over 3 years [14].

We suggest that another perspective on this barrier is that data is actually being shared by QV and CoreLogic, just not for free. Data sharing does not have to be free to provide value and the fact that these organisations make money selling this data implies that this model could be extended further - similarly to the GovTech example in Singapore [18]. Furthermore, data can still adhere to the principles of open standards and open access even if that data attracts a fee.

Possible solutions (discussed further below):




Country	Solution	Page number
	Reimburse organisations for sharing data	25
	Provide Free Open Data	26
	State owned entity charged with deriving value from data	26

Table 3 - Possible solutions to "funding models encourage data hoarding"

### Each agency must create its own process for data sharing

This barrier is not due to a lack of guidance [21, p. 10]. Rather the barrier is caused by an overabundance of compliance requirements for data sharing and a lack of understanding within government agencies and businesses as to what processes are required for responsible data sharing [19]. A workshop [19] further found that the causes of this barrier are:

- Cost (time and money) of compliance, especially since the compliance activity is perceived to have little value after the initial execution since it is often not repeated
- Lack of consistent rules and processes
- Lack of standards and frameworks for data sharing
- Widely differing levels of ICT maturing and practice

There has been some talk of automating compliance [19], thus reducing compliance costs and red tape. Estonia adopted blockchain in 2008 as a means to provide transparency and auditability of the data “supply chain”.

Related solutions (discussed further below):






Country	Solution	Page number
	Improve Data-Literacy	26
	State owned entity charged with deriving value from data	26
	Provide transparent compliance through Blockchain	20
	Build shared platforms	23
	Consent Management	21

Table 4 - possible solutions to “each agency must create its own process for data sharing”

### Agencies fear that sharing data will expose poor practices

Some agencies and non-government organisations fear that release of information may lead to an interpretation of data which may reflect poorly on the agency responsible [10], for example: exposing overfunding or poor practices.

The expectation is that with better guidelines and more positive stories through **communicated benefits**, those fears which are unfounded can be reduced. In cases where the fears are founded (due to poor practices), providing **shared platforms** and **top-down governance** may provide better frameworks for data sharing, reducing the burden on organisations to provide their own practices.

Possible solutions (discussed further below):





Country	Solution	Page number
	Communicate the benefits	18
	Improve Data-Literacy	26
	Build shared platforms	23
	Top-down governance	27



Table 5 – Possible solutions for “agencies fear that sharing data will expose poor practices”

### Privacy concerns complicate data sharing

This barrier does not mean to imply that privacy law itself is a bad thing. Privacy law is essential to providing the public with the confidence that their data can be shared safely [22]. Instead, this barrier recognises that there is generally a lack of understanding as to how the act works – both by members of the public and those charged with abiding by the act [19].

The result of this confusion is that those who feel they are at risk of exposing private information will err on the side of caution and forbid data sharing, resulting in less data sharing.

Negotiations around securing data and an interpretation of the act have broken down with a failure to reach agreement as to interpretation [20].

The cure for lack of understanding would be to improve the general **data literacy** of decision makers as well as the general public. In addition to this, a **top-down governance** approach would provide organisations with a stronger framework for consistently applying privacy law when sharing data.

From a technological perspective, **block-chain** (as used in Estonia) would provide a transparent ledger of data sharing transactions potentially reducing privacy concerns. **Consent management** is another technology (employed in Estonia and Singapore) which could provide citizens with a high degree of control over which data is shared and how.

Possible solutions (discussed further below):






Country	Solution	Page number
	Improve Data-Literacy	26
	Consent Management	21
	Provide transparent compliance through Blockchain	20
	Top-down governance	27
	Communicate the benefits	18

Table 6 - Possible solutions to “privacy laws limit data sharing”

### Managing and developing shared data is very complex

There are a number of complexities inherent in the activity of data sharing [19].






Data is typically used for a different purpose than it was captured for, meaning that it is not necessarily structured in a way that is conducive to data sharing.

There is no one master dataset even within the same organisation and it is not considered to be feasible to produce one cohesive view because data is requested and collated in different ways even within the same organisation. Even private entities such as banks have no consistent view of “the customer” across all business units.

Organisations themselves are diverse with respect to processes and culture, even within a single sector. When we consider that data sharing extends between organisations in multiple sectors, this

complexity is further compounded. These factors all combine to result in a high level of complexity involved in successfully managing and developing shared data between organisations.

Possible solutions (discussed further below):

Country	Solution	Page number
	Improve Data-Literacy	26
	Top-down governance	27
	Build shared platforms	23
	Provide transparent compliance through Blockchain	20
	State owned entity charged with deriving value from data	26

*Table 7 - Possible solutions for "managing and developing shared data is very complex"*

### **Fear and lack of trust in data misuse/abuse**






This complex barrier speaks to the heart of New Zealand culture. This barrier was manifest clearly in recent work by the Data Futures Partnership to do with public trust in data sharing [23].

There appear to be two cultural principles (or kaupapa) at play when it comes to mistrusting organisations in the use of data:

- Rangatiratanga – I want to have self-determination over my data [24]. I want to know how my data is being used and want to be able to debate it openly by actively participating and taking a leadership role [25].
- Fair go – it's unfair for someone else to profit off my data, even if I couldn't do so myself. If someone is profiting, it should be to the benefit of everyone. This cultural principle has a negative corollary in the form of Tall Poppy Syndrome [26].

Kiwis are naturally interested in debating the fairness and rangatiratanga with respect to data sharing and reuse, this manifests itself in some respects as a lack of trust or sometimes fear that their data will be misused. This fear is partially founded on truth since datasets may be integrated to produce new datasets with unintended classification and privacy consequences.

