DIRDC FREIGHT DATA REQUIREMENTS STUDY INSTITUTIONAL ARRANGEMENTS

A research Report for the Department of Infrastructure, Regional Development and Cities

Dr Charles Karl, Joe Branigan

FINAL REPORT
28 February 2019

Contents

Figures

Tables

Abbreviations

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
AGIMO	Australian Government Information Management Office
AGLDWG	Australian Government Linked Data Working Group
AIBE	Australian Institute for Business and Economics (UQ)
ALC	Australian Logistics Council
ANAO	Australian National Audit Office
ANDS	Australian National Data Service
API	Application Programming Interface
APP	Australian Privacy Principle
ARC	Australian Research Council
ARRB	Australian Road Research Board
ASAC	Australian Statistics Advisory Council
ATDAN	Australian Transport Data Action Network
AURIN	Australian Urban Research Infrastructure Network
BITRE	Bureau of Infrastructure, Transport and Regional Economics
CAV	Connected and Automated Vehicles
CBA	Cost Benefit Analysis
CITS	Co-operative ITS
COAG	Council of Australian Governments
CRC	Cooperative Research Centre
CSCL	Centre for Supply Chain and Logistics
CSIRO	Commonwealth Scientific and Industrial Research Organisation

DIRDC	Department of Infrastructure, Regional Development and Cities
DFAT	Department of Foreign Affairs and Trade
DPMC	Department of Prime Minister and Cabinet
DTA	Digital Transformation Agency
DTO	Digital Transformation Office
FMS	Freight Movements Survey
FOI	Freedom of Information
GIF	Graphics Interchange Format
GIS	Geographic Information System
G-NAF	Geocoded National Address File
GPS	Global Positioning System
GVA	Gross value added
HILDA	Household, Income and Labour Dynamics Australia
IAP	Intelligent Access Program
ICT	Information and Communications Technology
IDI	Integrated Data Infrastructure
iMOVE	iMOVE Australia (incorporating the iMOVE Co-operative Research Centre)
LBE	Large business enterprise
IoT	Internet of Things
IP	Internet Protocol
IPA	Infrastructure Partnerships Australia
IT	Information Technology
ITS	Intelligent Transportation Systems
JSON	JavaScript Object Notation
MaaS	Mobility as a Service

MADIP	Multi-Agency Data Integration Project
MBE	Medium business enterprises
MOG	Machinery of Government
MOU	Memorandum of Understanding
NCRIS	National Collaborative Research Infrastructure Strategy
NDC	National Data Custodian
NFSC	National Freight and Supply Chain (Strategy)
NID	National Interest Dataset
NHVR	National Heavy Vehicle Regulator
NSS	National Statistical Service
NTC	National Transport Commission
NSW DAC	New South Wales Data Analytics Centre
OAIC	Office of the Australian Information Commissioner
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
rCITI	Research Centre for Integrated Transport Innovation (UNSW)
SBE	Small business enterprises (LBEs)
SMART	SMART Infrastructure Facility, University of Wollongong
SMVU	Survey of Motor Vehicle Use
TCA	Transport Certification Australia
TIC	Transport and Infrastructure Council
TfNSW	Transport for New South Wales
TMR	Department of Transport and Main Roads Queensland

1 Introduction

1.1 Background

The purpose of this report is to consider how datasets and information related to Australia's freight supply-chain industry could be collected, hosted and disseminated and under what governance arrangements.

The purpose of the overall FDRS project is to conduct an in-depth study into the data requirements of the Australian freight industry and the freight data challenges identified by the recent Inquiry into National Freight and Supply Chain Priorities (NFSC 2018a). As outlined in the project request from DIRDC, the study is to:

- Identify what freight data is required (for governments and across industry) to improve freight related planning, operations and investment decision-making;
- Identify what part of those requirements can be satisfied from existing data collection processes, and what additional data would be required;
- Explore how needed data might be obtained; and
- Explore how freight data should be stored, analysed and disseminated.

On 13 November 2018, DIRDC briefed the iMOVE study team that the emphasis should be on the supply-chain perspective and approached from the strategic framework of the NFSC strategy. While the timeframe of the strategy is 20 years, pragmatic and practical actions and implementation options are required that will form part of the National Action Plan (which will be reviewed in five-year cycles).

DIRDC requested that the study team work closely with industry and other government bodies and build upon the evidence, reports and submissions of the NFSC inquiry. DIRDC also noted that in its stakeholder engagements, over 95% of stakeholders declared data is an important consideration.

1.2 Institutional approaches to dissemination, hosting and governance

The purpose of this report is to consider how data and information could be collected, hosted and disseminated and under what governance arrangements. The activities involve identifying and reviewing the current governance arrangements for data dissemination, assessing the effectiveness of these current arrangements, consideration of future dissemination options and governance implications, and the development of recommendations for incorporation into the NFSC Strategy.

This Institutional Approaches report involved: (i) reviewing previous report findings and recommendations on freight data and the performance of data hosting and dissemination activity, and (ii) engagement with key stakeholders.

1.3 How this report is set out

This Report is set out in 7 sections, as follows:

- Section 1 – Introduction;
- Section 2 – Policy considerations;
- Section 3 – The uniqueness of data;
- Section 4 – Review findings;
- Section 5 – Review of priority projects;
- Section 6 – Data evaluation framework; and
- Section 7 – Taking action.

2 Data

This section sets out the unique characteristics of data, how those characteristics could be leveraged to improve freight supply chain efficiency and how it potentially impacts on the design of data governance arrangements.

2.1 The uniqueness of data

Data (or bits of information) are a unique commodity, especially in our modern world. Unlike a piece of coal, a piece of information – like the GDP figure published quarterly by the ABS in the National Accounts – can be used by an infinite number of people. For example, the Australian Treasury and the Reserve Bank as well as countless financial services firms and the media can simultaneously analyse the National Accounts data without impacting on each other's use.

Data also becomes more valuable when aggregated and connected to other pieces of data. This trait is similar to infrastructure networks, like the telecommunications network. And the value of data continues to increase when it is analysed and disseminated – an analysis of Chinese demand for steel reveals declining demand which in turn causes a reduction in Australian mining investment.

Further, original (or 'raw') data is valuable because there are so many potential uses so long as that data is freely available and standardised in some way (to aid comparison, transfer and analysis). The data revolution of the past two decades is proof of the value-added inherent in data.

The Productivity Commission (2017) in its inquiry report *Data Availability and its Use*, noted these unique characteristics as follows:

- one person's use of data does not detract capacity of others to also use it;
- data does not wear out; its value may increase or decrease over time;
- digital data is costless to reproduce; and
- data is non-fungible (inter-changeable), it cannot be perfectly substituted for other data.

In recent years, governments in Australia and internationally have become interested in the potential of data from an economic management viewpoint. While the modern concept of the National Accounts is around 90 years old and industry data collections have been around for centuries, the data possibilities today are almost infinite.[1] For instance, it is now possible to track in real-time the trains, trucks and ships that traverse our supply-chain networks, which allows us to better understand impediments to efficiency and act on those impediments. New agencies, such as Infrastructure Australia, can now analyse detailed data about freight supply-chain use in order to prioritise public infrastructure projects.

[1] The earliest form of recognisable National Accounts was developed in the 1930s by the British-Australian economist Colin Clark, whose grandson Colin Clark is an economist working in the Federal public service in Canberra.

2.2 Data regulation

Australia is undoubtedly a leading country in terms of the availability of publicly funded and produced data. For instance, the ABS is regarded as one of the world's leading statistical collection agencies and almost all of its products are provided free of charge and there is no restriction on access. And many other agencies augment the work of the ABS, both at a Commonwealth, state and even local government level. Some industry bodies and research institutions produce regular, occasional or *ad hoc* freight related datasets for public consumption and private firms naturally invest heavily in data collection and analytics to foster logistical efficiency.

In terms of the scope for increased government involvement, it has long been accepted in Australia that there is a role for all levels of government to collect, analyse and disseminate data. For one thing, governments play an indispensable role in national economic management and could not effectively do this without data. State Governments need to plan new suburbs, roads and highways to keep pace with population growth. Agencies such as the Australian Bureau of Statistics (ABS), the Australian Bureau of Agricultural and Resource Economics (ABARES), the Bureau of Infrastructure, Transport and Regional Economics (BITRE), federal and state departments, CSIRO and many other government agencies collect and collate data on behalf of the taxpayer.

Compared to some overseas jurisdictions (notably in the European Union), there is currently little regulation or coordination of commercial data in Australia.[2] There are potential costs and benefits to this lack of coordination. On the one hand, regulation often involves costs for businesses to meet regulatory requirements and the benefits may seem insignificant from the firm's perspective. On the other hand, regulation can potentially create value by coordinating and harmonising data collection standards or engendering trust among industry participants.

Relative to some leading countries overseas, Australia appears to be trying to rapidly 'catch-up' with open data policies, better coordination of commercial data, encryption policies and new standards to meet new data-related challenges. The Commonwealth Government in particular has recognised the potential of some government involvement that could foster significant increases in the number and value of freight related datasets.

2.3 Hierarchies of data

Data may come in very small or very large packages, and everything in between. The Productivity Commission (2016) has usefully defined data as follows:

- **Data** refers to representations of facts that are stored or transmitted as qualified or quantified symbols.
- A **dataset** is a collection of related data points or records with a common context (such as the 30 second GPS data of a heavy vehicle as it travels) that can be manipulated as a unit.

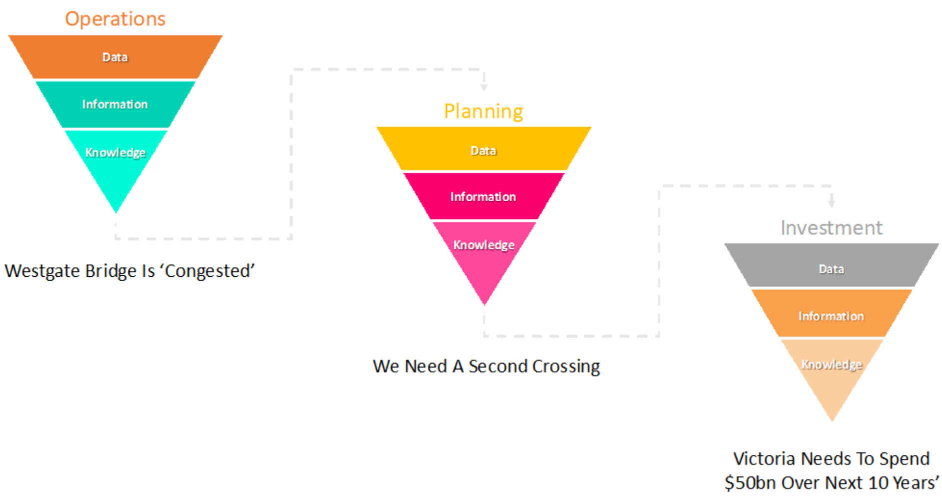
[2] Personal data (like medical records) is regulated under the Privacy Act (1988) and the related 13 Australian Privacy Principles (APP) and well as various state legislation.

- **Information** is the meaning resulting from the interpretation of facts conveyed through data (and other sources). Information can be derived from a set of data after it has been presented in context and interpreted and finally, knowledge is considered to be the information and experience that has been internalised or assimilated through learning (PC2016).

By way of example, in Figure 2-1 below, the information that the Westgate Bridge in Melbourne is congested and not operating at maximum efficiency is utilised to conclude that a second crossing over the Yarra River is required, which in turn informs an overall infrastructure budget required for the State of Victoria over the next 10 years.

This is an example of how data is transformed into information then knowledge in operations, planning and investment. And what is considered knowledge in one area becomes a data point in another area. The critical point here is that data can be aggregated without losing the raw information (that another party might use for another purpose) and, as it is aggregated and analysed, value is created.

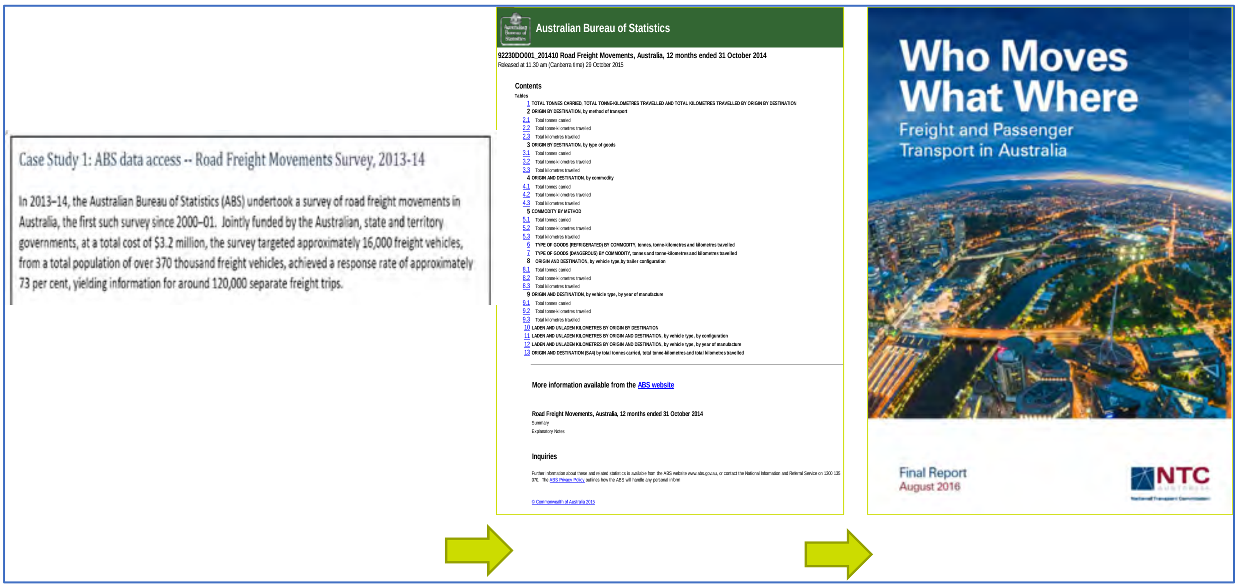
Figure 2-1: Data to information to knowledge



Source: ARRB analysis, 2018.

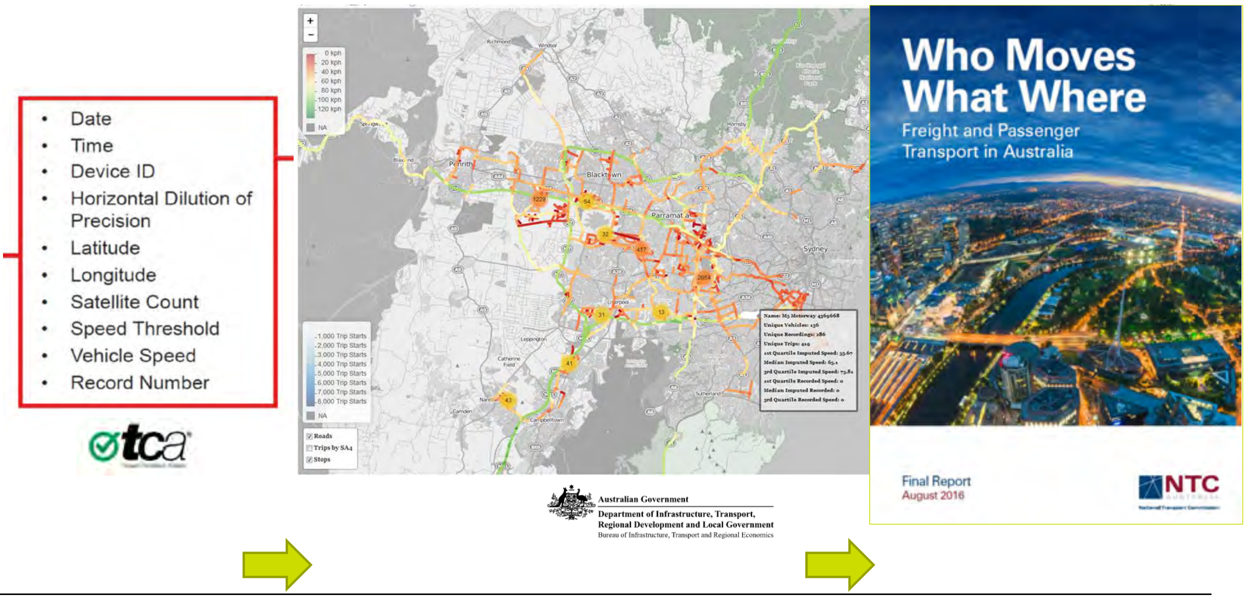
Two further illustrations, in Figure 2-2 and Figure 2-3 are shown regarding the use of how: (i) survey data on freight movements (ABS 2015), and (ii) heavy vehicle telematics data (BITRE confidential) enabled the NTC to produce a widely-read report on *Who Moves What Where* (NTC 2016). This report considered over 150 different datasets in its preparation.

Figure 2-2: ABS data informing NTC report



Source: National Transport Commission, 2016.

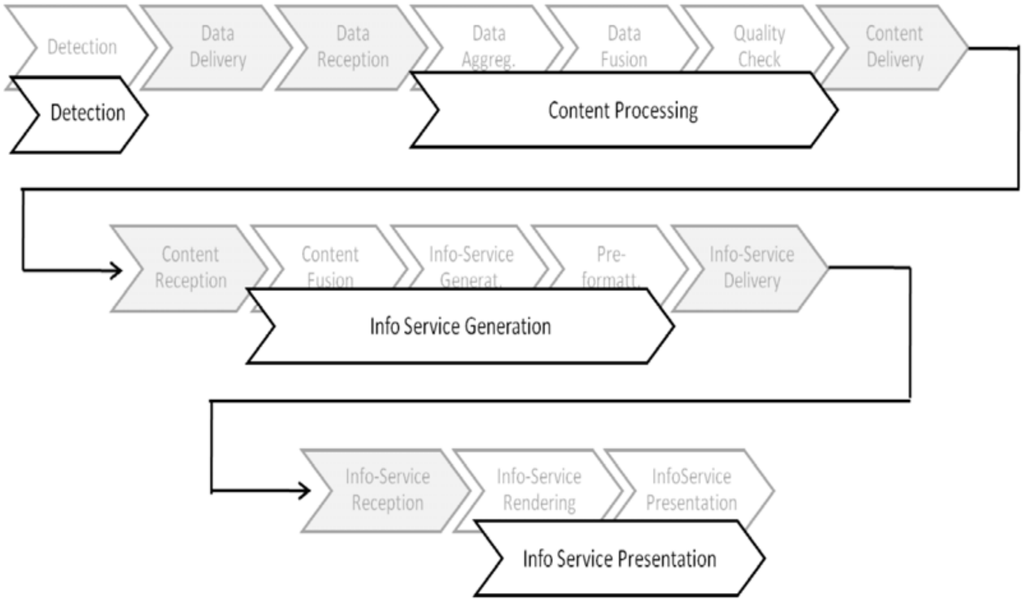
Figure 2-3: BITRE initiative informing NTC report



Source: National Transport Commission, 2016.

The ISO TS 17427 Roles and Responsibilities standard in C-ITS (ISO 2013, p.23) in Figure 2-4 presents the typical lifecycle process of information and helpfully unpacks the three steps from data to presentation of information. The process starts at detection leading to content processing, leading to the generation of the information and finally ending with the presentation or dissemination of the information.

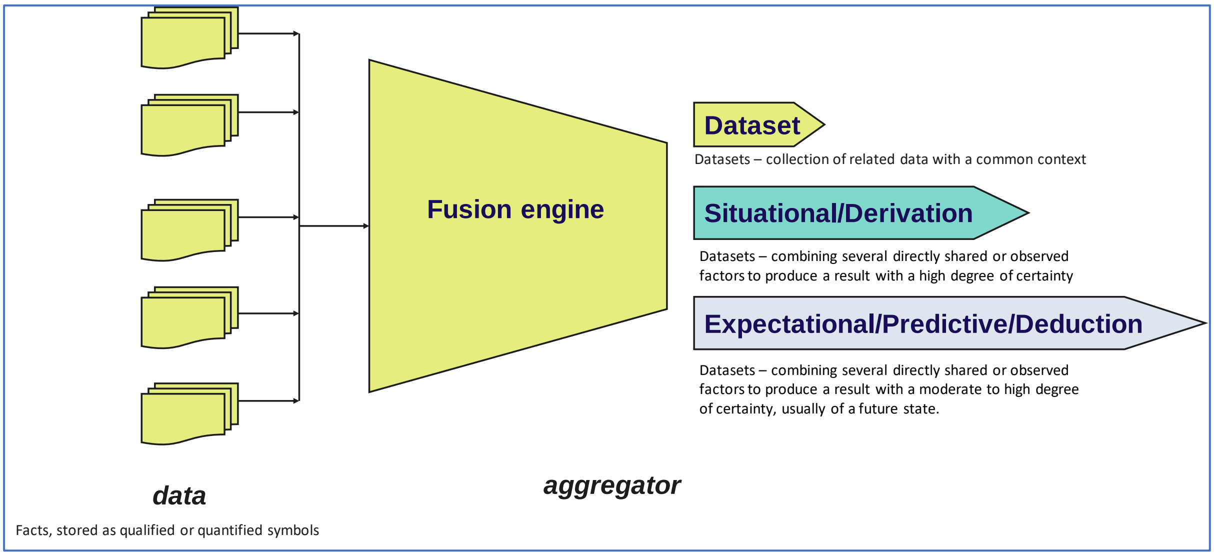
Figure 2-4: Data lifecycle process



Source: ISO 17427:2013

Content processing can be further unpacked into different types of data, from the raw sensor data to the addition of human knowledge and other sources of data to produce further data/information, as shown in Figure 2-5.

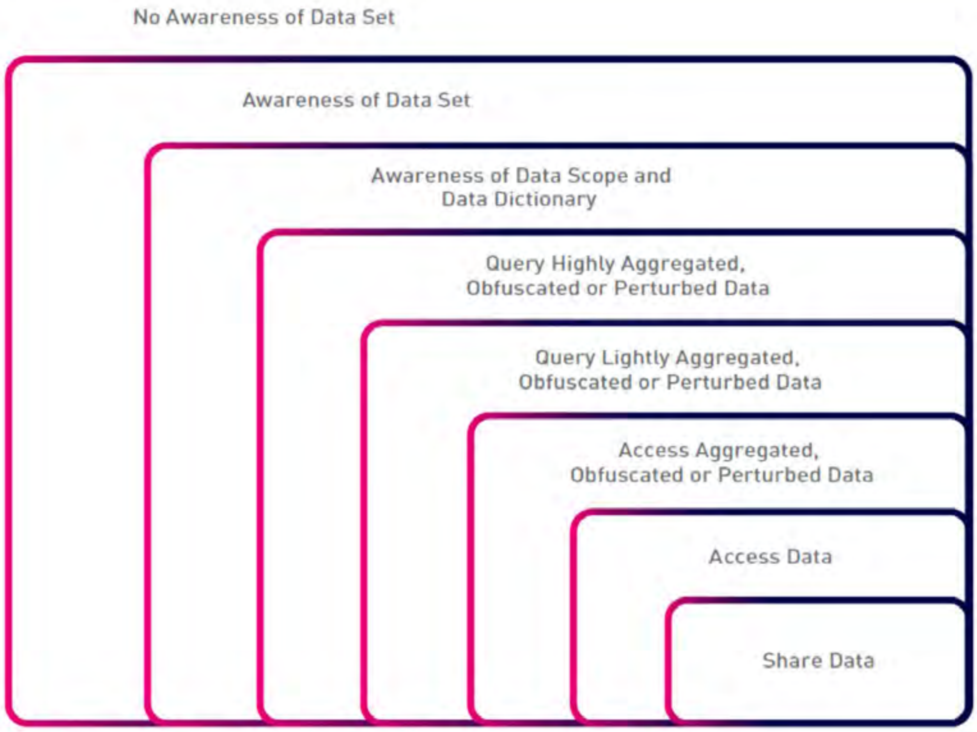
Figure 2-5: Data fusion



Source: Karl 2003, p58.

Therefore, the data and datasets discussed in this report can be accessed at many different levels. The Australian Computer Society in its data sharing framework paper (ACS 2017) presented the levels of data that can be shared, Figure 2-6. It begins with a simple awareness that a dataset that can be shared even exists, and then progresses from highly aggregated data to access to the raw data to being able to share the raw data.

Figure 2-6: Levels of data that can be shared



Source: ACS, 2017.

2.4 Big Data and Internet of Things (IoT)

Over the last 10 years, we have experienced a significant growth in data. This growth has occurred in areas such as: (i) social media posts, video and audio files and emails, (ii) in a huge increase in personal/nomadic devices such as mobile phones and in-vehicle telematics and most recently in (iii) physical objects embedded with sensors (internet of things). Supporting and enabling this growth has been the corresponding improvements in connectivity both in latency and bandwidth. The Productivity Commission categorised the data growth as a result of connectivity in three areas: (i) volunteered data, (ii) observed data and (iii) inferred data (PC 2016, p.58).

In June 2018, Ericsson forecasted that from an average worldwide monthly data consumption of 3.4GB/month, in 2017, within six years, a worldwide average typical mobile phone will consume 17GB/month, based on a growth rate of 31% per annum (Ericsson 2018).

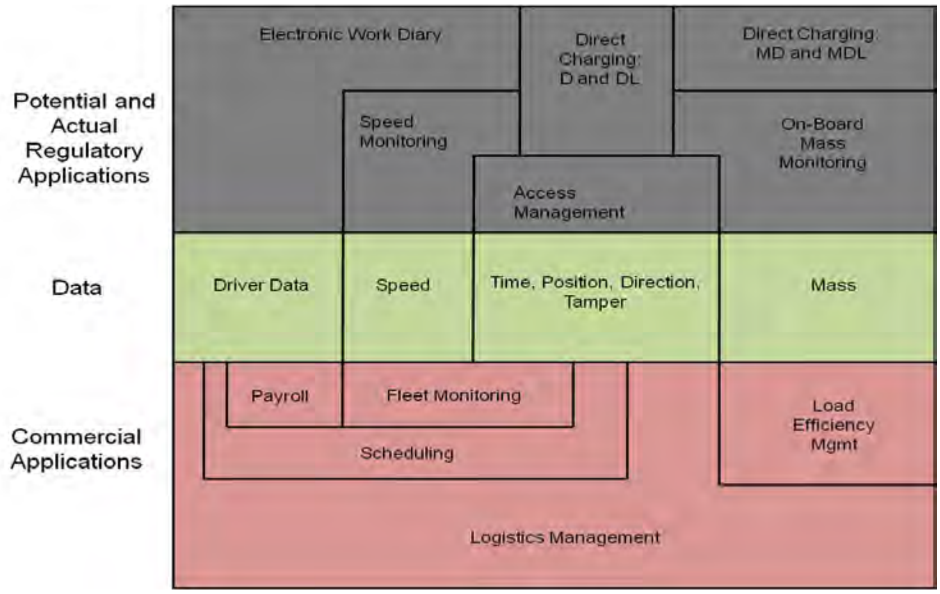
The International Transport Forum at the OECD reported that the volume and speeds at which data today is generated, processed and stored is unprecedented and will fundamentally alter the transport sector (ITF 2015). They found that sensors and data storage/transmission capacity in vehicles provide new opportunities for enhanced safety and multi-platform sensing technologies are now able to precisely locate and track people, vehicles and objects.

Within such an environment, it goes unsaid that the nature of data sources and data analytical techniques are evolving rapidly and moving away from any effective control by individuals. As data standards and metadata improve, digital data can be readily transferred across sectors and boundaries.

While the public is more aware of the impact of Intelligent Transportation Systems on passenger journeys than on freight, arguably the freight industry is further advanced in its adoption (ITS Australia 2017). Technology and connectivity are bringing new benefits to individual operators and their clients as well as to the system.

Data does not wear out, it can be used for many purposes. In Australian work associated with the Intelligent Access Program and other regulatory telematics applications (ARRB 2011), it was noted that data from heavy vehicles could be collected once yet used many times as shown in Figure 2-7 below.

Figure 2-7: Collect once use many times



Source: ARRB, 2011.

The complete range of data elements that are be available for such use, from heavy vehicle telematics, can be found in the National Telematics Framework (TCA 2018) in Attachment 1.

In addition to GPS and mobile phone data, studies are being undertaken on the use of Co-operative ITS technologies in transport, as shown in Table 2-1. In these examples, data from vehicles and the roadside are used. In addition to the trialling of technology, it is also important to note that access to road users' data and privacy and security considerations are being addressed side by side with the technology trialling.

Table 2-1: New data from C-ITS

Examples of new technologies and data generation in transport - *Cooperative Intelligent Transport Initiative (CITI)*

Transport for NSW (TfNSW) has established CITI, Australia's first C-ITS testing facility. CITI initially focused on commercial vehicles but expanded into light vehicles. TfNSW established CITI to better understand the safety benefits of C-ITS technology, participants' experiences and challenges with analysing data from the technology.

Data collected from commercial vehicles in the project is treated as commercially sensitive information rather than personal information, and there is a deed of agreement in place. Participants are informed upfront about what the data will be used for and who it will be provided to (largely for research purposes). Information about who is driving or the vehicle registration number is not collected.

- The C-ITS equipment records location, vehicle movement and speed information at least 10 times per second.
- Researchers may access participants' driving history from Roads & Maritime Services during the study and for three years prior to the study.
- Data collected will be used to assess road safety benefits of C-ITS and how user friendly the system is.

The CITI light vehicle study provides a good example of obtaining consumer consent for collecting personal information in the context of C-ITS.

Cooperative and Automated Vehicle Initiative (CAVI) – C-ITS Pilot
The Queensland Department of Transport and Main Roads (TMR), the iMOVE Cooperative Research Centre and the Queensland University of Technology are conducting a C-ITS Pilot project which will take place on public roads in Ipswich in 2019. Around 500 vehicles will be retrofitted with C-ITS devices, and roadside C-ITS devices will be installed on arterial roads and motorways. These devices allow vehicles and infrastructure to share real-time information and provide safety related warnings messages for drivers.

The C-ITS Pilot will utilise both DSRC and cellular communication. DSRC will generally be used for safety and time-critical message transmissions (for example, emergency brake light). Cellular may be used for less time critical message transmissions.

To participate in the pilot, participants must complete a consent form to authorise the collection of their personal information. Participant identity is not shared with TMR, but TMR will have access to C-ITS device identifiers. TMR is completing a privacy impact assessment to consider the potential impacts of the pilot on privacy.

Source: NTC 2018, Appendix A3.

2.5 Risks with data

The Productivity Commission Inquiry (2017) found that allowing and enabling data more generally to be available and used widely would provide enormous benefits, but there are risks involved that need to be managed. The Commission noted that the risks vary with the nature of the data holding, and the environment and purpose for which it is used. The Inquiry considered that the risk of harm needed to be assessed based on both the likelihood and scale of harm associated with data being more widely available. Where the adverse consequence of increased data access is considered high, the availability of the data needs to be carefully managed.

The types of risks that Inquiry participants pointed to as being most significant related to the loss of control around what others 'see', the reputational damage or embarrassment, identity fraud or criminal use, commercial harm and data security. To address concerns about the data risks identified above, Karl (2006) found that typical conditions of use found in data contracts include conditions and clauses such as:

- that a licence is non-transferable, or it is a non-exclusive licence;
- a license grants no warranty on quality, fitness or suitability;
- there is an acknowledgment on ownership of the data;
- privacy, disclosure, restrictions and indemnity provisions;
- that the information provider is not liable for any loss or damage caused by use of the information;
- that for websites, a condition is that the information provider does not guarantee to any particular level of service, i.e. downtime, delay or loss in transmission;
- that the user agrees that the information is solely for their personal use and not for commercial purposes, which would require a separate agreement with the information provider;
- usage for purposes of study, research, criticism and review is permitted but requires that the data owner to be acknowledged as the source of the material;
- in cases where the information that is subsequently repackaged and redistributed by a third party, are that:
  - the original owner is identified as the source of the information;
  - the original owner's copyright be acknowledged;
  - the owner gives permission is given to the repackaged information;
  - any copyright statement or logo included in the owner's product must be retained;
  - responsibility of any repackaging, including quality and timeliness of the services, should be clearly stated as that of the host organisation; and
  - all text or graphical re-presentation of forecasts must include the issue time and date and the validity of the period.

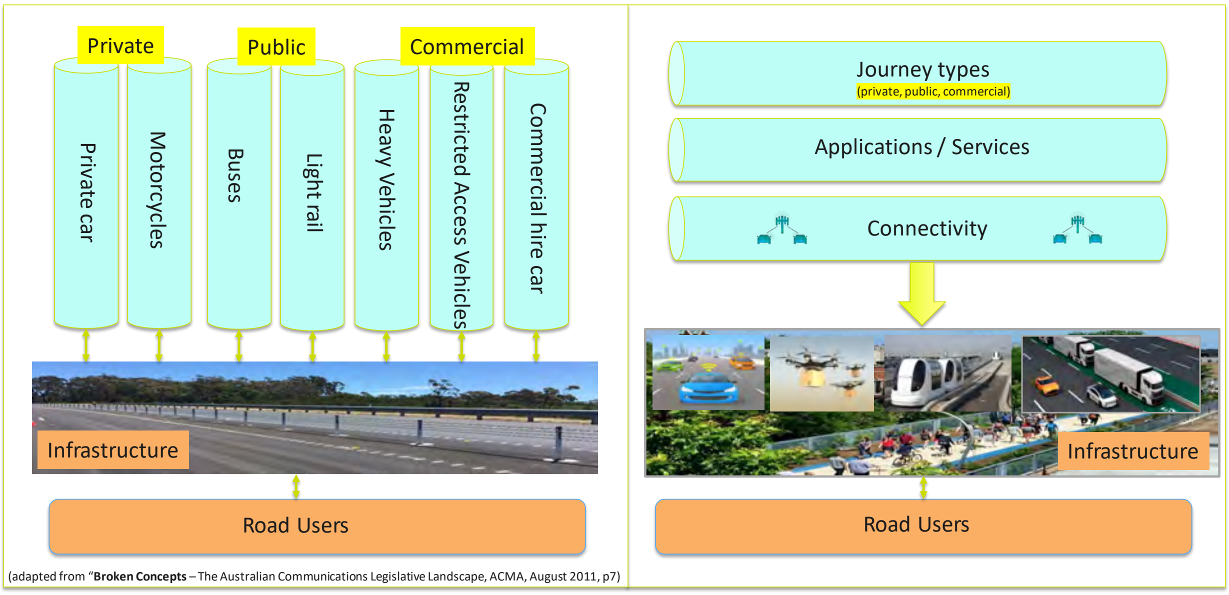
2.6 Future Freight Data

Advances in vehicle and infrastructure automation through innovations such as truck platooning, combined with the intensive use of real time data from connected vehicles, assists operations, compliance and safety alike. ITS Australia (2017) noted that possibilities are increasing for the development and implementation of parking and consolidation services in congested cities, and reducing the number of empty or part loaded trips. ITS can also enable information to be used to avoid queues at concentration points such as docks and to better utilise off peak times when the freight impact on the system will be less.

The traditional silos of land transport are being broken and, in the future, can be considered in different landscape made up of layers; Mobility (journey types) supported and enabled by Application and Services through high speed and high bandwidth Connectivity operating in Infrastructure (the land corridor) where vehicles can serve multiple purposes.

Figure 2-8 which depicts this transformation below was informed on earlier work for communications, *Broken Concepts, The Australian Communications Legislative Landscape* produced by ACMA in 2011.