Possible solutions (discussed further below):

Country	Solution	Page number
	Communicate the benefits	18
	Consent Management	21
	Improve Data-Literacy	26
	Provide transparent compliance through Blockchain	20
	Top-down governance	27

*Table 8 – Possible solutions for "agencies fear that sharing data will expose poor practices"*

It is important to note, however, that statistically, New Zealanders are more likely to trust their government than not. A recent report by the OECD found that New Zealanders were more likely to have confidence in their national government than either Denmark, Estonia or Australia [13].








## Security Concerns

It is unfortunate but timely that security concerns about data sharing are current in the New Zealand media. The deputy chief executive of the Ministry of Social Development recently resigned due to concerns over a potential security breach of private data [27]. The breach was found to have been caused by insufficient analysis of security requirements and little attention to the impacts of a privacy breach [28].

According to the open data barometer, restoring citizens' trust is not just about providing citizens with the data they need. It is also about protecting citizens' personal data, and making sure that their data is in safe hands. This means making sure citizens are aware of and consent to the way in which their data is collected, processed, and used by the government [29].

Possible solutions (discussed further below):

Country	Solution	Page number
	Build shared platforms	23
	Improve Data-Literacy	26
	National Identification Card	24
	Provide transparent compliance through Blockchain	20
	Top-down governance	27







*Table 9 – Possible solutions for “security concerns”*

## Poor Data Quality

The Sapere report identified quality as a key barrier to data sharing in New Zealand [10]. Data is coded in different ways when captured, meaning it's difficult to match effectively between systems or organisations. Data systems, formats and definitions are not standard and therefore a great deal of effort is required to combine disparate datasets for analysis.

Denmark found that data quality was much higher in instances where data was captured for the purposes of revenue generation but that in general data quality was poor when revenue generation was not the purpose of data collection [14].

Possible solutions (discussed further below):

Country	Solution	Page number
	Consent Management	21
	Improve Data-Literacy	26
	Build shared platforms	24
	Provide transparent compliance through Blockchain	20
	State owned entity charged with deriving value from data	26
	Top-down governance	27







*Table 10 – Possible solutions for “poor data quality”*

### Lack of trust and communication between organisations

Catalyst projects [20] identified that communication issues exist between government departments, within departments as well as between aligned not-for-profits. “Patch protection” between not-for-profit organisations with respect to data sharing was also an impediment.

Negotiations between parties are resource intensive and require a high level of expertise to conduct.

Possible solutions (discussed further below):

Country	Solution	Page number
	Build shared platforms	23
	Communicate the benefits	18
	Consent Management	21
	Provide free open data	26
	Provide transparent compliance through Blockchain	20
	Top-down governance	27

*Table 11 - Possible solutions for "lack of trust and communication between organisations"*



## Solutions

The table below identifies the research used to determine the solutions to data sharing in the literature surveyed:

The table below details the barriers that have been considered within scope for this research.

Solution	Lens	Sources
Communicate the benefits	Political	[10] [11]
Improve Data-Literacy	Social	[30] [14]
Provide transparent compliance through Blockchain	Social Technical	[11]
Consent Management	Social Technical	[11] [16]
Top-down governance	Political	[11]
Build shared platforms	Technical	[11] [16]
National Identification Card	Political Technical	[11]
Reimburse organisations for sharing data	Economical	[14]
Provide free open data	Economical	[14] [16]
State owned entity charged with deriving value from data	Economical Political	[18]

Figure 10 - Solution Summary

### Communicate the benefits

The Sapere report identified there are few success stories for data sharing in New Zealand and few examples where things went wrong but “everything turned out OK” [10, p. 10]. Expressed as a solution “more positive stories”, this seeks to ameliorate barriers to do with mistrust over data usage and fears that data sharing will expose poor practices.

There are several requirements to effectively communicating the benefits:

- Calculate the benefits – before opening their address data, the Danish government performed up-front analysis to determine the benefit of opening data to the public [11]. These benefits were communicated to stakeholders before the data sharing initiative was started.
- Measure the benefits – during the process, quantifying as accurately as possible the benefits in dollar terms, as well as social well-being, environmental and other benefits.
- Celebrate success – once a data sharing initiative has had some measure of success, share the positive stories both internally and externally.

#### Anticipated impact on barriers:

Barrier	Page Number	Impact
Lack of trust and communication between organisations	17	Medium
Agencies fear that sharing data will expose poor practices	12	High
Fear and lack of trust in data misuse/abuse	14	Medium
Privacy concerns complicate data sharing	13	Medium

Table 12 - Communicate the benefits: anticipated impact on barriers

By measuring and communicating the benefits of data sharing, especially when communicating positive success stories, we expect to have a moderate impact on any barrier that involves fear, mistrust, misunderstanding and concerns around privacy.

### **Improve Data-Literacy**

Denmark, for example, found that open access to data without the skills and understanding to interpret or capture that data accurately is ultimately flawed [14]. Data literacy needs to be tackled at a number of levels in New Zealand:

- In schools, as a part of the digital curriculum
- In the general public
- Within public and private organisations, specifically with decision makers

The Singaporean government has started campaigns to improve Data-Literacy at multiple levels in their country.

At the highest level, Singapore has started a Smart Nation Fellowship Programme, which encourages participation of data scientists from around the world [30]. The Smart Nation Fellowship Programme seeks to develop and apply quantitative tools to visualise and analyse data to enable evidence-based decision making in government. This has the benefit of raising the technical capability of their data scientists whilst also providing government decision makers with better quality data.

There is an opportunity for New Zealand to develop their own professional body of data scientists in line with the approach taken by Singapore. New Zealand has a long successful history of collaborating with Singapore, for example through the Beachheads programme, NZTE has been developing relationships with Singaporean companies and government since 2002 [31]. Beachheads are a network of private sector experts who offer perspective and insights to help NZTE customers shape the direction of their business, the Singapore office has the goal to provide incubators for small to medium sized enterprises establishing themselves in the offshore market.