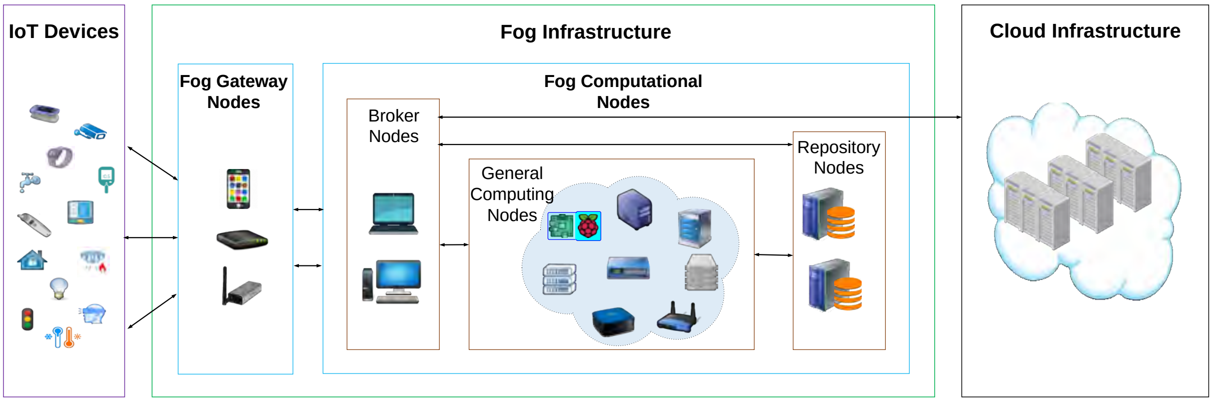
Figure 2-8. Future structure of land transport



Source: ARRB analysis 2018.

We are beginning to see these layers appear in shared mobility services, automated and innovative vehicles and IoT and big data. In the figure below, IoT devices at the edge of the network are connected via 'Fog" infrastructure to the "Cloud" infrastructure, Figure 2-9 (Buyya 2018).

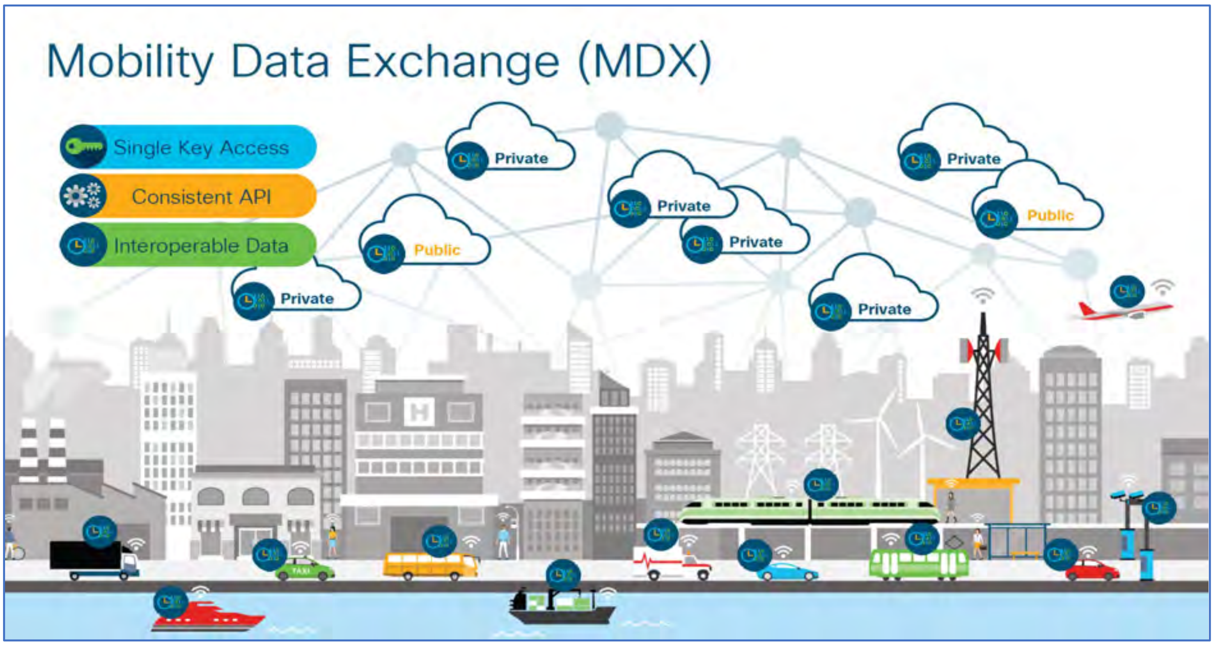
Figure 2-9. Edge to Fog to Cloud physical view



Source: Buyya, 2018.

Fog is used to describe a local cloud network (like LAN – Local Area Network), while a Cloud is a remoter network, like WAN or a Wide Area Network). Within the Edge and Fog, devices have both sensors and varying processing and connectivity prowess. Figure 2-10 shows this concept and supports exchange of multimodal transportation data for a range of private, commercial and regulatory products and services (CISCO 2018).

Figure 2-10. Mobility Data Exchange (CISCO)



Source: CISCO, 2018.

This 2018 report to DIRDC of freight data needs is necessarily based on the current landscape, however we should recognise that in the future, technology developments could substantially expand the possible options.

2.7 Implications

The rapidly changing technology landscape for freight data will provide better, richer and deeper possibilities of much needed information for all players in freight and logistics and this is already beginning.

However, what should not change are the data requirements for operations, planning and investment. So, the implications from our understanding of the data are:

- To focus on the enduring questions or requirements and to be agnostic on the technology – it is preferable to spend effort on getting the requirements clear. Even for a simple GPS location record, requirements such as accuracy, frequency, quality indicators, speed, bearing, record numbering, and other accompanying records such as vehicle identification, ignition status, fuel consumption, engine revolutions need to be clarified.

- To build understanding of new data sources and indicators that could provide fresh insights – to consider alternatives to the current data, eg. distance travelled by odometer, GPS, road side collection, origin destination records, mobile phone, tags, etc

- To explore new avenues to source data needed for current requirements – especially from many third parties harvesting data from social networks and IoT.

- To collaborate locally and internationally in networks and associations to share knowledge and thereby not recreate the wheel – to participate in working groups and as observers on projects, locally and internationally.

- To invest in knowledge and networks and in flexible arrangements for data collections which can be reviewed frequently as technology advances – to create systems that are flexible and configurable to ingest new data collections.

- The majority of the 52 projects noted in this Report are based on technical architectures and technologies that are already 10 years old and while these are now being adopted and applied in freight and logistics, in the near future we will see even greater changes as a result of the advances in IoT connectivity and the changes to our lifestyles that they will bring.

3 Review findings

3.1 Introduction

In its investigation into the economic significance of the Australian logistics industry, ACIL Allen (2014) noted that logistics involved more than just the transport of goods, it is an end-to-end supply chain process. The study found that the efficiency of logistics is important to Australia's productivity because the industry affects all of Australia's other industries and that efficient logistics costs enable competition over larger areas, crucial for the export performance of key industries, and for competitive domestic industries. In other words, to deal with the tyranny of distance requires efficient freight networks.

The Inquiry into National Freight and Supply Chain Priorities (NFSC 2018a) concluded that five critical areas needed to be addressed to lift freight productivity and efficiency for Australia. They are (NFSC 2018a, p7-8):

- an integrated approach;
- measurement of freight performance;
- planning for current and future needs;
- act to deliver the priorities; and
- communicate the importance of freight.

In the first critical action related to "An Integrated Approach" the report found that freight modes and operators needed to work together, and that future challenges and opportunities which required a national approach include: harmonisation, streamlined regulation and cross border planning among all levels of governments.

In the second critical action related to "Measurement of Freight Performance", the report stated that supply-chain activity and performance must be measured, and that a national approach to data consistency across jurisdictions was essential. It noted that freight performance data:

- will be used to monitor domestic and global competitiveness over time and identify areas where action is required to maintain and improve productivity; and
- should inform the need for capital expenditure and maintenance, regulatory and governance reform, and measuring progress, including implementation of the National Strategy.

In agreement, from the data perspective, the PC Inquiry on Data Availability and Use (PC 2017) found that incremental changes have failed to deliver a culture of making data available for widespread use and that more work needs to be done on how to control data held by individuals, yet use data more effectively for their own benefit. The PC Inquiry stated that:

1. The nature of data sources and data analytical techniques are evolving rapidly and moving away from any effective control by individuals and will continue to do so.

2. Digital data could be readily transferred across the economy, between sectors and across national boundaries with increasing ease. To ensure public awareness and social licence match these trends, data management frameworks need to be consistent across the economy.

3. Incremental changes in the data management framework to date have failed to deliver a culture of making data available for widespread use. The range and volume of datasets now held in the public or private sector, that could potentially be made more widely available and the associated opportunities are monumental.

4. There are key unanswered questions that go to the fundamental rights of individuals to control data held about them, and how individuals — as consumers — can use data more effectively for their own benefit, that lie at the heart of data availability and use. These questions necessitate an across-the-board rethink of the way data is managed.

Certainly, data can be used to improve productivity and performance in a range of areas (PC 2017, p62):

- the economic value of data is largely reaped when it is used to better inform the decision-making of individuals, businesses and governments;
- the information derived from data analysis can alleviate information asymmetry and reduce inefficiencies in market operation;
- it can stimulate competitive responses from suppliers in a way no other asset can; but
- the extent to which data can be used to improve these market and non-market operations, including individual decision making, will be constrained by restrictions on data access and use.

3.2 What is the need in freight supply chains?

The ALC (2014) report noted that the industry is affected by many regulations, some of which overlap and generate inefficiencies.[3] In recent years, there have been many strategies which affect the movement of freight and greater certainty on planning for freight would stimulate private sector investment in freight infrastructure. The ALC argued that freight does not have a voice in many planning debates, resulting in the provision of inefficient infrastructure and a loss of productivity. It also claimed that despite strategies and plans which sought to address this, there has yet to be a clear whole-of supply chain focus on strategic corridors. Among the problems identified in the report were:

- harmonising regulation and reducing bureaucracy;

[3] ALC (2014) report, The Economic Significance of the Australian Logistics Industry,

- identifying and then delivering key infrastructure projects;
- adopting whole of supply chain planning;
- a desire to make greater use of railways;
- high productivity vehicles access and charging;
- establishing a network of efficient intermodal facilities; and
- giving freight a voice in urban planning.

Having the appropriate freight data available would be a good starting point to address the problems identified. The NFSC Inquiry report (2018a, p.26-27) also identified several problems in the management of supply chains and specifically a lack of freight data and information, as shown in the list below:

- capacity limits and land-side access restrictions at key national freight terminals;
- diminishing industrial land around key national freight terminals and an inadequate allocation of land for intermodal terminals;
- conflicting freight and passenger rail and road movements during peak periods;
- fragmented access to national key freight routes;
- inadequate mechanisms for national supply chain integration, including a lack of freight data and information on the performance of Australian supply chains against international benchmarks;
- inadequate jurisdictional strategies for protecting freight corridors and strategic industrial and logistics areas from urban encroachment; and
- a lack of integrated planning and harmonisation of freight regulation and coordinated freight governance across and within governments.

The ALC GS1 trial in 2015-2016 (CWL 2016) investigated the use of an international standard for recording data events associated with the movements of goods through a supply chain involving Nestle, OneSteel and The Reject Shop and found that the barriers faced in implementation were:

- co-ordination across supply chain partners;
- competition among supply chain partners;
- data security; and
- differential organisational capabilities among supply chain partners.

The strong need for more and better data is expressed in many of the reports and projects reviewed.

3.3 Frameworks for freight data

A framework is typically a logical structure that is created to support, inform and achieve certain outcomes. In recent times, there have been several inquiries, reports and plans that describe frameworks for freight data, directly or indirectly. They include:

1. National Land Transport Productivity Framework (NTC 2018)
2. National Freight Performance Framework working paper (NFSC 2017)
3. Data availability and use (PC 2017)
4. Australian Government response to PC (Australian Government 2018)
5. National Telematics Framework (TCA 2018)
6. National Policy Framework for Land Transport Technology (TIC 2016)
7. Towards a Multimodal Transportation Data Framework (CISCO 2018)
8. Data Sharing Framework (ACS 2017)
9. Framework for co-operative telematics applications for regulated commercial freight vehicles (ISO 15638, 2013)

Apart from the ISO Standard, the first eight frameworks are all Australian. The working group that developed ISO 15638 was led by Australia and based upon TCA's National Telematics Framework which has been accepted internationally.

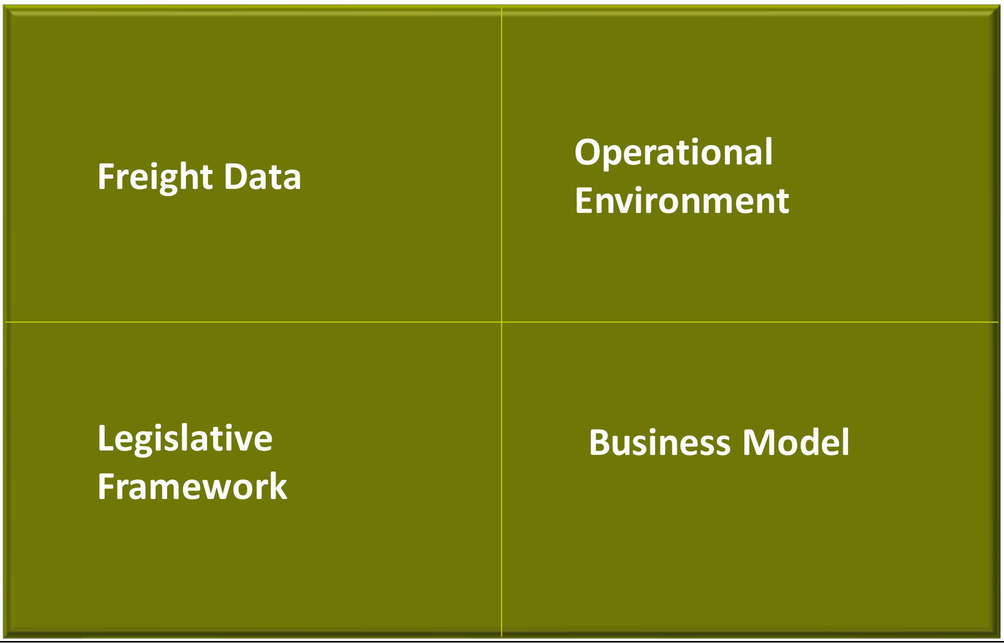
It would be desirable to have a nationally agreed framework for freight and logistics data. The existence of several overlapping frameworks in Australia reflects the different domains that freight covers and the range of stakeholders interested and involved. It confirms that co-ordination is a challenge but also that it is much-needed in order to deliver a successful outcome for all parties.

But a freight framework is not just about the data. It also must address other key parts of the entire system. The sections below will deal with the key parts of the framework.

3.3.1 Framework – a system view

It is suggested that the system for freight data works with the interaction of four key components; (i) freight data is supported by (ii) operational, (iii) legal frameworks and the appropriate, and (iv) business/funding model as shown in Figure 3-1. Freight data works within a system where the data is specified, collected and disseminated under agreements between all parties involved, requiring clearly specified terms and conditions.

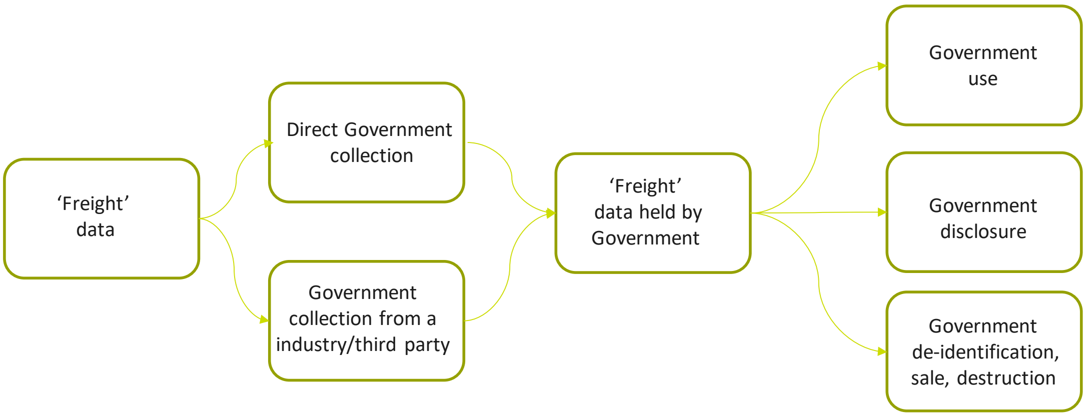
Figure 3-1: Key components of a System



Source: ARRB analysis 2018.

A simple system operated by a government entity may be depicted as in Figure 3-2. The same figure may also apply to industry data. Freight data held by government can be either part of a direct government collection or data which government has collected from industry or a third party or a combination of both. Government then uses this data internally or externally via several means.

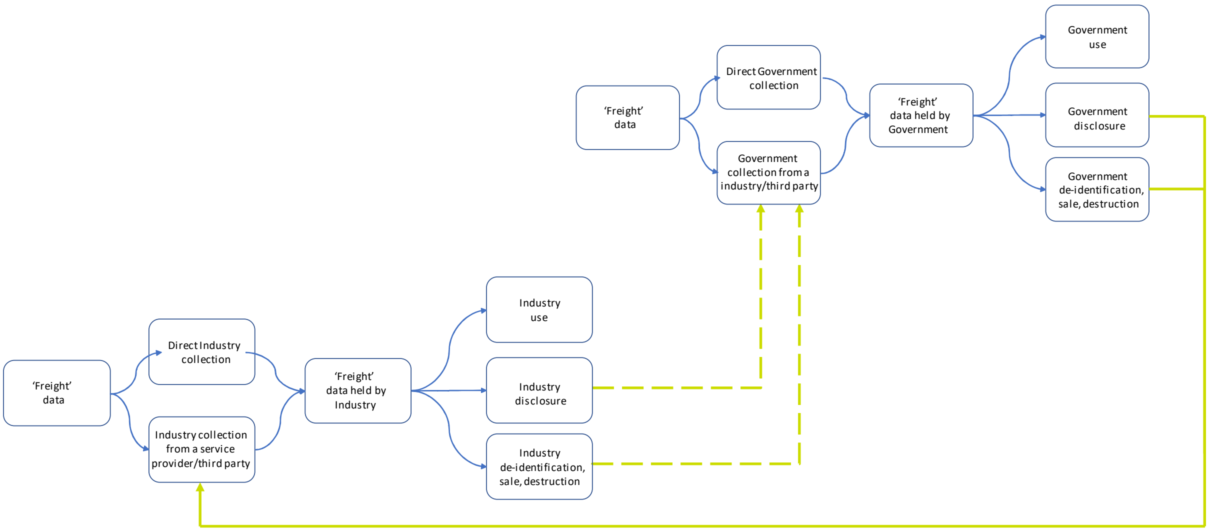
Figure 3-2: Data flow in one system (government agency)



Source: ARRB analysis 2018.

Linking industry data being used by government and then the government data being made available to industry leads to Figure 3-3 below. The private sector organisation discloses data to the government agency (dashed arrows) which the Government agency aggregates with its own data to lead to new data held by the Government agency. This new data is subsequently disclosed by the government agency and is then collected by the private sector company for its own consumption.

Figure 3-3: Data flow between government and industry

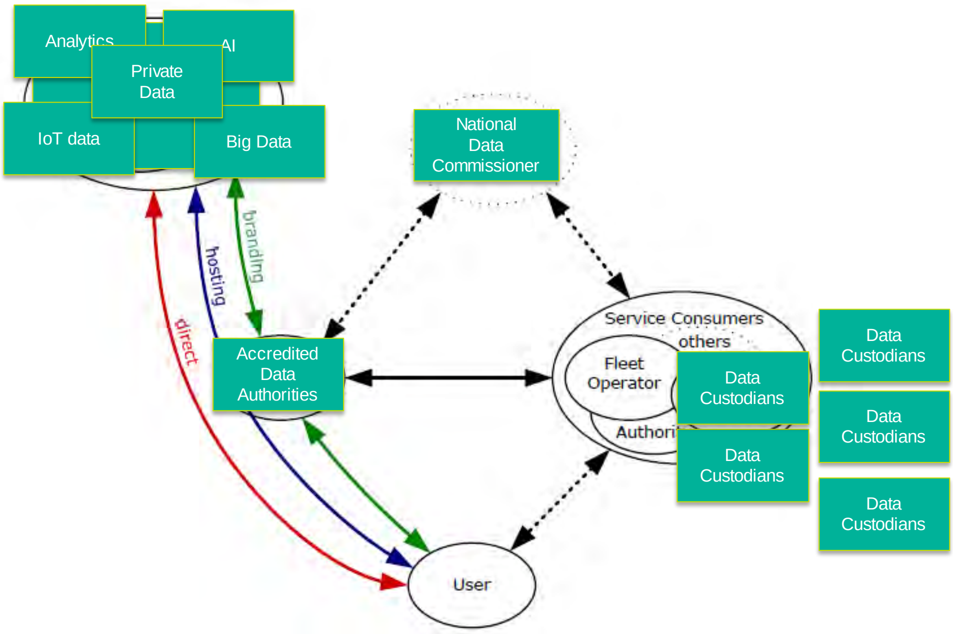


Source: ARRB analysis 2018.

A representation of the whole system that may emerge is envisaged in Figure 3-4. The system is shown to have an overall **System Manager** (for example, National Data Commissioner) and **Accredited Data Authorities** who interact with **Users** who are seeking the freight data. Users can also deal with **Data Custodians** directly (government and industry) as well as other third parties who can provide other data (private data, big data) and services (analytics, artificial intelligence/machine learning techniques, visualisation and presentational). **National Interest Datasets** which generate significant community wide benefits will also be identified within this system.

These services may be available directly from the third parties and/or also procured via the Accredited Data Authorities who might add hosting and branding value to the data.

Figure 3-4: A system for freight data



Source: ISO 2013b.

The specific roles and responsibilities of each of the entities would need to be defined. An example of a similar system design can be found in *ISO TS 17427 ITS Co-operative Systems – Roles and Responsibilities in the context of co-operative ITS* (ISO 2013b).

Australia yet does not have an overall system view. The Australian Government (2018) in its response to the PC Inquiry has identified some of the key roles and activities in a future System. These need to be more broadly discussed with other stakeholders to harmonise architectures and be consistent with extant international models.

3.3.2 Framework – governance

Within the overall system, governance has to be established. The key role that has to be clarified is that of the overall System Manager. It is suggested that some of these roles have already been identified in a recent Australian Government response. The Australian Government announced, in May 2018, a range of reforms (Australian Government 2018) in response to the PC Inquiry on data availability and use. The Government's response includes the following:

- A Consumer Data Right (CDR). The CDR will be designed to ensure strong privacy protections and would allow consumers to securely share their data with third parties such as comparison websites.

- A new data sharing and release framework supported by a National Data Commissioner to oversee the integrity of data sharing and release activities of Commonwealth agencies. This aims to increase community trust and confidence in the way government manages and uses its data.

- New legislative and governance arrangement (Accredited Data Authorities) to improve data sharing and release, subject to strict data privacy and confidentiality provisions.

Other supporting actions proposed in the Government's response include (Australian Government 2018, P.10):[4]

- taking a risk-based approach to releasing available publicly-funded datasets;
- publishing registers of available publicly-funded datasets;
- developing best practice guidance and standards on data availability and use;
- working to identify and release high-value datasets;
- streamlining data sharing arrangements; and
- monitoring the performance of Australia's data system.

The above regulatory response complements and supports the system design framework described in the earlier section.

An existing actor in governance of transport data is the Australian Transport Data Action Network (ATDAN) which was created in 2009 for the purpose of implementing a transportation data action plan as endorsed by transport ministers in 2008. The ATDAN is an inter-jurisdictional group comprising officials from Commonwealth, state and territory transport and infrastructure agencies, for the purpose of providing strategic direction and leadership in national infrastructure and transport data collection, dissemination and management.

ATDAN reports to TISOC and meets biannually. The group is chaired by the ABS and comprises representatives from DIRD, the NTC and jurisdictional transport agencies. As well as providing advice to TISOC regarding strategic transportation data issues, ATDAN also undertakes projects to improve transportation data collection and develops and promotes the use of metadata standards and frameworks. In its Project Outcomes Report (NTC 2017c, p.10), it was suggested that:

- ATDAN encourage adoption of open data standards and access arrangements and undertake a review of metrics collected across jurisdictions to allow for better national comparisons; and
- ATDAN monitor and report progress in adoption of open data standards and open data access.

It was found that several roles and responsibilities described have been identified and that there are agencies and groups that are currently or will be performing the parts of these roles. Some effort in

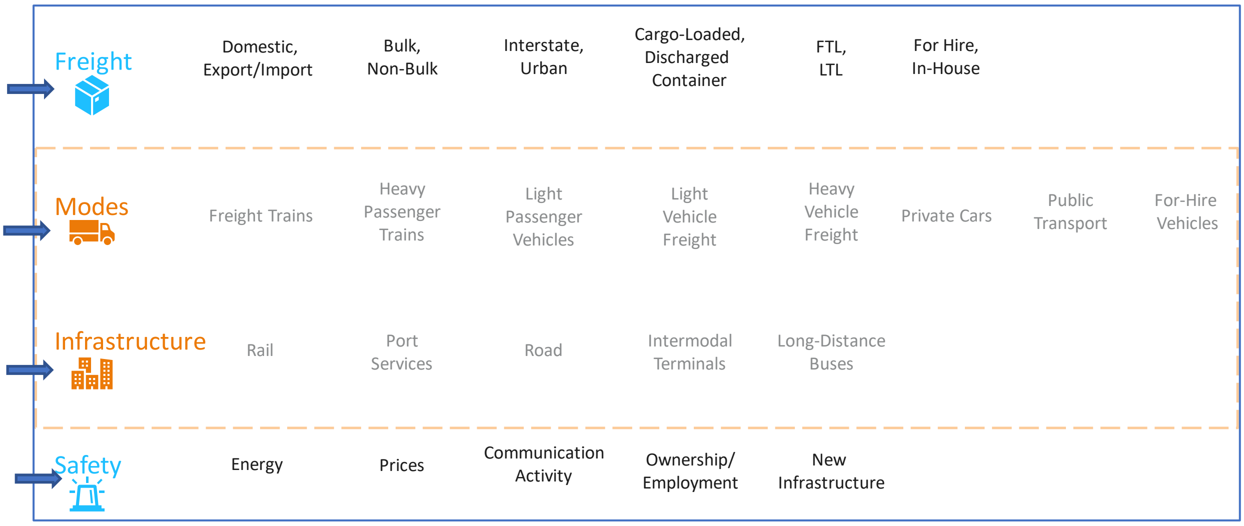
[4] The Productivity Commission (2017) recommended establishing a new form of national data asset, a "National Interest Dataset". These would be datasets generating significant community-wide benefits. The Australian Government's was to establish a framework to identify those datasets.

consolidation and confirmation of the actors in the roles are needed for smooth operation of the overall system.

3.3.3 Framework – data focus

The requirements for freight data can be considered from several different sources based on the needs of different stakeholders. As shown in Figure 3-5, the key areas of interest are freight supply chains, modes, infrastructure, and other areas, such as safety or sustainability.

Figure 3-5: Focus of freight data



Source: ARRB analysis 2018.

We comment on the recent work of the NFSC and the NTC below.

3.3.3.1 National Freight Supply Chain Priorities Report (NFSC 2018a,b)

This report identified three main supply chains for interest:

- import/export freight;
- inter and intra state freight; and
- urban freight.

The NFSC Inquiry noted that several mode-specific indicators were currently available in several publications from BITRE and other sources as shown in Table 3-1. It recommended that as part of a national freight performance framework, these indicators could be presented in single location, increasing visibility and allowing an overall picture of freight performance.

Table 3-1: Suggested new indicators for freight (1)

Indicator	Container Ports	Rail	Road	Air Freight
Cost	$/container (including land-side) ABS producer price indexes	Freight rate estimate ARTC revenue/tkm ADS producer price index	Freight rate estimate ABS producer price index	Freight rate estimate
Travel/transport time	Container turnaround times Truck turnaround times Vessel turnaround times Duration of import/export procedures (DIBP)	Scheduled terminal to terminal time	Road speeds Average travel time/truck speeds on key freight routes	
Reliability	95th percentile of ship turnaround time Ships waiting at anchorage >2hr	Trains waiting 30mins of schedule	GPS truck movement data	Freight delays
Productivity	Wharfside, landside and whole of port indicators ABS productivity estimates	Tonnes/truck per km ABS productivity estimates	ABS productivity estimates	ABS productivity estimates
Capacity	Ship turnaround times	Scheduled dwell time (due to other trains using the line)	Congestion measures (Austroads, TomTom, HERE) Truck speeds at congested locations	
Safety	Maritime fatalities and injuries	Rail-related fatalities and injuries	Fatalities and injuries from heavy vehicle crashes	Aviation fatalities and injuries

Source: NFSC, 2018b.

In addition, several additional indicators were proposed by the NFSC inquiry as shown in Table 3-2. These indicators related to road access for heavy vehicles and land use around ports and terminals. Indicators for several specific supply chains, raised by industry, were also proposed.

Table 3-2: Suggested new indicators for freight (2)

Indicator	Transport mode	Potential indicator
Access	Road	% of network accessible to each vehicle class
		% of producers within a set distance of network for each class
Land use / encroachment	Ports Intermodal terminals	Population and jobs density with set distance of port precinct or intermodal terminal sites
		Congestion on roads approaching ports

Supply chain	Perspective represented	Representative routes	Transport Modes: Road	Rail	Sea	Port Inter/ Mod	Air
Grain	Producer/exporter	Riverina-overseas	√	√	√	√	
		WA wheatbelt-Perth		√			
Export beef (air)	Producer/exported	Darling Down- overseas	√			√	√
Imported manufactured goods	Final customer	Overseas-suburban retailer	√		√	√	
Intercapital general freight	Freight customer	Sydney-Brisbane	√				
		Melbourne-Perth		√			

Source: NFSC, 2018b.

3.3.3.2 **National Infrastructure Data Collection and Dissemination Plan (BITRE 2018a)**

This report firstly identified a full list of enduring questions, from the infrastructure viewpoint, as shown in Table 3-3. The range of questions are framed broadly to cover the entire infrastructure domain including freight.

Table 3-3: Enduring questions

Table D.1 Full List of Draft Enduring Questions

Topic	Enduring Questions
1. Infrastructure Stocktake	EQ 1.1 – What infrastructure does Australia have, what is its capacity, geospatial location and value?
	EQ 1.2 – What is the condition of Australia's infrastructure?
2. Infrastructure and freight performance	EQ 2.1 – How well are Australia's infrastructure networks performing?
	EQ 2.2 – How can customer satisfaction measures be combined with other infrastructure performance measures to provide a holistic measure of the performance of Australia's infrastructure networks?
	EQ 2.3 – [Specifically] How well is Australia's freight sector performing?
3. Infrastructure investment and planning	EQ 3.1 – How well are infrastructure projects assessed in Australia before they are built?
	EQ 3.2 – What are the planned and actual costs and benefits involved in infrastructure projects?
	EQ 3.3 – How do infrastructure construction costs vary?
	EQ 3.4 – Are Australia's infrastructure assets sufficient to meet current and projected needs?
	EQ 3.5 – How do we encourage network optimisation solutions to ensure transport network infrastructure use is optimised before major infrastructure investment?
4. What are the impacts of our infrastructure?	EQ 4.1 – In what ways and to what extent does infrastructure provision impact on the environment?
	EQ 4.2 – What are the social impacts of infrastructure?
	EQ 4.3 – What are the main sources, types and quantities of economic benefits from transport?
	EQ 4.4 – How, when, why and in what numbers do people get injured, or die on Australia's roads?
5a. Infrastructure use – Transport	EQ 5.1a – What freight is moving to, from and around Australia, what is it comprised of, how are different industries affecting the volume and value of freight?
	EQ 5.2a – How and when does freight move to, from and around Australia, and by what routes?
	EQ 5.3a – What barriers exist to efficiently transporting freight to, from and around Australia?
	EQ 5.4a – What are the key service characteristics of freight movement services in Australia (including cost, time and reliability) and how do these characteristics affect mode and route choice, and the amount and type of services provided?
	EQ 5.5a – How, when, why and in what numbers do people travel to, from and within Australia, for what purposes, what are the origins and destinations of their journeys?
5b. Infrastructure use– Energy, Water and Communications	EQ 5.1b – What are the key service characteristics for water, energy and communications (including cost, time, speed, accessibility and reliability) and how do these characteristics affect the amount and type of services provided?
6. Data and information for decision making and innovation	EQ 6.1 – What infrastructure data and information is currently publicly available and what datasets and information can be made available?
	EQ 6.2 – What data do governments need to provide in order to enable emerging technologies and innovative business models of infrastructure provision and use?
	EQ 6.3 – How can existing and new data be used to enhance transport service delivery? What data can be collected from existing and future transport services and infrastructure?

Source: BITRE, 2018a.

The BITRE work was informed by an earlier study by the New Zealand Ministry of Transport in developing a shared understanding of transport data and information priorities (NZ MoT 2016). The scope of the NZ MoT was even wider to encompass not just the needs of industry and government but also of the communities.

BITRE (2018a) identified the specific areas where further data collections may be useful in informing the gaps in the enduring questions raised, as shown in Table 3-4.

Table 3-4: Gaps in Enduring Questions

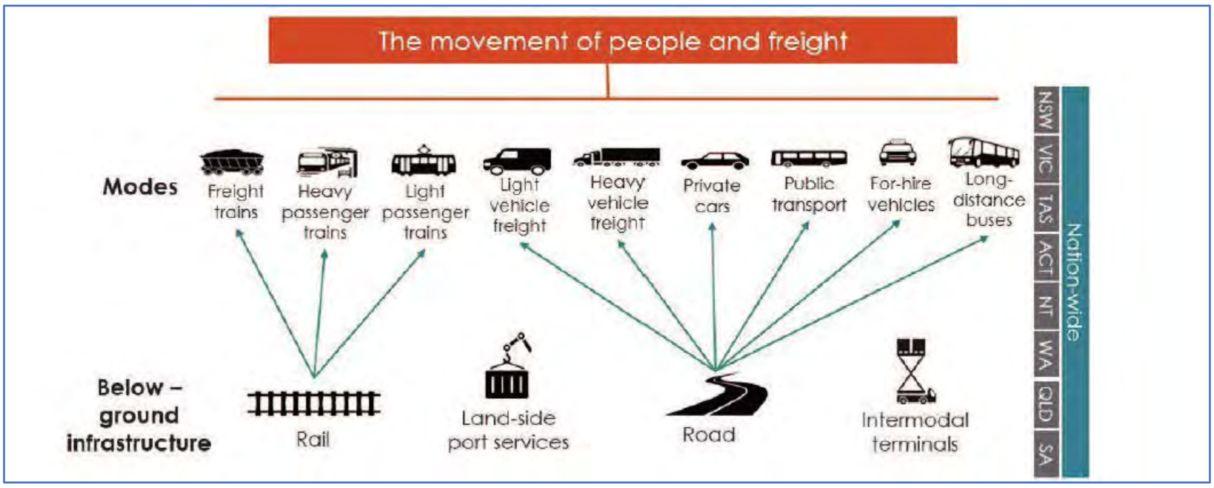
Topic	Questions
1. Infrastructure	• What is the condition of Australia's infrastructure and networks? • How can customer satisfaction be incorporated?
2. Freight	• What is the Australia's freight performance?
3. Investment and Planning	• What are the costs and benefits of infrastructure projects? • How do infrastructure construction costs vary? • How can network optimisation be encouraged?
4. Impacts	• What are the environmental, social and economical impacts of infrastructure? • How, when, why and in what numbers do people get injured or die?
5. Infrastructure use	• What freight is moving and what industries are affecting it? • How and when is it moving? • What barriers exist? • What are the service characteristics of freight movement? • What are the characteristics of people traveling to and from Australia? • What are the service characteristics of water, energy and communications?
6. Data and Information	• What infrastructure data is currently public and what else can be added? • What data do governments need to provide to the public? • How can current and new data be used to enhance transport service delivery?

Source: BITRE, 2018a

3.3.3.3 National Land Transport Productivity Framework (NTC 2017b)

The NTC considered the key focus for data from the perspective of modes and infrastructure as shown in Figure 3-6. From a government perspective, the focus falls upon the movement of people and freight through the lens of the modes (vehicles) and the infrastructure (rail, road and ports).