McMurren et al identified that “developing skills in data collection among public servants” [14, p. 18] as a major challenge in the future and thus the Denmark example offers insights as to how New Zealand might better ameliorate this [32].

The Data Futures Partnership has been developing a set of eight questions to better inform the New Zealand public about what they can expect from organisations seeking to use their data as well as to provide a simple framework for organisations sharing data to determine whether the data use being considered has social acceptance (social licence).

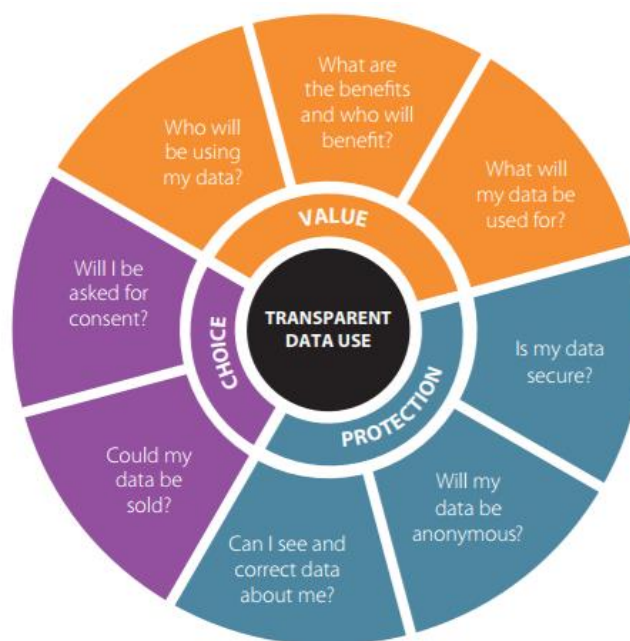


Figure 11 - Data Futures Partnership – Transparent Use Dial [32]

#### Anticipated impact on barriers:

Barrier	Page number	Impact
Managing and developing shared data is very complex	13	Small
Agencies fear that sharing data will expose poor practices	12	Small
Privacy concerns complicate data sharing	13	Small
Poor Data Quality	16	Small
Security Concerns	16	Medium

Table 13 - Improve data literacy: anticipated impact on barriers

By providing data literacy in schools and for the public (especially through the use of the social licence guidelines) we expect that concerns about **security** and **privacy** will be somewhat ameliorated. This is because the principles of data re-use and sharing will be better understood and communicated to the public.

Data **quality** is also modestly improved because those collecting data understand the importance of data quality capture at the source.

Although the **complexity** inherent in data sharing will never go away completely, we expect that better data literacy will provide decision makers and organisations with a common language about data sharing, which will reduce misunderstandings and miscommunication that result in this complexity. We expect this will also reduce **fear** around exposing poor practices partly because practices will be generally improved and there will also be a common framework for discussing data sharing between organisations.

#### Provide transparent compliance through Blockchain

As a part of the workshop on barriers to data sharing [19], it was suggested that an open ledger of successful data transactions “like Trademe” could be used to overcome barriers of mistrust and fear about data sharing and reuse. By publishing an open ledger that anyone could verify, it would go some way towards allowing the New Zealand people some rangatiratanga over their data, as well as providing the transparency to allow for “fairness” in data sharing.

Estonia, for example, have taken the approach with personal data that individuals can access audit information of who is accessing what information [11]. This is by far the most aggressive approach to transparency in data usage reporting and aligns well with New Zealand's principle of rangatiratanga. Estonia uses blockchain to provide a distributed log of data access for auditing purposes. Blockchain is a cryptographic technology which allows for the creation of a shared distributed ledger of information which can be independently verified by any third party who has access to the block chain. Singapore has also embarked on the journey to use blockchain in the form of a digital currency [33].

#### Anticipated impact on barriers:

Barrier	Page number	Impact
Lack of trust and communication between organisations	17	Medium
Managing and developing shared data is very complex	13	Medium
Privacy concerns complicate data sharing	13	Medium
Poor Data Quality	16	Small
Security Concerns	16	High
Each agency must create its own process for data sharing	12	Small
Fear and lack of trust in data misuse/abuse	14	High

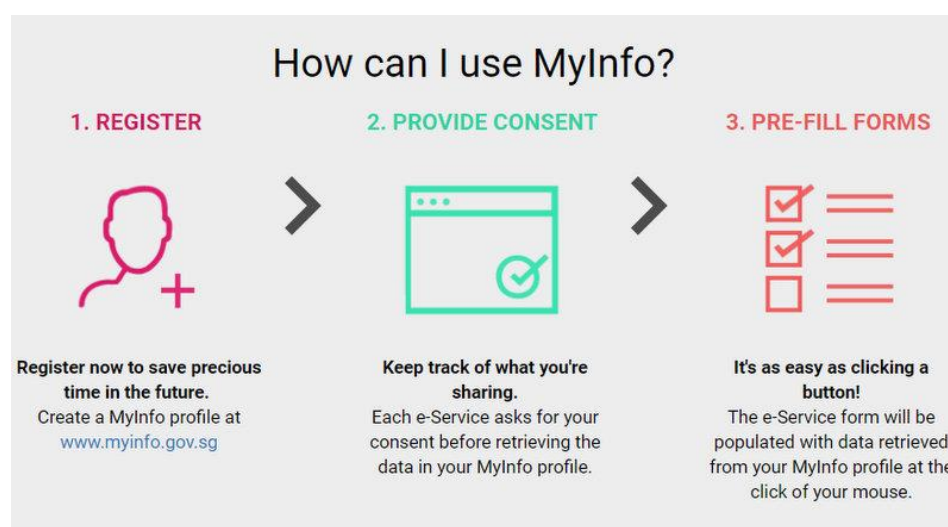
*Table 14 - Transparent compliance through blockchain: anticipated impact on barriers*

## Consent Management

Consent management is a broad and interesting topic deserving of detailed elaboration. Consent management was originally focused on protected health information, allowing individuals to give permission to share their health information.