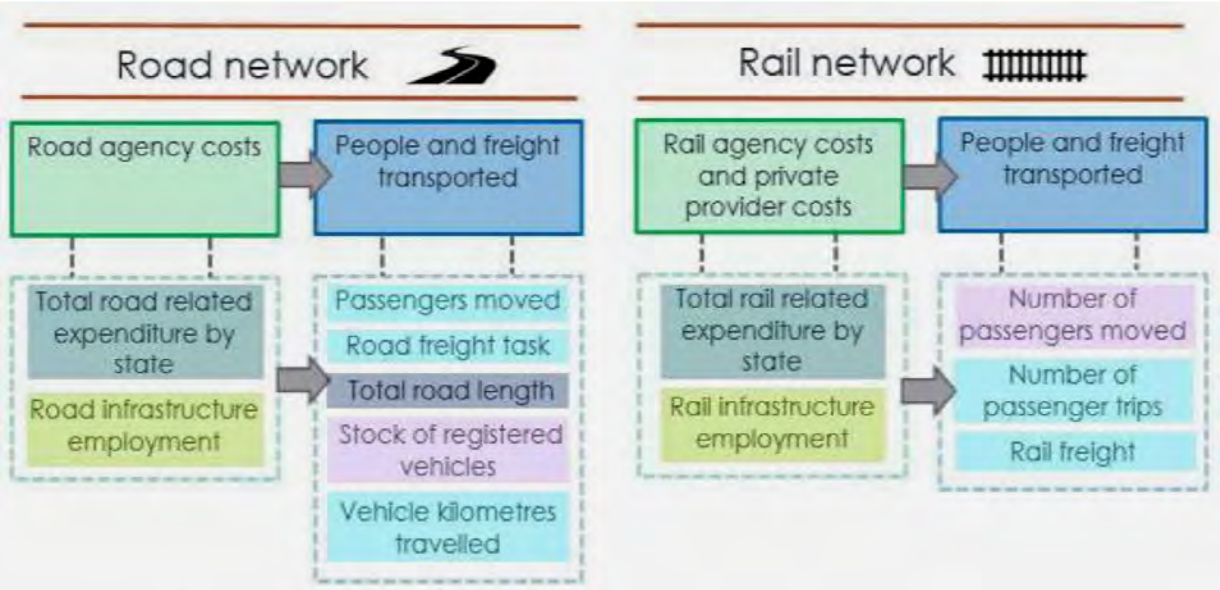
Figure 3-6: Focus of land transport framework



Source: NTC, 2017b.

The NTC further elaborated the data requirements in Figure 3-7 which show just road and rail. This provides a much greater level of the detail from which the required information for the key indicators are derived.[5]

Figure 3-7: Data requirement for land transport



Source: NTC, 2017c.

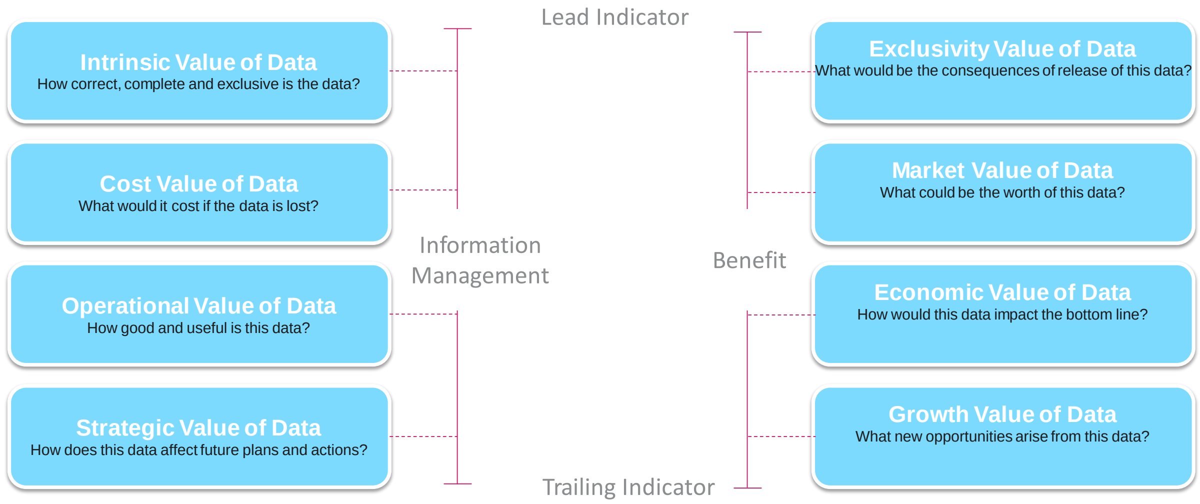
In conclusion, the data focus of the frameworks reviewed showed several foci; mode, infrastructure, freight type and other areas such as employment, environment and safety. Therefore, in an overarching framework, it will be desirable to have a number of sub-areas of focus, based on the specific focus of the key stakeholders

3.3.4 Framework – risk management

Sharing data incurs risks such as potential loss of economic value, loss of exclusivity or unintended consequences of the use of the shared data (ACS 2017, p.62). ACS utilised a commercial value framework, shown in Figure 3-8, to highlight the areas in which the use and access to the freight data could be effectively evaluated.

[5] The full requirements are detailed in Attachment 2 and can be found in NTC 2018b, p.14.

Figure 3-8: Value framework for data



Source: ACS, 2017.

The PC Inquiry (2017) recommended that the emphasis for government agencies in handling data should be on making data available at a 'fit for release' standard in a timely manner. Beyond this, agencies should only transform data beyond the basic level if there is a clearly identified public interest purpose or legislative requirement for the agency to undertake additional transformation, or:

- the agency can perform the transformation more efficiently than either any private sector entities or end users of the data;
- users have a demonstrable willingness to pay for the value-added product;
- the agency has the capability and capacity in-house or under existing contract; and
- the information technology upgrade risk is assessed and found to be small. (PC Inquiry 2018, Recommendation 9.1).

The key point about the risks of sharing data is that the risks are well known. Therefore, projects for freight data and information can focus their attention on measures to mitigate and eliminate these risks in a number of ways, in design, in contractual and licensing arrangements and in business and operating safeguards (see also section 3.5).

3.3.5 Framework – accessibility

Access to data and information can be viewed from several different levels. Karl (2006) in an Austroads Research Report on road use data pricing, partnerships and accessibility looked at reporting of data which entails making data available to a range of users at differing levels of access. Such considerations include:

- storage formats which should be clearly stated for easy unpacking and processing;

- download formats which should include the most commonly used applications (pdf, spreadsheets, zipped, etc.);
- methods of access which should include traditional hard copies and more common electronic forms of access (internet, dial up, help desk, etc.);
- improved levels for access, for example access facilities that allow direct queries (which can be specified by the user) to be generated; and
- limitations on sensitive and commercial information (if any).

Organisations hold divergent views on the nature of 'release' of the materials at varying levels of detail, from the underlying raw data through to the final published information. In some cases (eg. in contract bidding) a common data set or 'data release' is required for competitive neutrality. In fact, it has been argued that active and effective use and appraisal of data can substantially improve the likelihood that data collection will be able to justify more attention in the future to the special needs of applications users. As more users use the data, there is consequently more support for the continued collection and even expansion of the data set.

For example, in consideration of issues associated with access, the Bureau of Meteorology (BOM), has stated its position with three categories of access:

- to the community, which is called the 'basic service' and is made available free of charge in the public interest;
- specialised services, which fall outside the 'basic service' and charges made to the users; and
- to civil aviation and the defence forces, which is part of the BOM's responsibilities and is charged on an incremental basis (calculated to reflect the cost of provision of the service additional to that of the 'basic service').

3.4 Options for hosting, governance and dissemination

This section details a range of options for hosting, governance and dissemination of freight data and information.

3.4.1 Freight observatories

'Freight Observatory' is the term given to an institution or system that is intended to "…collect, analyse and publish freight performance data for all freight modes and supply chains to better inform decision making and investment, with appropriate governance arrangements and the potential for this function to be held by an independent body that has industry confidence" (NFSC 2018a).

According to McKinnon (2015) the objective of a Freight Observatory is to collect enough information to be able to answer four public policy questions:

1. How much freight is being moved?

2. What are the origins and destinations of the freight?

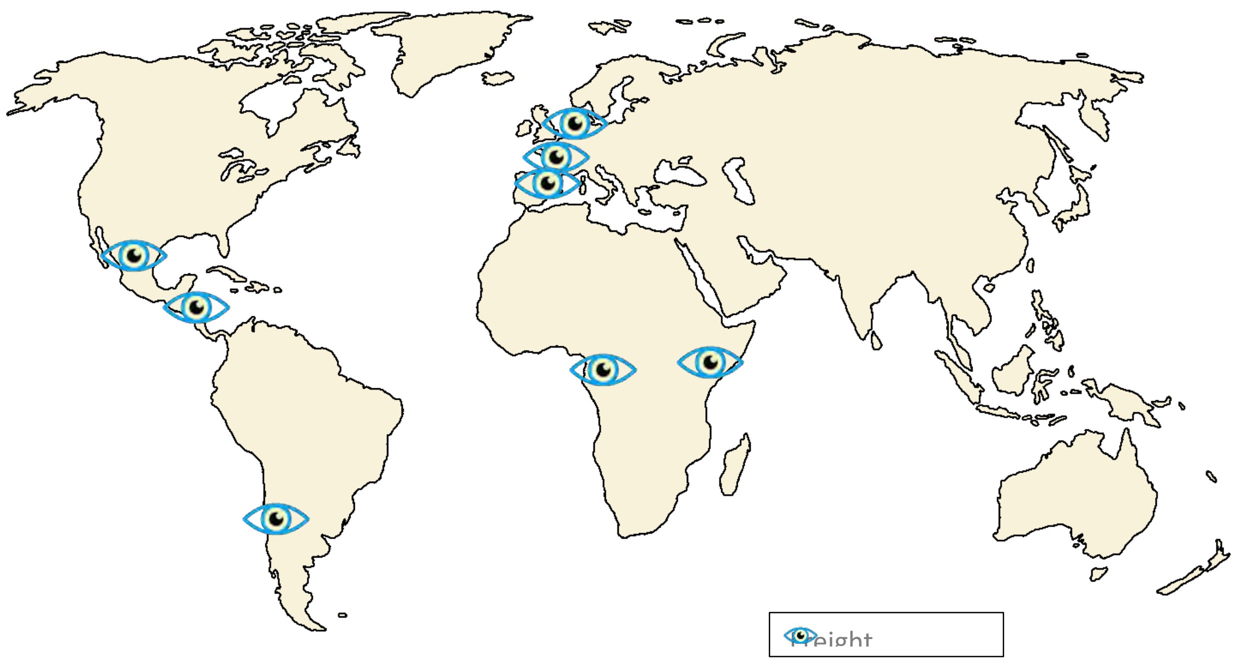
3. What is the relative use of different transport modes?

4. How efficiently is freight being transported?

Together, the answers to these four questions build a picture of the aggregated journeys of all freight and – if answered in sufficient detail – with the ability to drill down to understand the movement of individual shipments. The closer this ideal can be approached, the better actions to increase efficiency and effectiveness can be identified.

Freight Observatories exist or are in development in a number of nations around the world (see Figure 3-9). The countries found to have Freight Observatories are: Chile, France, Gabon, Kenya, 'Mesoamerica', Mexico, Netherlands and Spain.

Figure 3-9: Freight Observatories (existing or in development) around the world

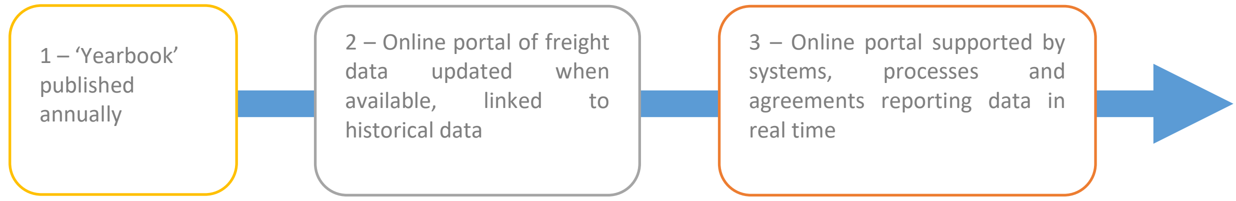


Source: ARRB, 2018 (adapted).

The extent of what is meant by a 'freight observatory' tends to be based on the nature and extent of data available prior to planning and development of each nation's freight observatory. The first step for many nations is to be able to produce 'yearbooks' that collect and/or collate information about freight movements, transport infrastructure, freight assets, and costs.

Australia has an established practice of reporting annually on data of this type through the Australian Bureau of Statistics and the Bureau of Infrastructure, Transport and Regional Economics, based on surveys and other types of reporting (Stage 1 as shown in Figure 3-10). However, this information does not provide data in enough detail to be able to identify inefficiencies to be addressed or inform effective infrastructure investments.

Figure 3-10: Stages in the development toward a freight observatory



Source: ARRB, 2018.

The next stage of development towards a Freight Observatory would be to host the information in an online platform. The advantages of this stage over the annually published information are:

- improved access to and representation of data (through use of a graphic user interface);
- both current and historical data available from a single location; and
- can be updated at any time as data becomes available.

This seems to be as far as many of the freight observatories internationally have advanced.

The final stage once the online portal is established with a responsible institute in place is ongoing, where the system can mature over time as agreements to supply data are formed, and technological solutions to collecting and reporting information are developed and implemented. Further maturity is achieved as these processes become increasingly automated.

There are technical, commercial and political challenges that would need to be overcome for this to be achieved in Australia and is likely to take many years. A realistic approach is to establish processes and agreements now that are able to mature over time to eventually achieve a better representation of freight in Australia over a longer time frame.

In April 2018, Infrastructure Partnerships Australia released a report recommending the creation of a single national statutory body called Freight Performance Australia (IPA 2018). An excerpt from the executive summary is attached in Table 3-5. A four-stage implementation plan was proposed which comprised of objective setting, establishment, publishing indicators and information dissemination and engagement with the key stakeholders. No budget for the proposed entity was provided but an indicative annual budget was suggested in the $11.5 to $47 million range (IPS 2018, p.57).

Table 3-5: Freight Performance Australia

Fixing Freight: Establishing Freight Performance Australia Freight Performance Australia would be charged with addressing data and information gaps. It would provide a basis for a much clearer measurement of the problems – and a much clearer understanding of the solutions that will restore the competitiveness of Australia's freight market. Freight Performance Australia would be established as a statutory, independent national agency with governance processes that ensure appropriate connections to government agencies, freight providers and customers but also appropriate independence from each. Our consultations with industry in the development of this work confirm a greater willingness to provide data to an independent body, with requisite statutory protections, than to a private company or traditional government department. This concept is not new. Various countries across the world, such as Chile and Spain, have made steps towards deepening their understanding of the performance of the freight network. This international experience is valuable because we can draw lessons to guide the establishment of an Australian body. Existing freight measurement agencies and observatories around the world vary in structure (ie. public, private or both), scope, modes covered and objectives. In general, they aim to strengthen and facilitate decision making and support robust policy and regulation through three broad functions: • freight and logistics performance indicators • measurement of externalities such as congestion and environmental impacts • specific policy or analytical reports - for example, using its information and data to inform sector-wide policy, investment and structural considerations.

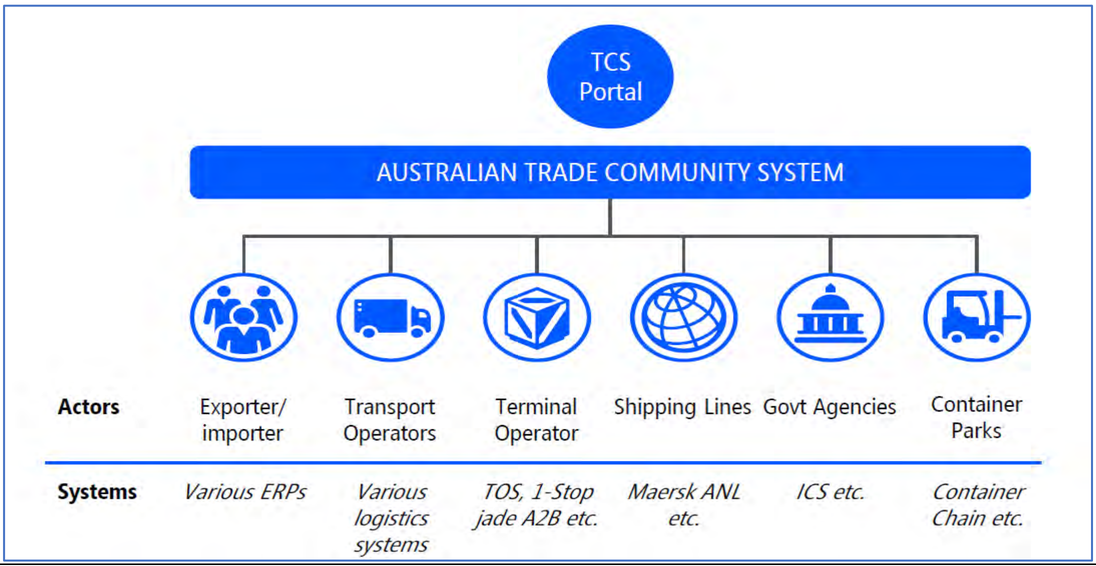
Source: IPA, 2018, p.4.

3.4.2 Trade Community Systems

A Trade Community System (TCS) is a platform where participants in the supply chain can share information securely in order to drive productivity and service innovation through trusted end-to-end visibility of the supply chain (PwC 2018). In contrast to traditional Port Community Systems (EPSCA 2018), a TCS would operate beyond the boundaries of the port community to the source and final destination of goods.

PwC are working with the Australian Chamber of Commerce and Industry and the Port of Brisbane to initiate a pilot TCS with blockchain technology. A six-month pilot program is proposed in mid 2019 with the first three months devoted to development and integration of the pilot platform to run in parallel with the supply chains of two significant Australian businesses and their supply chain actors. The subsequent three-month period will then focus on assessing the technological and commercial impacts of the TCS concurrently to evaluate and refine identified costs, benefits, risks and opportunities. The outcomes will feed into an investment case to build out a complete national TCS solution (PwC 2018). The proposed pilot platform is shown in Figure 3-11.

Figure 3-11: TCS Pilot - proposed



Source: PwC, 2018.

PwC noted that anecdotal evidence suggested previous attempts suffered from a perceived lack of IT capability, a lack of support from key stakeholders, perceived conflicts of interest and a desire to maintain the status quo. Combined, these issues resulted in a lack of industry-wide support, despite the identified benefits. PwC further set out a roadmap outlining four stages of the Trade Community System, from proof of concept stage to their currently proposed pilot in 2019 and subsequent growth and commercialisation stages (Figure 3-12).

Figure 3-12: TSC Roadmap

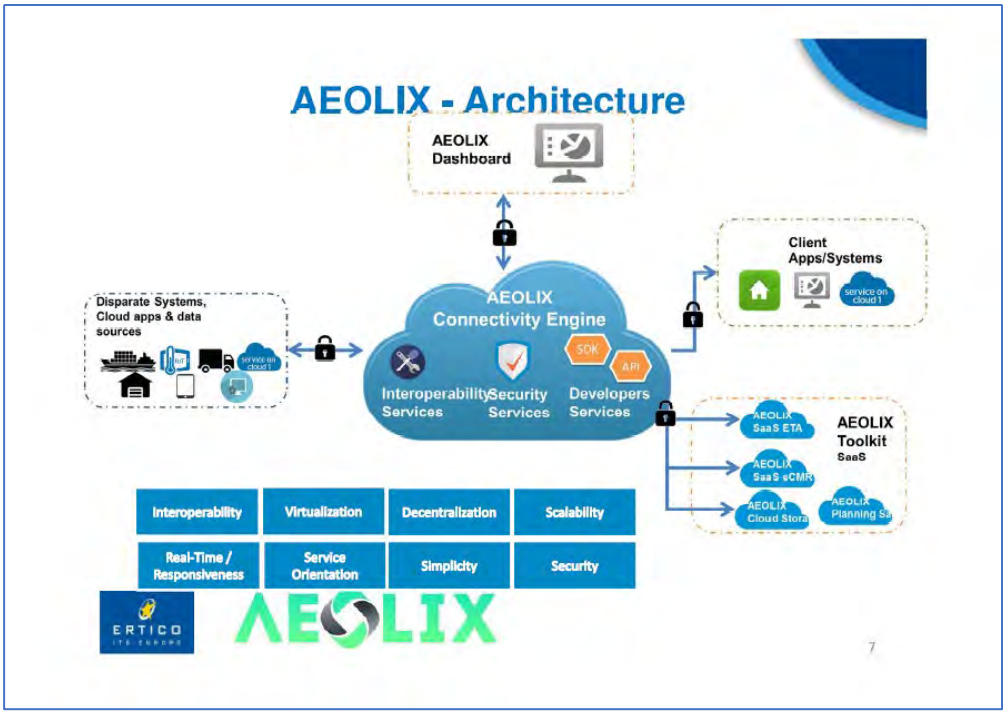
Source: PwC, 2018.

Such a roadmap provides a good example of the stages of development required for freight data and information generation which is typical for such ventures and sets out the possible involvement of industry, government and technology suppliers at each stage of the development.

3.4.3 AELOIX

The Architecture for European Logistics Information exchange (AEOLIX 2018) is an open cloud ecosystem facilitating collaboration and information sharing, real-time and responsiveness, simplified integration and performance in pan-European logistics (ERTICO 2018). It is a three-year program that started in Sept 2016 to Aug 2019 with EU funding of 16mil euros, 30 partners and 12 living labs (www.aeolix.eu). The AEOLIX architecture is shown in Figure 3-13.

Figure 3-13: AELOIX architecture

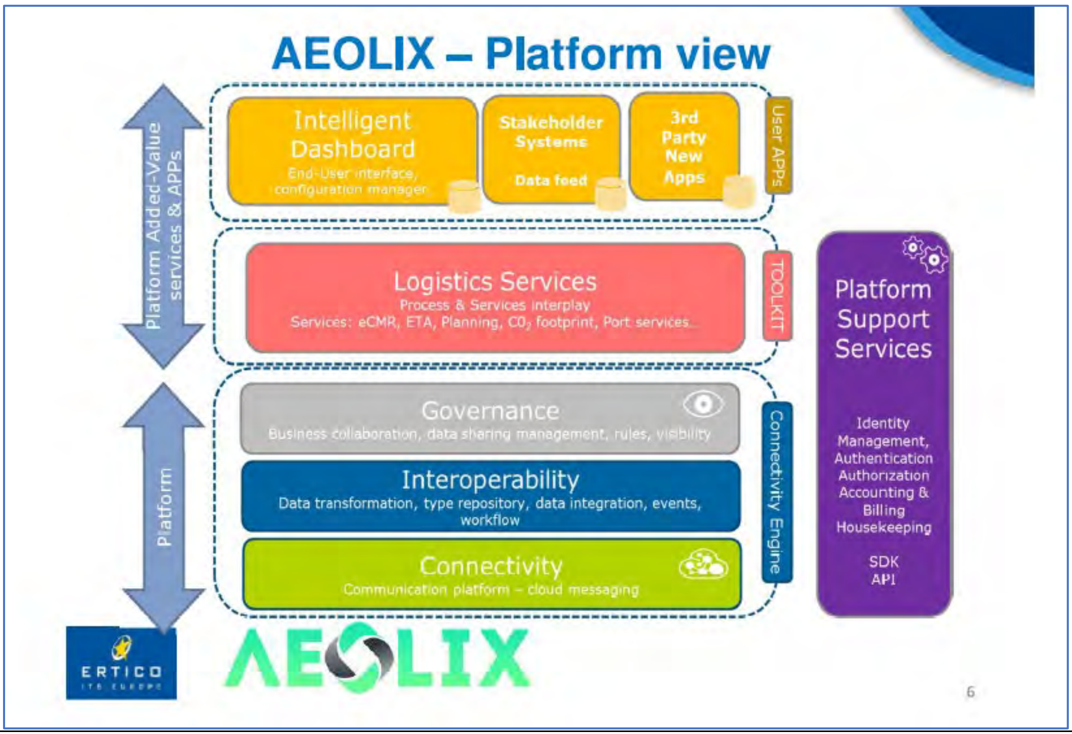


Source: AEOLIX, 2018

AEOLIX will develop a platform for connecting logistics information systems of different characteristics, intra- and cross-company, for immediate (real-time) exchange of information in support of logistics-related decisions (AEOLIO 2018). The ambition is to develop architecture for a distributed open system which will exchange information among key logistics actors (commercial companies as well as relevant authorities), enabling increased use and impact of such information in the value chain. During the project, logistics related business issues have been selected as use cases to be researched at different Living Labs to validate and demonstrate the benefits of the platform.

The platform view of AEOLIX is shown in Figure 3-14. In combination with the proposed PwC TCS system detailed earlier, the developments in AEOLIX across the EU and the linkages with the Australian TCS initiative linking in the future is obvious and capable of delivering significant benefits to the freight and logistics industry.

Figure 3-14: AEOLIX platform view



Source: ERTICO, 2018.

Another EU project that links into AELOIX is InterCor. InterCor Corridor is a program for the deployment of interoperable ITS services in Belgium, France, The Netherlands and the United Kingdom. This project has just commenced in mid-2018.

InterCor intends to streamline and pilot selected 'day 1 services' in four EU member states and to facilitate first assessment of co-operative-ITS services on freight and logistics by building a common hybrid communications architecture for: (i) traffic management (in-vehicle signage, probe data, road work warnings and GLOSA – green light optimised speed advisory, and (ii) freight and logistics (truck parking, multimodal cargo and tunnel logistics) (ERTICO 2018). Three test sites in the UK are proposed; rural, urban and inter-urban.

There is value in considering Australian representation in the program as an observer to learn and ensure compatibility with local initiatives.

3.4.4 Customs Integrated Cargo System data

The Integrated Cargo System (ICS) administered by the Department of Immigration and Border Protection is the only method of electronically reporting the legitimate movement of goods across Australia's borders. The NTC and the Department of Immigration and Border Protection (DIBP) have been working together under arrangements consistent with the Commonwealth guidelines for data sharing, to establish access to information about the movement of commodities across Australia's borders. Non-sensitive DIBP data about commodity movements at a de-identified, aggregate level have been produced and are available to governments (NTC 2017c). The NTC is currently considering the processes to make the data available to private port operators.

The 'Who Moves What Where' report (NTC 2017a) identified a lack of detailed commodity information, which meant planners couldn't map the movements of freight types across Australia, or fully understand consumer demand and the related transport network demand. Subsequently the NTC approached the DIBP in mid-2016 and discussed opportunities for transport planners to access non-sensitive data from the DIBP's Integrated Cargo System (ICS) about commodities arriving into and leaving Australian ports. It was agreed that at a de-identified, aggregate level this information could significantly aid transport decision making.

The NTC continued work with DIBP at officer level to agree data fields and a report template to be provided to the NTC on a quarterly basis. As there was nothing in the data that identifies individuals or companies, the NTC was also able to provide data access to State and Territory governments for their own analysis purposes.

To do this, the NTC established a cloud-based solution where all jurisdictions were able to access and download the data. The first report was provided for the January – March 2017 quarter. The NTC has developed a SharePoint site where jurisdictions are able to access and download the reports for their own analysis purposes each quarter. Since that time, the CSIRO has been able to produce some sample freight flow maps utilising the data (NTC 2017c).

The above example provides a great example of agencies working together to release valuable freight data for both governments, research and industry.

3.4.5 Transport Certification Australia

In addition to managing the IAP and other regulatory telematics programs, Transport Certification Australia has been involved in projects and developing tools to enable improved data and road usage analysis and information based on telematics data collected from in-vehicle systems. These include

- Road Infrastructure Management (RIM) application – utilises telematics data to generate large pools of de-identified data to support operations, planning and investment;
- Traveller Information exchange – a centralised operation with service providers to provide more timely information to HV drivers;
- IAP lite – development of a telematics platform for industry monitoring applications; and
- Enhanced data analysis – supporting industry and governments in providing specialist services in data analytics of telematics data.

A listing of TCA's relevant projects in data and capabilities in data and road usage analysis and information, supplied by TCA for this report, is shown in Table 3-6.

Table 3-6: TCA data projects and capabilities

Relevant TCA projects and new functionalities for data and road usage analysis and information	
Road Infrastructure Management application	**Title**: Road Infrastructure Management (RIM) application **Objectives**: RIM App is aimed at supporting planning, operations, maintenance and access decisions. Potential for public dissemination of routine analytics. **Description**: RIM will utilise data from participating operators and vehicle owners (on an opt-in basis) to generate large pools of heavy vehicle road usage data for analysis. TCA will collect, de-identify, aggregate and analyse data from wide range of heavy vehicles to support broader analysis of road network utilisation. **Partners**: TCA lead, RMS and TMR working to implement early trials. Service providers supporting development.
Traveller Information Exchange	**Title**: Traveller Information Exchange (TIX) **Objectives**: Better information about the road network to drivers and operators, in vehicles and for schedulers. **Description**: Create a framework for data from many different sources can be centralised, and easily disseminated in a standard format to service providers for telematics users to receive in vehicle. Heavy vehicle rest areas, and Port of Fremantle access information are initial data sets for dissemination. **Partners**: TCA lead. Initial partners TMR, DPTI, Port of Fremantle and Rod Hannifey. All other road agencies have been involved in application development, and service providers are supporting development.
IAP Lite	**Title**: IAP Lite **Objectives**: Improving the suite of risk management tools (as available access conditions) for road managers and industry – IAP lite is a lower assurance telematics monitoring application for lower risk transport tasks. **Description**: IAP Lite enables vehicle-specific monitoring, without the 'gold standard' – looking at systemic (non-compliant) behaviour rather than non-conformance reports, with robust data on vehicle behaviour without the burden of systems required for evidentiary quality data. An example of a potential IAP Lite application is for certain Over-Size, Over-Mass vehicles.

Relevant TCA projects and new functionalities for data and road usage analysis and information	
	Partners: TCA lead, DIRD, RMS, TMR and Tasmania working to develop early trial proposals. Service providers supporting development.
Enhancing data analysis capability	**Title**: Enhanced TCA data analysis **Objectives**: Supporting more streamlined research analysis for clients of TCA, with improved data analysis functionality. **Description**: TCA is investing in faster computing power, and has commenced a data enrichment process to streamline analysis when needed, and to add value to data stored in the TCA data warehouse. **Partners**: TCA lead.
Make the TAP more widely available	**Title**: Improved access to and functionality of TCA's telematics analytics platform (TAP) **Objectives**: Increase accessibility to existing data, supporting new applications and improving the functionality of analysis through TCA's TAP. **Description**: Developing potential for local governments to access TCA's TAP on a 'self-service' basis, as well as requesting research and analysis from TCA directly. Increasing the availability of data analysis from new applications through the TAP, broadening the 'standard' analysis tools available through the TAP, based on common searches and research requests (for example, average speed and vehicle counts across a particular bridge). **Partners**: TCA lead.

Source: TCA supplied, 2018.

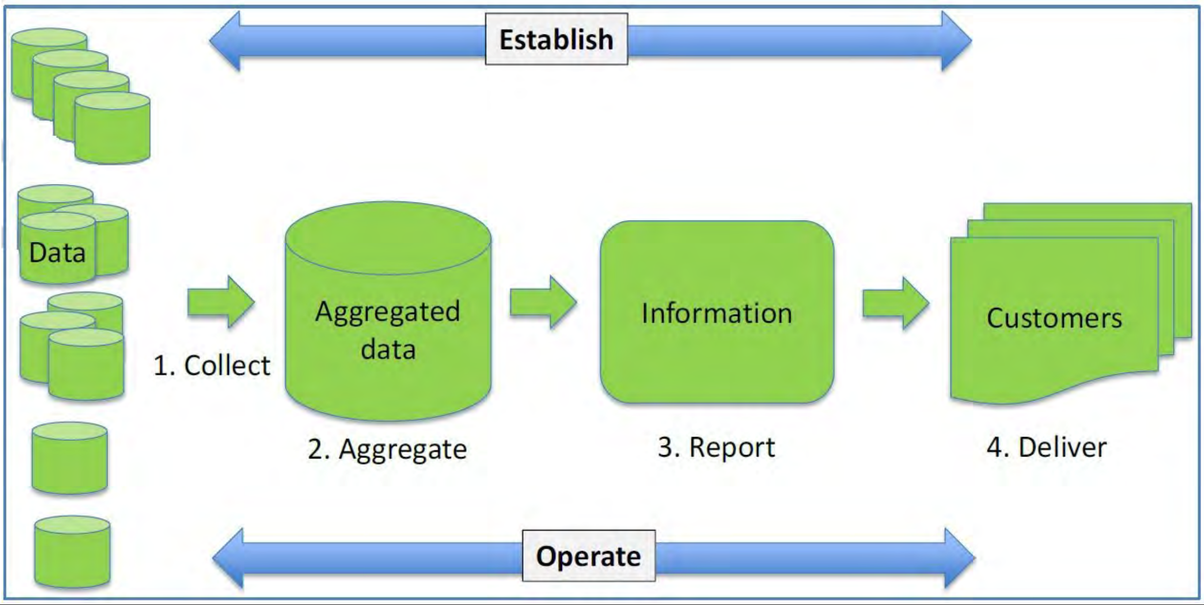
3.4.6 Freight movement data collection service

During 2015, discussion took place between Main Roads Western Australia (Main Roads), Fremantle Ports, the Western Australian Road Transport Association (WARTA), the Department of Transport (DoT), the Freight and Logistics Council (FLC) and ARRB Group Ltd (ARRB) on the collective benefits in developing a comprehensive data collection capacity sourcing government and private sector transport data on the movement of heavy and medium sized freight vehicles. This would be principally in the metropolitan area but would also have value for regional movements. The agencies saw merit in investigating the establishment of a Freight Movement Data Collection Service (Service) of which they would become the foundation partners.

The discussions focused on: (i) ways of developing a one language/one platform system to merge various government and private sector data sets; (ii) generating reports on truck movements across the metropolitan area including port related information; and (iii) identifying the cost to establish such a Service. To give some direction to this discussion, ARRB was asked to provide advice on the establishment of a Service with the aim of delivering benefits and savings for government agencies and transport industry groups through the provision of a one stop shop for freight movement information (ARRB 2016).

The Service would draw on relevant data sets from various sources and platforms and aggregate these into a consolidated format under standard headings. This allows for the information to be tailored to individual customer requirements. The data would come from existing government data sets and from industry information, particularly the larger trucking companies. Other platforms such as HERE, Google, on-board vehicle reporting platforms, collection of data from telematics and cameras would also be utilised. The operation of the service is depicted in Figure 3-15.

Figure 3-15: Service operation for data collection



Source: ARRB, 2016.

A three staged approach was proposed with scoping, a data collection pilot followed by the establishment of a full-scale freight movement data collection service.

3.4.7 Bureau of Transport and Infrastructure and Regional Economics

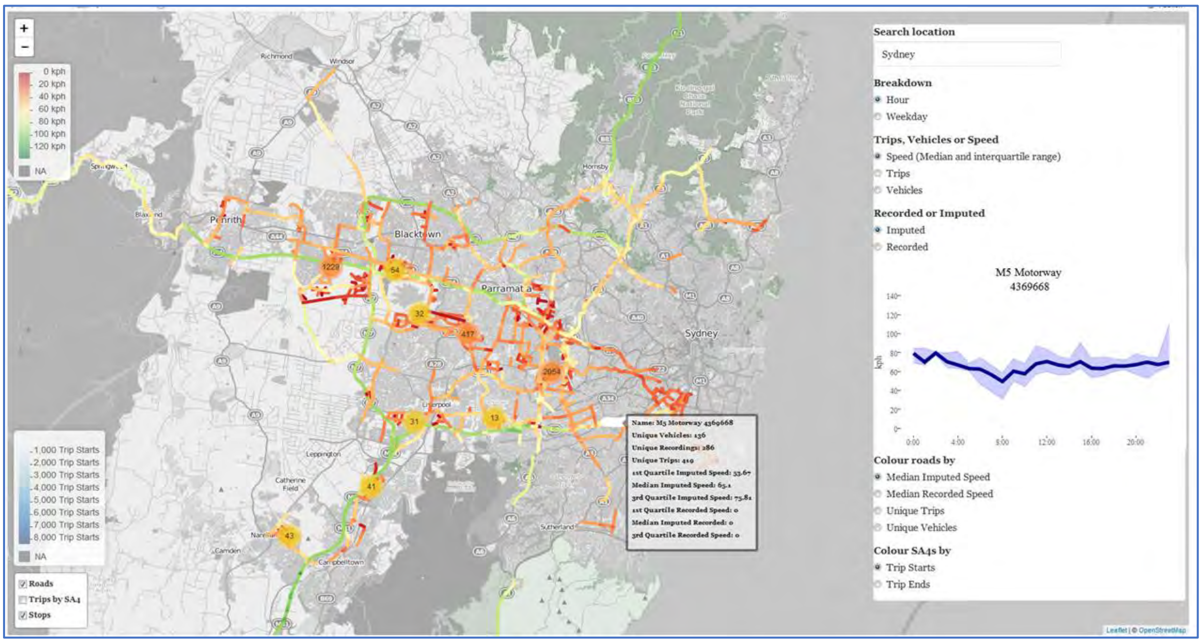
BITRE is undertaking a range of projects to improve transport data, including making use of GPS data from trucks and through better measuring in-house transport activity. In addition to these activities, BITRE in the production of the National Infrastructure Data Collection and Dissemination Plan (BITRE 2018a) and its listing of 16 priority projects displays that it has extensive knowledge of freight data projects in Australia. Its Freight Performance Dashboard, short-listing of enduring questions for freight and initiative in progressing work in truck telematics data collection and on developing supply chain indicators and piloting data collection (BITRE 2018b unpublished) shows its motivation and determination to improving transport data.