Singapore's **MyInfo** platform enables individuals to provide consent at the point of transaction. Acting like an automatic form-filler, the system allows users to log on with their national identification number, and then consent to share specific information with an entity requesting that information. It does not appear to offer revocation of consent, however.

Consent revocation is an important part of a consent management solution, allowing users to withdraw data once a transaction is complete or their relationship with the trusted organisation changes.



*Figure 12 - Singapore's MyInfo Platform*

As discussed above, MyInfo supports the sharing of personal and other information (e.g. property ownership) all from verifiable government sources. This information can be used when performing activities such as applying for accommodation a savings or current account at a bank [17].

Finland has taken a similar approach with their “MyData” Platform. Unlike MyInfo, “MyData” supports transitioning between consent management operators, just as they would between banks. This ability to transfer between consent management operators is significant.

These solutions need not be limited to government solutions. Meeco is an example of a technology company seeking to implement consent-based ecosystems with their Personal Data Marketplace Platform.

New Zealand’s Realme® identity solution supports rudimentary consent management:

## Consent

### Protecting your privacy

The RealMe service is all about protecting your privacy and giving you control over your information. We need your consent so we can display your address information each time you access your RealMe account.

[What does this mean?](#) ▾

NO, I DON'T CONSENT

YES, I CONSENT

Figure 13 - Consent management in Realme®

Once again, the mechanism of consent management aligns well with the New Zealand principle of rangatiratanga.

Below is a matrix of functionality comparisons between consent management solutions surveyed.

Functionality	RealMe®	MyInfo (Singapore)	X-Road (Estonia)	Meeco	MyData (Finland)
Allow for voluntary sharing of authoritative data	✓	✓	✓	✓	✓
Allow the user to correct data at any time		✓		✓	✓
Allow for sharing of partial / subsets of data	Address only	✓	✓	✓	✓
Allow for the revocation of consent				✓	✓
Permit anonymous compliance if permissible by law				✓	✓
Support transitioning between operators				✓	✓

Table 15 - Comparison of consent management approaches



#### Anticipated impact on barriers:

Barrier	Page number	Impact
Lack of trust and communication between organisations	17	Medium
Privacy concerns complicate data sharing	13	High
Poor Data Quality	16	Low
Each agency must create its own process for data sharing	12	Low
Fear and lack of trust in data misuse/abuse	14	High

*Table 16 - Consent Management: anticipated impact on barriers*

#### **Build shared platforms**

Estonia, for example, developed a nation-wide data backbone called X-Road [11]. This shared platform provided a data exchange for third parties to share and distribute data. Another shared platform for digital identity was developed and linked to the country-wide cryptographically secure Estonian ID card.

There are a number of initiatives within New Zealand that have already embarked on building shared platforms under the auspices of the Data Futures Partnership catalyst projects [34]:

- 2shakes – automating the management of client authorities
- Cohelix – employee documentation system
- Nexus marketplace – a digital platform for leveraging New Zealand government’s data
- Data commons – a common platform for data sharing in New Zealand

#### Anticipated impact on barriers:

Barrier	Page number	Impact
Lack of trust and communication between organisations	17	Medium
Managing and developing shared data is very complex	13	High
Agencies fear that sharing data will expose poor practices	12	Medium
Poor Data Quality	16	High
Security Concerns	16	Low
Each agency must create its own process for data sharing	12	High

*Table 17 - Build shared systems: anticipated impact on barriers*

Both Estonia and Singapore have a national identity system tied to a physical ID card. Both countries assert that without this one centralised country-wide identification system, the data sharing initiatives would be greatly reduced.



Australia attempted a national identification card in 1985. That attempt failed abjectly and attempts to reinvigorate the conversation have been referred to as “an affront to human dignity” [35]. Unlike Estonia and Singapore, New Zealand and Australian citizens have choice and their choice, thus far, has been to roundly reject attempts to introduce a national card.

RealMe® verified, for example, caters for the purpose of identification without requiring a national identification system, as long as the system remains voluntary, it does not raise the same level of concern as a national ID card might.

If, however, a digital ID is mandatory and centralised, how is it different from a national ID card? To ameliorate concerns, identity providers need instead to be interoperable, allowing individuals to choose the identity provider they prefer, and allowing citizens to share only information about themselves necessary for a transaction to take place [37].

#### Anticipated impact on barriers:

Barrier	Page number	Impact
Privacy concerns complicate data sharing	13	High negative
Security Concerns	16	High
Fear and lack of trust in data misuse/abuse	14	Medium negative

*Table 18 - National Identification card: anticipated impact on barriers*

We anticipate that a national identification system involving a national ID card will improve security concerns due to the ability to a reduction in identity theft, this is certainly the argument made in favour of such a system by Estonia and Singapore. Unfortunately, the expected trade-off of this is a considerable lack of perceived privacy by the general public and lack of trust that data re-use will be fair and equitable. It is possible to uniquely identify an individual without needing a centralised repository or a physical card, and this may achieve the security outcome without the negatives.

#### **Reimburse organisations for sharing data**

In order to reimburse municipalities for providing address data for free that they otherwise would have sold, the Danish government paid EUR 1.3 million in lieu of the expected income from data sales over the next 3 years. At that point, the agreement offered them the opportunity to renegotiate for further compensation, but no further negotiations were sought by the municipalities.

The argument for reimbursing organisations is that it completely mitigates the barrier **Funding Models Encourage Data Hoarding** by removing the opportunity cost. Denmark found that the benefit of this 1.3 million EUR investment was 62 million EUR in productivity, though most of that productivity was attributed to private enterprise.

The disadvantage is that this approach results in shifting a cost to the taxpayer to the benefit of private enterprise, which may not be tenable in the context of New Zealand's "fair go" culture.

#### Anticipated impact on barriers:

Barrier	Page number	Impact
Funding Models Encourage Data Hoarding	11	High

*Table 19 - Reimburse organisations for sharing data: anticipated benefits*

The only barrier this solution is expected to overcome is the barrier of funding models. That said, it is expected to have a significant positive impact on this barrier since it removes the funding model concerns. Although Denmark found that when capturing data that related to revenue, the data quality was high, we do not anticipate paying organisations for sharing data will improve quality since the quality impact is at the point of collection, not sharing.

## Provide free open data

Singapore offers free open data via data.gov.sg, which allows anyone to access statistics available from the government. Denmark offers open data as well for address information and has measured the value of this to be in the order of 62 million EUR from 2005 - 2009. Providing data for free has been linked to a number of tangible and intangible benefits. In particular, providing data for free encourages experimentation which is likely to also foster innovation in the use of data.

### Anticipated impacts on barriers:

Barrier	Page number	Impact
Lack of trust and communication between organisations	17	Low
Funding Models Encourage Data Hoarding	11	High

*Table 20 - provide free open data: anticipated benefits*

Open data policies are already in place in New Zealand. Although this solution interacts with other solutions, we interpret it as mandating that Government and non-profit entities offer open data for free. We anticipate that this mandate has a large positive impact on data hoarding as long as the mandate is clear, we also expect that this improves communication and trust between organisations because they are operating under the same framework. We don't expect this solution to have an impact on other barriers, however.

## State owned entity charged with deriving value from data

As well as offering free open data, Singapore in particular has set up a state-owned enterprise (GovTech) with the express purpose of deriving value from Singapore's data. This is a relatively new enterprise and so there is limited evidence as to its success.

In theory, however, a centralised body which is focused on deriving value from a strategic resource could provide funding for data sharing through the sale of data.

### Anticipated impacts on barriers:

Barrier	Page number	Impact
Managing and developing shared data is very complex	13	Low
Funding Models Encourage Data Hoarding	11	High
Poor Data Quality	16	Low
Each agency must create its own process for data sharing	12	Medium

*Table 21: state owned entity charged with deriving value from data: anticipated impacts on barriers*

In a best case scenario, a centralised organisation focused on deriving value from data could be cost neutral, reinvesting any income resulting from data sharing back into systems and tools to promote the same. Part of this re-investment, we expect, would be offsetting the funding model challenges to do with data hoarding. We expect this will have a small impact on complexity, since although the centralised organisation would be responsible, each party involved in sharing data will still need to conform to requirements for data sharing by the centralised organisation. Data quality may improve somewhat due to centralised practices to do with data sharing but since data quality issues start at the point of capture, we do not expect a significant impact. Finally, a centralised organisation could help ameliorate the need for independent fragmented processes, allowing pooling of capability, resources and systems.

## Top-down governance

Every country studied found that some level of top-down governance was required to achieve their vision of data sharing. Denmark in particular noted that they had to change the governance structure for the basic data program to be “less democratic” [14]. The components of a top-down governance solution would need to include:

- Guidance with respect to complying with the privacy act
- Communication and “road-rules” between organisations
- Common data models
- Processes for handling data capture, aggregation, sharing and reuse
- Expectations around security processes
- Guidance for improving trust in data sharing and reuse [32]

### Anticipated impacts on barriers:

Barrier	Page number	Impact
Lack of trust and communication between organisations	17	Low
Agencies fear that sharing data will expose poor practices	12	Low
Privacy concerns complicate data sharing	13	Low
Poor Data Quality	16	Low
Security Concerns	16	Low
Each agency must create its own process for data sharing	12	Low
Fear and lack of trust in data misuse/abuse	14	Low

*Table 22 - Top-down governance: anticipated impacts on barriers*

Top-down governance has one of the broadest impacts across the most diverse sets of barriers. Although the impact on each barrier is relatively low, we believe that top-down governance is an essential component to the success of data sharing and without it, many of the other solutions (such as shared systems, consent management or data literacy) would not be as effective. This has been borne out by the experience in all three of the countries surveyed.

Top-down governance helps improve communication between organisations by setting clear approaches and expectations. It helps by defining common processes for ameliorates fear of exposing poor practices because the rules of engagement are clear. It reduces internal complexity of data sharing by offering common data models and processes.

Top-down governance also assists with public perceptions of privacy, security and trust by offering guidelines for the trusted sharing and reuse of data.