Two sample outputs of the freight performance dashboard and aggregated truck telematics data are shown in Figure 3-16 and Figure 3-17 below.

Figure 3-16: Freight performance dashboard

Source: BITRE, 2018.

Figure 3-17: Truck telematics data - Sydney



Source: BITRE, 2018.

3.4.8 Other Initiatives

In addition to the above initiatives, several other organisations maintain information platforms containing freight data for a range of purposes. This section is a review of various information platforms to identify the various arrangements for hosting freight data; and the nature and extent of the accessibility/dissemination of the data from those platforms.

A number of state road agencies have Data Portals. The availability of data can be defined by both the extent of the data and the form it is made available in. The *extent* of the data can be described as:

- limited – referring to a limited range of data types provided as high-level summaries, usually for the network as a whole;
- broad – referring to a wide range of data types being made available, but in most cases still at a high level that lacks detail; and
- extensive – referring to a wide range of data types that is made available in high detail; eg. by location and not averaged over time, etc.

Likewise, there are generally three forms (or levels) of *availability*:

- reports – where usually summarised data is presented in documents that are published or available for download.
- datasets – where raw data is available for download from websites in simple data formats such as text or csv files.

- data portal – where users can access data through a dedicated interface that includes user-friendly features to assist searching and ultimately even previewing/displaying data.

A Data Portal is largely distinguished from a website with downloadable datasets by a conscious design effort to build a user-oriented platform that can mature over time with richer data and more sophisticated tools.

These descriptions are all points on the data extent or availability continuums rather than strict categories and provide only an approximate indication of how far organisations have progressed toward the full dissemination of data that may be ultimately needed under the National Freight and Supply Change Strategy. The Table 3-7 below summarises a view of the policy, extent and availability of data provided by each of the states and territories in Australia.

Table 3-7: Summary of governance of freight data

Jurisdiction (Agency)	Data policy	Data extent	Availability
ACT (Transport Canberra)	Open	Broad	Data Portal
NSW (Transport for New South Wales)	Open	Broad	Data Portal
NT (Dept. of Infrastructure, Planning and Logistics)	None	Limited	Reports
Qld. (Dept. of Transport and Main Roads)	Open	Broad-Extensive	Data Portal
SA (Dept. of Planning, Transport and Infrastructure)	Open	Broad	Datasets
Tas. (Dept. of State Growth)	Open	Limited	Datasets
Vic. (VicRoads)	Open	Broad-Extensive	Data Portal
WA (Department of Transport)	Open	Broad-Extensive	Data Portal

Source: NTC 2017a.

There are also a large range of other data portals reported elsewhere and noted below:

- National Exchange of Vehicle and Driver Information System (NEVDIS).[6] This is the database of Australian driver and vehicle information. It is a primary source of information about the national operator and fleet profile.

[6] https://austroads.com.au/drivers-and-vehicles/nevdis/about-nevdis , (NTC 2017c).

- Australian Bureau of Statistics – Transport Satellite Economic Account: An Experimental Transport Satellite Account 2010-11 to 2015-16 ABS 5270.0, and Information Paper: A future Australian Transport Satellite Account: ABS Views 2011, ABS 5269.0.55.001

- National Road Safety Partnership Program, https://www.nrspp.org.au/ , (NTC 2017c)

- CSIRO Transport Network Strategic Investment Tool TraNSIT, https://www.csiro.au/en/Research/LWF/Areas/Landscape-management/Livestock-logistics/TRANSIT ,(NTC 2017c)

3.4.9 Discussion on options

A summary table of the options detailed in the earlier section is provided in Table 3-8 below.

Table 3-8: Summary of governance of freight data

Options	Data collection	Processing	Access	Governance	Focus area
Freight Observatory	Internal/ external	internal	Open	Government	Planning Investment
Trade Community System	internal	internal	Restricted	Industry	Operations
AEOLIX	internal	external	Restricted	Industry	Operations
Customs Integrated Cargo Systems	internal	internal	Restricted	Government	Planning Investment
TCA data / platform	external	internal	Restricted	Government	Operations Planning Investment
Freight movement data	external	internal	Restricted	Research	Operations Planning
BITRE	external	internal	Open	Government	Planning Investment
ABS TrSA	external	internal	Open	Government	Planning Investment
CSIRO TraNSIT	internal	internal	Open	Research	Planning Investment
NEVDIS	internal	internal	Restricted	Government	Operations
NRSPP	Internal/ external	internal	Open	Industry	Operation Planning

The table shows that industry activities in freight data are more operationally focussed while government activities are weighted towards planning and investment needs. Industry data is restricted access while more government options have open access. More importantly, most options involve internal processing, so there could be some scale economies in closer co-operation on back offices and technologies.

4 Review and classifying priority projects

This section reports on a survey undertaken for this report on a range of priority projects involving freight data in Australia. It was expected that a study of the projects would lead to learnings in many key areas associated with the governance, hosting and dissemination of freight data, mentioned earlier in this report, providing a ground-truth based on local experiences. Further investigation could later be undertaken targeted projects and their stakeholders for greater insights and guidance as necessary.

4.1 Background

The idea for this study was based on the listing of 16 priority projects found in the BITRE Data Plan report (BITRE 2018a). Each of the 16 projects in that report were detailed and listed against a range of key enduring questions that data produced would inform.

We undertook an investigation based on in-house knowledge and contact networks to identify other freight data related projects. Given the time constraints of this report, only a high-level description of the projects we found is provided. In total a further 36 projects were identified. The complete list of the 52 projects is provided in Attachment 3. The 16 projects from BITRE are included and distinguished in grey shaded rows.

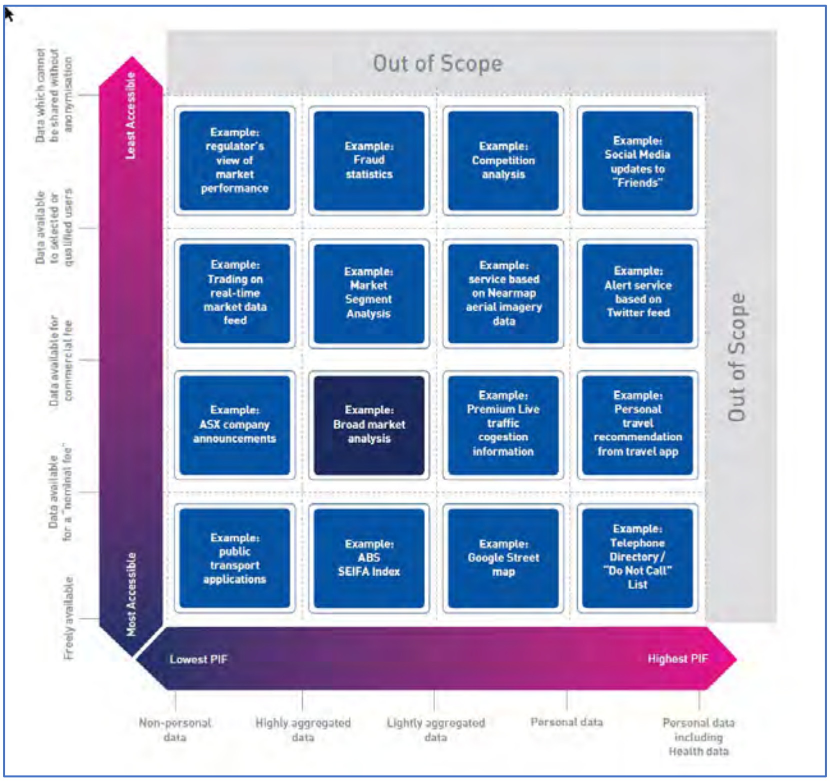
This is a significant finding, as while we are at beginning on the journey of public/private freight and logistics data, it is encouraging to find a great number of local initiatives.

4.2 A classification framework

The next step was to identify a lens through which to look at the 52 projects. For this we used a matrix developed by the Australian Computer Society (ACS 2017, p.55) which ranked degree of accessibility on one axis and degree of confidentiality on the other axis.

Figure 3-18 below depicts the sorts of data/information that would fall into the space between the two axes. In the bottom left hand quadrant, where the data/information is highly accessible and of no commercial sensitivity, we have data such as public transport timetables and applications. At the other end of the scale in the upper right-hand quadrant, where the data or information is highly restricted (or least accessible) and the information is highly sensitive, such data/information could be social media updates to ‘friends”, as shown in the figure.

Figure 3-1: Accessibility and confidentiality matrix



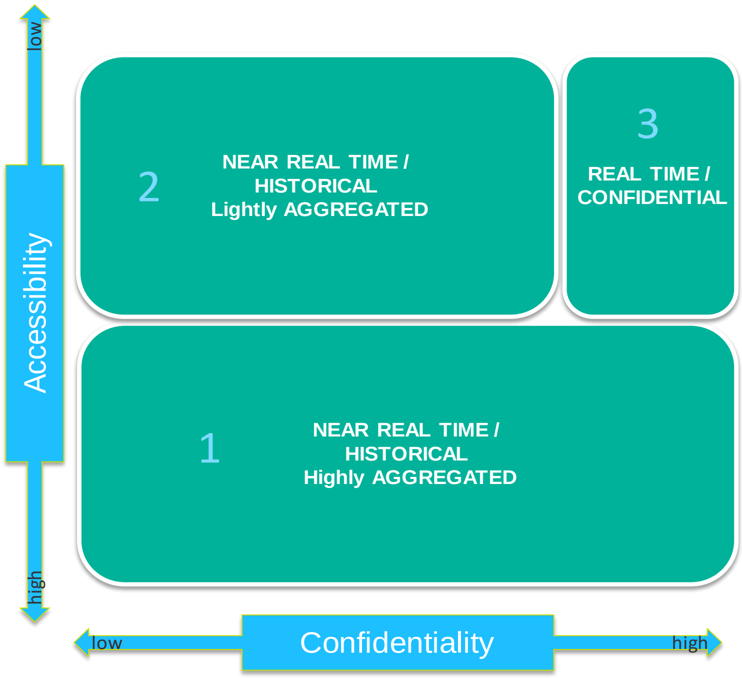
Source: ACS, 2017.

In transposing this lens for freight data, we considered three groups;

- Group 1 - Highly aggregated freight data/information (historical or near real time); for example, road link travel times, weigh-in-motion data by axle groups and vehicle classification;
- Group 2 – Lightly aggregated freight data/information (historical or near real time); for example, Bluetooth data based on MAC address on a road link, truck telematics data, mobile phone data at SA1 level, supply chain data along a key route; and
- Group 3 – Confidential freight data/information (real-time)
    - For example – identifiable compliance and enforcement data, individual supply chain data, image data, e-tag data, individual tracking data.

Figure 3-19 below shows the three groups developed for this report. Group 3 appears at the top right-hand side of the matrix the data is personally identifiable and therefore confidential to the operator or business and has highly restricted access. Group 2 has lightly aggregated data but such data is still sensitive or confidential as it relates to commercial operations, products and $ values. Finally Group 1 data is more highly aggregated an of a less sensitive commercial value.

Figure 3-2: Matrix for 52 projects



Source: ARRB analysis, 2018.

4.3 Key observations

The selection of the projects into the three groups was subjective. While there may be differences in group allocation with other selectors, it is probable that the difference may be small. There were 23 projects listed in Group 1, 15 projects in Group 2 and 14 projects in Group 3, making a total of 52 projects. The details of the projects in the three groups are listed in Attachment 4.

The common elements and differences in the groups are described below.

4.3.1 Common elements: Groups 1 and 2

Investment and planning focus – information and reports

The objectives of a number of projects in these two groups were to produce information and reports for specific purposes. The purposes mainly related to planning and investment requirements. Hence the creation of the priority projects was to enable the collection, integration and presentation and dissemination of specific data/information for the stakeholder needs.

Larger perspective, eg. supply chains, infrastructure investment

The projects in these groups mainly had a larger perspective or scope – eg., national or state level, a supply chain, infrastructure access, asset pricing, platforms for exchange, aggregation of specific data and information, network performances, etc.

Products and services

- In development and mature
- Product and service development

The groupings also include more mature data/information products and services that once started as proof of concepts and trials with a smaller scope and pool of data. In this area, we can find examples where private data is available as a service or product which is then utilised or supports in the creation of new data/information required in addressing other data/information gaps.

Data standards / guidance / methods

In support of the co-operation of industry and government and third parties in these projects, we also see projects developing standards, processes, platforms and tools for interoperability and scalability across many stakeholders. This then links into international activities.

Combining datasets to inform for information gaps

A further few projects involve integration of disparate data collections which when presented together provide more insights for government and industry. The task of refine data into a common set of units and co-ordinates is not trivial as each stakeholder often have their own way of storing data. Modelling, crash data, traveller information data, road use and road condition data, mass data, freight type data, congestion data and incident data are some such examples.

Proof of concepts / trials

As mentioned earlier, some of the specific projects are not just desk based, but involve real world, in field trials requiring sensors, infrastructure, collection systems and connectivity to provide the content for transformation into data and information. Some projects also work the opposite way and disseminate the information back to roadway systems, message boards and road users.

Frameworks

At a system level these projects also develop and transfer knowledge to all the stakeholders involved which then lead to projects reviewing frameworks, performance measures (new and improved), processes, tools and policy.

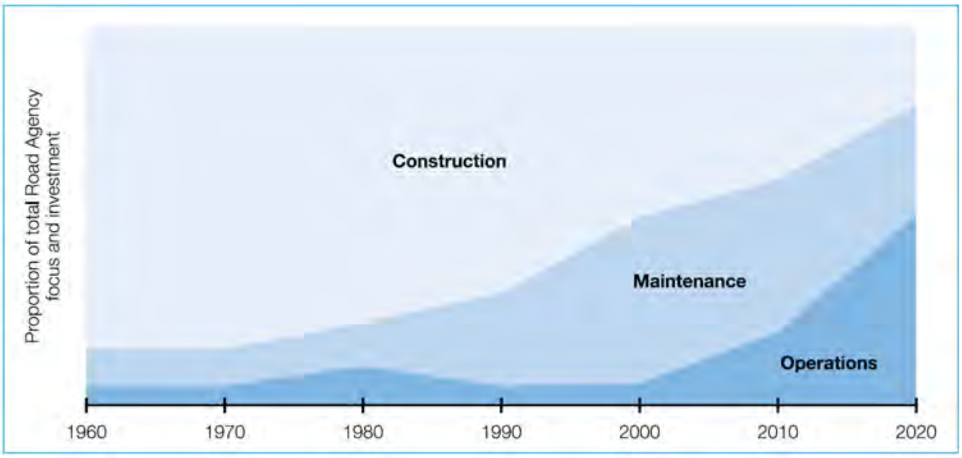
4.3.2 Common elements: Group 3

While many of the elements identified from Group 1 and 2 could also apply to Group 3, the key difference is that the Group 3 data/information needs are for real-time operational needs, be it as part of the supply chain and logistics operations, or government operations in traffic management (priority, green light progression, incident management), monitoring and compliance (mass, access, fatigue, speed, parking, etc).

Thus, some of the issues raised by industry in terms of timeliness and reliability, are key areas that can be addressed with the data and information enabled and generated from Group 3 projects. The data generated is critical as it provides the feedback loop for fine tuning business and technical treatments and interventions to supply chain logistics and network operation.

Figure 3-20 below shows the proportion of focus on construction, maintenance and operations of an Australian Road Agency and shows the increasing importance of real time operational data to achieve key performance outcomes.

Figure 3-3: Focus of Road Agency 1960-2020



Source: ARRB analysis 2018.

A further point is that real time data/information, if it stored in a data collection, can be subsequently used by projects in Group 1 and 2 (subject to appropriate de-identification and user controls).

1. Compliance – there are projects that continue exploring further applications of regulatory telematics, using technology over paperwork, roadside enforcement and roadside infrastructure to achieve regulatory outcomes as mentioned previously (access, speed, fatigue, mass, etc) and recently announced heavy vehicle charging initiative.