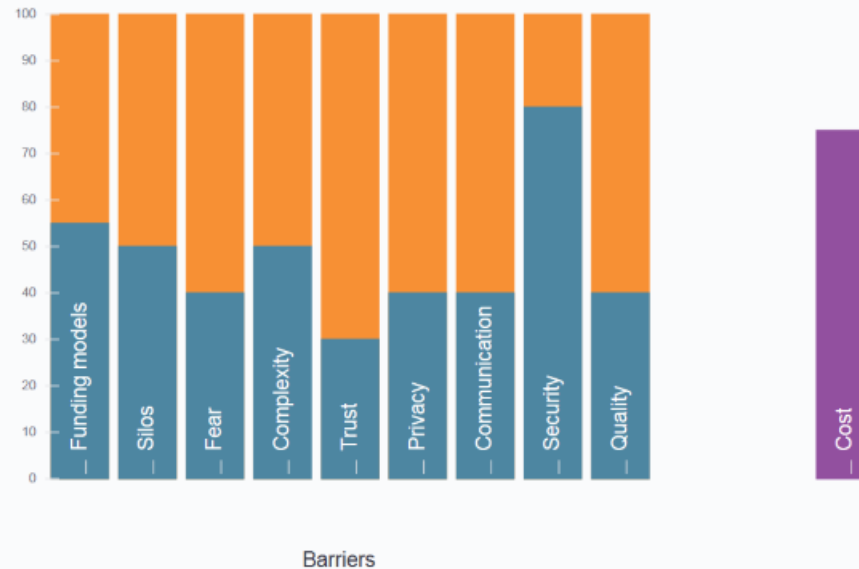
## Model

The image overleaf depicts the software model developed to illustrate the interrelatedness between the solutions employed by the countries in the scope of this study and the barriers to data sharing identified, this model is interactive and available for use on the data futures website. The model is driven by weightings derived from the impact assessment of the solutions to the barriers above.

Please note that this is a theoretical model, and not based on statistical analysis. The model is intended to be validated against the outcomes of solutions when those are attempted in the real-world. The model is a starting point for a more structured discussion of the solutions available and their expected impact on the barriers identified.

## Solutions

- Consent Management
- Improve Data-Literacy
- Provide transparent compliance through Blockchain
- Build shared platforms
- Reimburse organisations for sharing data
- Provide free open data
- State owned entity charged with deriving value from data
- Communicate better
- National Identification Card
- Top down governance



Added Value

## Instructions

Barriers to data sharing are shown in the center. Hover over a barrier to view more information. Click on a solution on the left to test out the solution's theoretical effect on the barriers.

Please note that this is a theoretical model of how solutions are anticipated to impact on barriers.

## About: Exploring Different Approaches

The Data Futures Partnership's aims are to create the right environment for trusted data use in New Zealand and increase the value being generated by New Zealand's data. One work stream "diagnose and fix" has been established to review the unique barriers to data sharing in New Zealand and what solutions we can draw from to ameliorate those barriers. Click on a solution on the left to test out the solutions' effect on the barriers!

Figure 16 - The above image depicts the tool developed to explore the relationship between the various barriers and solutions identified in this paper.

## **Conclusion**

Based on the results of this narrowly-focused review of international approaches to data sharing, themes emerge which allow us to address the barriers to data sharing identified in New Zealand.

There are two streams which can be started in parallel to address the barriers of data sharing within New Zealand.

### **Communications Stream**

Improving data literacy has the broadest applicability of any of the solutions. If New Zealand is to be able to treat data like a strategic resource, then all citizens, from children in schools, to seasoned decision makers in government, need to have a shared basic understanding of data, its value, and the constraints around its use.

Another broadly applicable communications solution is to communicate the benefits. This involves calculating expected benefits, measuring actual benefits and then communicating those benefits to all stakeholders.

### **Technical Stream**

Of all the technical solutions identified in the international approaches, consent management is by far the most interesting and complex. Consent management could simultaneously address concerns around privacy and trust by giving control to individuals, which aligns well with New Zealand's culture of choice and autonomy in decision making.

Securing this consent management solution is going to be essential. Due to New Zealand's unique cultural and political context, a national identification system is unlikely to be acceptable and one could argue that the security benefits that such a system would provide could be provided through careful application of an anonymous, decentralised, cryptographically secure system such as Blockchain.

## Annex 1: Methodology

The problem of data sharing in New Zealand is an information systems research problem, as such, it benefits from a research methodology designed for the purposes of Information Systems Research. We chose a multi-methodological approach to research, based on the work by Nunamaker *et al* [38]. We have chosen Observation, Theory Building and Experimentation as the three elements of our research methodology. Observation is used to develop the theoretical model of how data sharing barriers can be overcome in New Zealand, this model can then be validated through the use of experiments to understand the accuracy of the model.

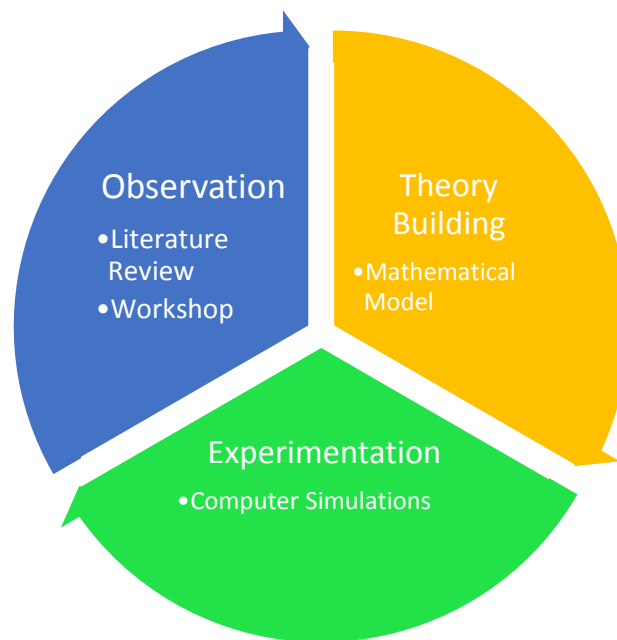


Figure 17 - Methodological Framework adapted from Nunamaker *et al* [38]

To this end, we have undertaken the following as a part of this research:

- Literature review of barriers to data sharing in New Zealand.
- Literature review of international approaches to data sharing in Singapore, Estonia and Denmark (with an accepted limitation in focus due to a limitation of time).
- Workshop with public and private sector representatives to capture a clear understanding of both the barriers and initial thinking around proposed solutions to those barriers in New Zealand.
- Developed a quantitative mathematical model of barriers, solutions and elements of those solutions.
- Built a software simulation allowing those reading this report to explore the various approaches to overcoming barriers.

The literature review comprises the bulk of this research paper. The workshop was undertaken using an approach known as Dialogue Mapping [39]. Dialogue Mapping was chosen recognising that some problems to do with data sharing in New Zealand are “wicked problems” as identified in the Data Futures charter [2, p. 10]. A selected maps from the dialogue mapping exercise is reproduced in Appendix 2.

The mathematical model will be manifest as a web-based visualisation. The intent is that this model can then be used to empirically test the assumptions made in this research as well as to help inform readers of this research as to the trade-offs.

## Defining the problem

Before we can attempt to understand the problem of data sharing in New Zealand, we must first understand what we mean when we say “data” and “sharing”.

### Data, a semantic discussion

The semantic meaning of Data was discussed at length during the industry workshop [19]. Ackoff [40] distinguishes between Data, Information, Knowledge and Wisdom in his seminal paper on this hierarchy. In his work, Data is defined as symbols that represent the properties of objects, events and their environment. Data is not considered useful in Ackoff’s model. Information, by contrast, is useful because it is contextualised and answers questions such as “how”, “what” “when” or “how many”.

Ackoff’s concept of Knowledge is usually excluded from research into data sharing since Knowledge is considered actionable [41] and usually information systems are not able to take action.

With the advent of artificial intelligence, however, some computer systems could take action on someone’s behalf and provide actionable knowledge. For this reason, we include those elements of “knowledge” which could reasonably be captured by an information system with the technology we have today, such as “you should take an umbrella to work today”.

Therefore, for our purposes, (as decided in the industry workshop), we include Ackoff’s “Information” and “Data” in our definition of data, as well as that “Knowledge” which could be captured by software systems today.

### Data, a domain discussion

There are many different types of data which could be included within the scope of this research. For our purposes, we define data in line with a report into Data Driven Innovation in Australia [42]:

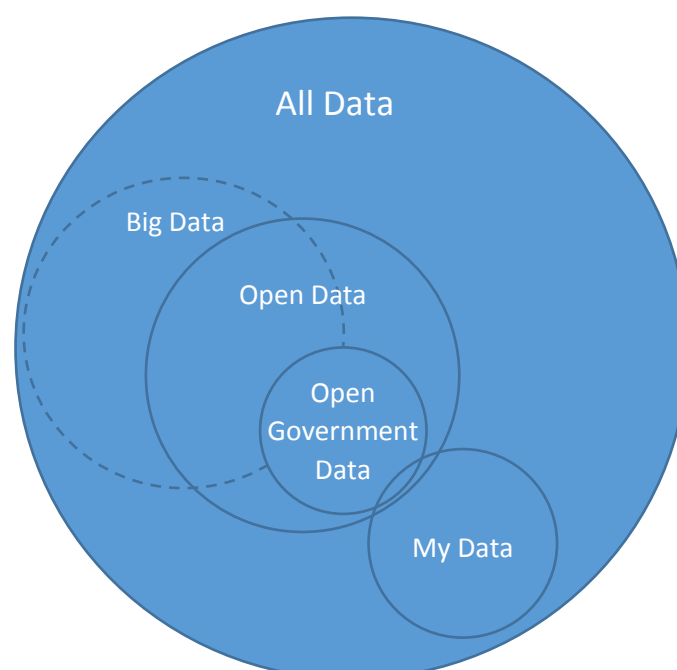


Figure 18 - Data domains, taken from McKinsey Report on Open Data [43, p. 4]

The domain of data within scope is:

- Open Data – data which is free to access, use, modify, and share for any purpose [44]
- Open Government Data – open data supplied by government
- My Data – information about an individual
- Big Data – data which is such a high volume, variety or velocity as to require different approaches to data processing

We note that we are explicitly including “all” data in the above model, including data which is not open.

### Sharing, a semantic discussion

For our purposes, we expand the scope of “Data Sharing” to include the following broad activities:

- Sharing – Sharing dataset between entities so another entity can use that data
- Reuse – using a dataset for a different purpose for which it was collected
- Integration – combining a dataset with another dataset to produce a new integrated dataset

Expanding this definition is essential since sharing data without reusing it does not achieve the benefits (realising value) for New Zealanders.

During the course of this paper, we refer explicitly to either data sharing, reuse or integration so as to avoid any ambiguity.

### Sharing, an entity discussion

When discussing sharing, it is useful to make a distinction between which entities are performing that sharing. Logically, data sharing could take place:

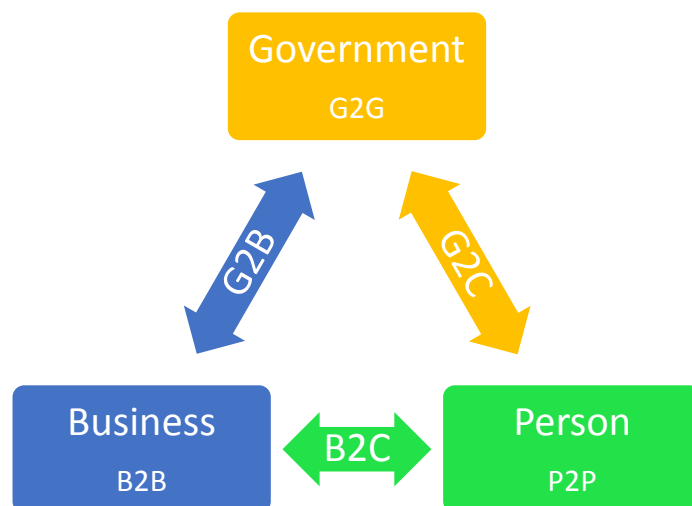


Figure 19 - Sharing between entities

We embrace all forms of sharing in this paper, with a bias towards those forms of sharing where government can have an influence.

Government is motivated to share data to:

- Cut the cost of government bureaucracy
- Provide services to the public, either more efficiently or as new services
- Encourage greater transparency of government or facilitating civil involvement

- Measure outcomes/results of public service delivery

Businesses are motivated to share data to:

- Drive innovation e.g. developing new services for commercial use, reaching new markets
- Improve decision making with data-based insights
- Improve efficiency of current processes
- Derive additional benefits for shareholders (e.g. profit)

Zuiderwijk et al [45] opine that data sharing, and open data sharing in particular creates opportunities for innovation in both public and private organisations.

### **Lenses for analysis**

To understand the barriers to data sharing in New Zealand, we needed to first understand them through a number of unique perspectives or lenses. Zuiderwijk et al [45] identified the following perspectives on the barriers to open data in their research:

- Political
- Social
- Economical
- Institutional
- Operational
- Technical
- Legal

We borrow from these seven perspectives for our research. We propose an additional eighth perspective: Governance, which cuts across all seven other lenses. We will be using these lenses to categorise both the barriers to data sharing as well as the various solutions employed by other countries within the scope of this research.



## Appendix 2: High level Dialogue Map

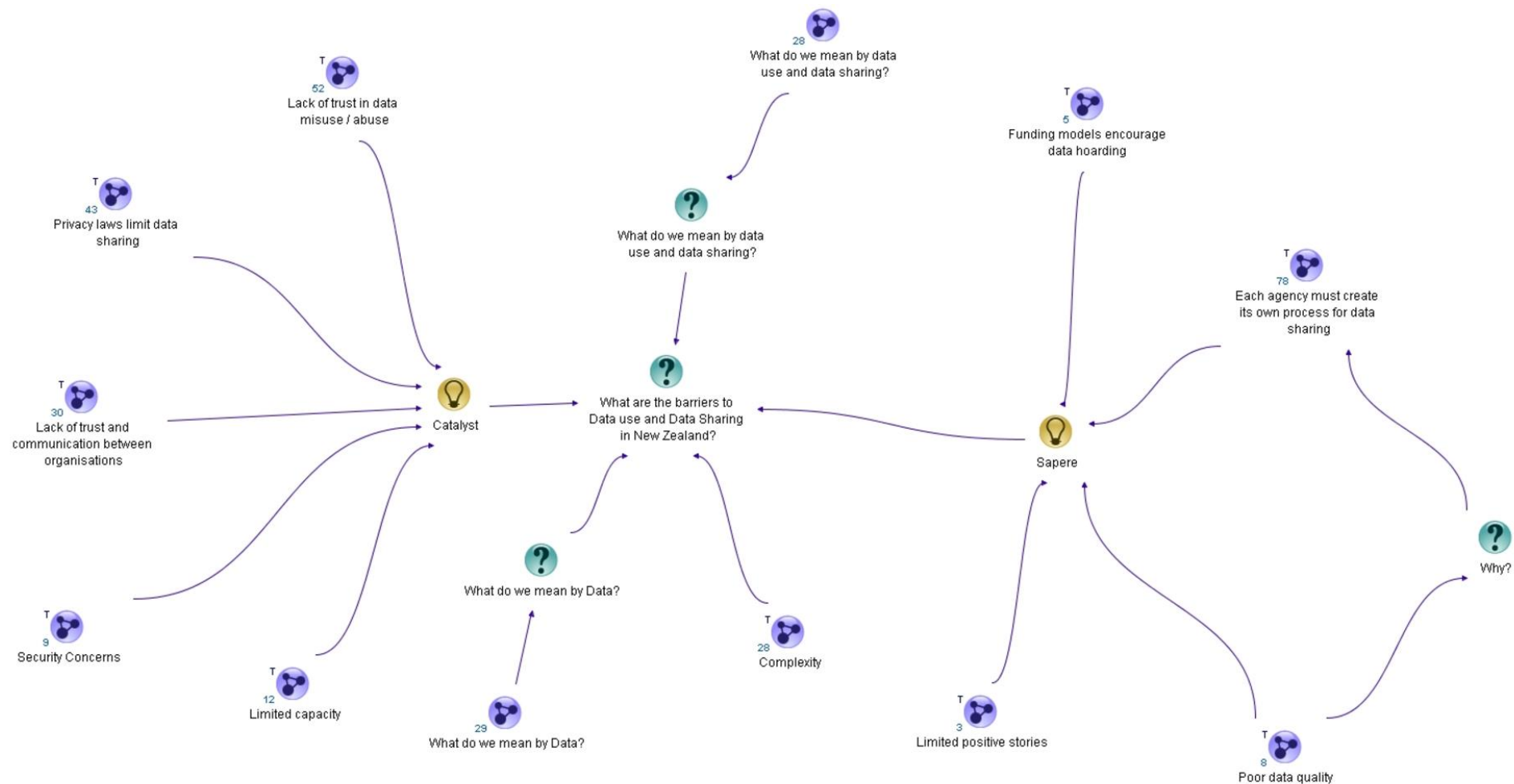


Table 23 - Dialogue map<sup>3</sup>: What are the barriers to data use and data sharing in New Zealand?

<sup>3</sup> This dialogue map was created during the data sharing workshop [19] using the software package "compendium". Dialogue mapping is a facilitation process for "wicked" problems, which creates a map of participants' comments as the conversation unfolds. It is non-linear and allows participants to jump from the problem to solution space dynamically without getting side tracked [39].

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