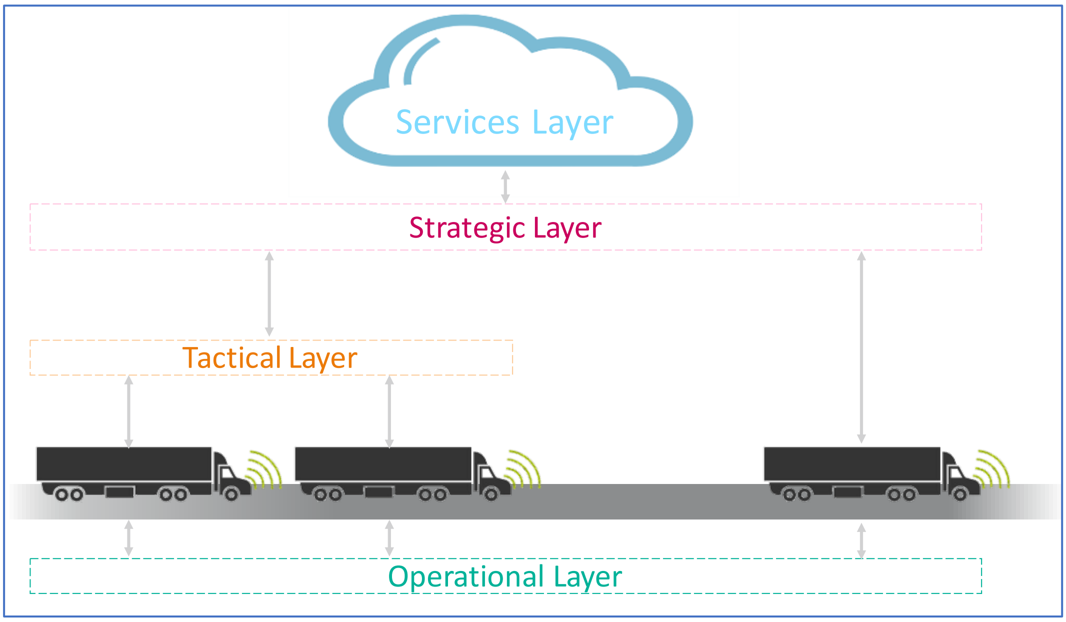
2. Operations – other projects include the CAVI (Qld), CITI (NSW) and various trials not mentioned around improved green light progression for heavy vehicles and enhanced level crossing safety between heavy vehicles and rail. The projects utilise technology to communicate between vehicles to infrastructure and have been detailed earlier in this report.

In the next generation of technology, ARRB has been involved in a number of studies and projects to trial heavy vehicle platooning. This enables the headway between trucks to be reduced thereby delivering between 8-15% fuel savings.

A figure of truck platooning is shown below, Figure 3-21. It shows that certain confidential data at the operational layer is required to be shared at the Tactical Layer so that trucks of different makes, from different operators and carrying different freight can be electronically coupled together. A further Strategic Layer is required for overall co-ordination of platooning as well as enhanced downstream visibility of other heavy vehicles, not specifically involved in the current platoon. The Services and Tactical Layers will also need to interact with the State Road Authority for permission to operate in these configurations. A trial of this system might occur as early as 2019 in Australia.

This is an example where some highly personalised and commercial data will need to be shared in order to achieved certain mutually desirable outcomes.

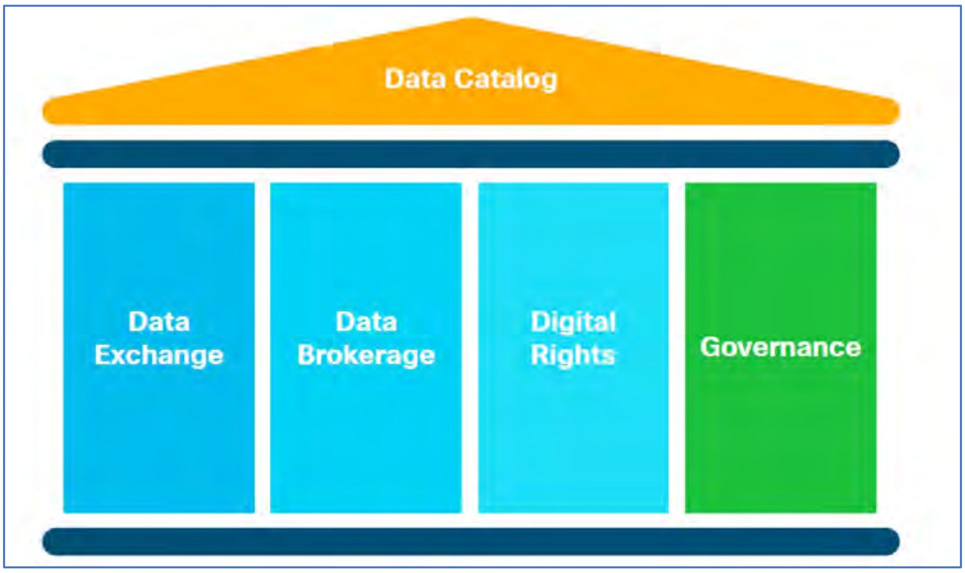
Figure 3-4: Data layers for truck platooning



Source: ARRB, 2018.

3. Exchange data – As described earlier, projects in Group 3 tend to focus on how to exchange data between the parties involved in the project. The areas of interest are shown in Figure 3-22 (CISCO 2018). As part of the project, each of the areas depicted, data catalogue, data exchange, data brokerage, digital rights and governance need to be scoped, developed and implemented for the project.

Figure 3-5: Key elements in Data Framework



Source: CISCO, 2018.

4. Big data / IoT – a number of the Group 3 projects are forward looking and investigating operational frameworks for the future of big data and Internet of Things (AIMES, https://industry.eng.unimelb.edu.au/transport/aimes and various Smart Cities funded projects). See the section on future freight data for more details.

5. Technology – a number of these projects have greater numbers of technology partners as they are showcasing or proof of concepts of new architectures and infrastructure. A number of these projects are supported under the Smart Cities Program from DIRDC (https://infrastructure.gov.au/cities/smart-cities/).

6. Administrative – at the same time, specific projects are also developing protocols and interoperability rules, standardised data inputs, developing tools, processes and social networks between the parties involved.

7. Traveller information – a couple of projects are also focussed on provide more time sensitive real time information to drivers and enforcement officers at the roadside in addition to traffic management systems as mentioned before.

8. Next generation data – in general the projects are involved in exploring, within the context of Australian field deployments in specific use case (urban, arterial, precinct, etc), a whole of system view of next generation data for transport.

9. Security blockchain – two projects are also looking at blockchain security, one project initiated by the private sector and another facilitated by transport agency.

4.4 Discussion

There is likely to be further insights that could be unpacked from a closer examination of the similarities and common elements in the 52 projects but for the present the key observations are:

1. There is such interest in this area that Australia is fortunate to host over 50 projects on freight data at the present time. We should: (i) increase our knowledge from those projects, (ii) and position ourselves to invest wisely in future projects.

2. There are some common themes within each of the projects. These common themes become the CORE elements in the system for freight data/information. We need to recognise what they are and support a national approach to strengthen the CORE which will support all projects.

3. The projects can be unpacked across several lenses: (i) data, (ii) platforms and technology, (iii) supply chains, and (iv) issues. Therefore, the selection of specific projects for implementation can be assessed or ranked upon a selection criteria based on those elements.

In further explaining the concept of the CORE SYSTEM in the Concept of Operations, the figure below provides an illustration of four silos in transport which all 52 projects touch upon, they are: (i) Freight data, (ii) Mobility as a Service, MaaS, (iii) Traffic Management and (iv) Connected and Automated Vehicles of the future, CAVs.

It can be argued that in each of the four silos there are some common elements in the Data and in the Governance, Hosting and Dissemination parts of each silo as shown in Figure 3-23. For example, for Data core, it could be standards, protocols, definitions, etc while for Governance, it could be legislation, agreements, system manager, accreditation and agreed operational processes, eg. data exchange.

Figure 3-6: Common elements in Freight and other areas in transport

Source: ARRB analysis 2018.

If 52 projects can be identified in the Freight data silo, one can imagine the number of projects that are ongoing in the other transport silos, notwithstanding other completely different domains of health, telecommunications and finance.

Stakeholder Consultations

As part of the search for information about additional projects and reviewing arrangements for hosting, governance and dissemination for some of the key priority projects, we also engaged in consultations with a few key stakeholders (BITRE, NTC, TCA, PwC, CISCO, IPA, Transurban) and industry and technology experts. Some of the key points noted are detailed below.

1. Setting up is difficult, following on is automated – several agencies remarked that considerable effort is required upfront to set up the data collection process, but once established much less effort is required as the process is largely automated. There is considerable effort required in reaching agreements, forming collaborations and getting the whole process to work both administratively as well as operationally.

2. Memorandum of understanding – again several agencies noted that their projects did not require a cash payment for the data, but an MoU covering ownership of the data and the purpose for which the data will be used for. And when the data was going to be collected from industry participants who competed against one another, how commercially sensitive information would be protected, de-identified and not used for any other purposes.

3. Different reasons for the projects coming into existence – there are a few reasons why the projects were initiated. They mainly fall into: (i) improving the data required, (ii) seeking data to solve a particular gap or issue, commercial, regulatory, research or reporting, and (iii) technical and system demonstrations of new technologies, hardware and services.

4. Need to have a problem to solve – like the above point but looking at it from the perspective of the owner of the 'problem', the problem owners are firstly: (i) government and then (ii) industry, (iii) champions, (iv) business start-ups, or (iv) technology partners looking for business.

5. Mainly government initiated – most of the projects involving freight data are government initiated (federal, state) as they are trusted (largely).

6. Phased approach – all the projects started with a small scope, problem to solve or as a proof of concept. So fewer parties were involved, they knew each other and agreed to collaborate for whatever reason.

7. Collaboration is key – all the of projects require collaboration of the data owners (usually industry) to share industry data with government and technology partners.

8. Trust was mentioned many times. The initial proof of concepts and the degree of willingness to participate crucially depended on trust of the parties involved. ACS (2017, p.59) has a way of illustrating trust as being comprised of credibility, reliability and intimacy within the context of the focus and motivations of the data collection exercise (referred to as self-orientation), see Figure

3-24. Some parties are less trusted than others, depending on their motivations, credibility and other factors that together determine their identity in the data space.

Figure 3-7: Components of trust

Source: ACS, 2017.

9. Other partners are attracted once the project is running – for example, the NTC obtaining the Customs data for governments has led to the private port operators requesting similar access; the BITRE telematics data collection is gradually increasing the pool of transport operators who are contributing data, etc.

10. Scalability problems with internal IT becomes an issue – several agencies reported that once the project is operational and data collection is automated then internal IT issues arise such as in managing the daily data collections that is delivered to the agency, computational requirements in processing the collections and dissemination challenges in making the data accessible to the approved parties. This is to be expected as these project activities are not core business of the agencies.

5 Data evaluation framework

As a general matter, setting out the policy evaluation framework that has been used to develop policy recommendations is an important part of good public policy analysis. Without that transparency, it would be difficult for the department to understand the basis of those recommendations. In this regard, this chapter sets out the evaluation framework applied to developing our recommendations.

5.1 A complicated landscape

Freight supply-chains in Australia are complex networks that utilise not only dedicated freight infrastructure such as ports and intermodal terminals, but also shared infrastructure such as the rail lines and roads that accommodate freight and rail passengers, private vehicles, trucks and public transport vehicles. A key feature of Australia's freight network is that there is a complex mix of government and private ownership across all transport modes. And different networks are subject to different regulatory regimes by various governments. Overlapping this is the fact that the Commonwealth and state and local governments act as custodians for different parts of the same network and share decision-making and financing responsibility for maintaining the network.

While there are economic and political trends at work that will continue to re-shape this environment over time, the pace of change in the transport sector since the Hilmer competition reforms of the 1990s has been slower than in other network industries (such as telecommunications and electricity).[7]

It would not be surprising that these layers of structural complexity are negatively impacting the overall efficiency of the freight supply-chain network. Therefore, we acknowledge that broader policy issues related to ownership, regulation, and asset usage charging also affect the effectiveness of Australia's freight supply-chain networks.

While making this point, for our purposes we take this network complexity as given. Firms aim to operate as efficiently as possible in the given political, policy and regulatory environment. And governments make decisions about infrastructure investment within the same complex environment.

It is not directly within the scope of this study to critique the political and regulatory structure of Australia's supply chain environment. Rather, we see greater information flow as a means to overcome some of the problems that arise from the complexity but expect that data sharing arrangements that need to be established may also be complex and multi-faceted.

5.2 Government policy objectives

Many of the recommendations that we are likely to make as part of this study will require public resources. It is therefore appropriate to consider whether government investment in these proposals

[7] The National Competition Policy Review (1993); accessed here: http://ncp.ncc.gov.au/docs/National%20Competition%20Policy%20Review%20report,%20The%20Hilmer%20Report,%20August%201993.pdf

is justified, especially given that any recommendations that are made by DIRDC will need to go through a rigorous public policy review process before funding is approved.[8]

Governments must reconcile multiple policy objectives related to individual welfare, economic growth, regional development, unemployment, effective transport networks, essential services, industry productivity and efficiency, health, public amenity, the environment and international relations (including treaty obligations).

From a broad public policy perspective, data collection, analysis and dissemination funded by the Australian taxpayer brings potential costs and benefits. Specifically, increased investment in data collection means either:

- less investment in another government priority (i.e. a rearrangement of priorities); and/or
- higher taxes (eg. general taxation or a specific industry levy); and/or
- increased borrowing (which means higher taxes in the future).

These costs must be weighed against potential benefits. For instance, government involvement may significantly add value to existing collections, particularly if that involvement facilitated the creation of new value by bringing together previously disparate data.

5.3 Policy assessment criteria

The essential criteria for assessing new policies or programs can be summarised as follows:[9]

- Effectiveness - The policy achieves its goals
- Efficiency - Benefits to the community exceed the costs
- Equity - The distribution of gains or losses across the community is acceptable
- Good governance - There is a transparent and accountable institutional framework for the implementation of policy

The primary policy assessment tool used by governments is cost benefit analysis (CBA). CBA can be used to assess whether community welfare would be increased by (say) publicly funding a freight data observatory compared to the relevant alternatives (which may involve doing nothing, sharing the cost with the private sector, or mandating the private sector to establish and fund a similar body).

A CBA compares all benefits of a project, with all of its costs (including social and environmental costs), using a methodology that discounts values into a common base year. If the benefits exceed the costs,

---

[8] New federal spending proposals are subject to review by the Cabinet Budget Review Committee (CBRC), which is a subcommittee of Cabinet generally comprising the Prime Minister, Treasurer, Finance Minister and the Minister proposing the new spending.

[9] Productivity Commission, (2006, Chapter 7).

a project is evaluated as 'net beneficial' and society would be better off if the project is implemented. Because net benefits are measured in dollars – CBA has the advantage that results can be compared across competing projects.

Like all government spending, there is a need to ensure that any publicly-funded activity is cost effective. Government spending that does not pass an appropriately defined cost-benefit test would likely detract from Australia's wellbeing. That is, when taxpayer funds are not put to their best use, Australia's wellbeing is not as high as it otherwise could be.

5.4 What is the purpose of collecting freight data?

In commissioning this study, DIRDC has asked us to identify what freight data are required to improve freight related planning, operations and investment decision-making, or, more broadly, what freight data are required to improve the efficiency of Australia's freight supply chain. Efficiency is thought of as having three components:

- productive (short-term) efficiency, which is concerned with minimising costs (broadly defined) in a given environment with existing investments and infrastructure, for instance, by trucking goods between two points via the most direct route;
- pricing (short-term) efficiency, which is concerned with sending the 'right' price signals that reflect the underlying opportunity costs, for instance, by raising or lowering charges depending on whether the capacity utilisation of a port is particularly high or particularly low; and
- dynamic or investment (long-term) efficiency, which is about ensuring that the investments which are undertaken are 'net beneficial' in the sense that the resulting benefits exceed the costs, and that the investments themselves are least-cost. In other words, at the firm-level, dynamic efficiency can be thought of as achieving productive efficiency over time.

Efficiency is therefore a relatively complex, but also multi-faceted context. In the context of freight supply chains, this concept touches on a large number of operational and investment aspects.

The Aberdeen Group (2013), for instance, notes that there is a strong desire to improve supply chain operations, increased customer demand for accuracy and timeliness, pressures to reduce supply chain execution costs, a need for improved inventory and asset management and a need also to optimise the numbers of trading partners (suppliers, carriers, logistic service providers).[10] These objectives largely relate to different aspects of productive efficiency, for instance by minimising transportation costs, delivery times and delays, inventory and storage costs, as well as maximising usage for a given capacity.

The ALC (2014) report noted that the industry is affected by many regulations, some of which overlap and generate inefficiencies.[11] In recent years, there have been many strategies which affect the

---

[10] Aberdeen Group, *Supply chain visibility report*, 2013.
[11] ALC (2014) report, *The Economic Significance of the Australian Logistics Industry*.

movement of freight and greater certainty on planning for freight would stimulate private sector investment in freight infrastructure.

The ALC argued that freight does not have a voice in many planning debates, resulting in the provision of inefficient infrastructure and a loss of productivity. It also claimed that despite strategies and plans which sought to address this, there has yet to be a clear whole-of supply chain focus on strategic corridors. Among the problems identified in the report were:

- harmonising regulation and reducing bureaucracy;
- identifying and then delivering key infrastructure projects;
- adopting whole of supply chain planning;
- a desire to make greater use of railways;
- high productivity vehicles access and charging;
- establishing a network of efficient intermodal facilities; and
- giving freight a voice in urban planning.

In part, ALC's concerns relate to long-term investment efficiency, as it relates to Australia's freight supply chains, including by better identifying and delivering important infrastructure projects, and supporting efficient intermodal facilities. The concern raised by ALC about overlapping jurisdictional regulations points to a potential source of productive efficiency, since multiple regulations may require operators to expend additional effort and resources to navigate the regulatory landscape.

The NFSC report (2018, p.26-27) also identified several problems in the management of supply chains and specifically a lack of freight data and information:

- capacity limits and land-side access restrictions at key national freight terminals;
- diminishing industrial land around key national freight terminals and an inadequate allocation of land for intermodal terminals;
- conflicting freight and passenger rail and road movements during peak periods;
- fragmented access to national key freight routes;
- inadequate mechanisms for national supply chain integration, including a lack of freight data and information on the performance of Australian supply chains against international benchmarks;
- inadequate jurisdictional strategies for protecting freight corridors and strategic industrial and logistics areas from urban encroachment; and

- a lack of integrated planning and harmonisation of freight regulation and coordinated freight governance across and within governments.

The existence of capacity limits, land use restrictions, and the lack of information to support national supply chain integration suggest that efficient investments that could deliver net benefits to freight operators (and ultimately to customers) cannot be undertaken, a source of dynamic inefficiency. Other issues identified by NFSC (such as conflicts between passenger and freight transport, and multiple freight regulatory regimes) are likely to constitute productive inefficiencies, in the sense that they would raise transportation costs.

Overall, it is clear that the task of collecting freight data as a means of gaining some insights into the efficiency of Australia's freight supply chains would need to cover many, if not all aspects of these complex constructs. There are also a number of broader considerations that are relevant to identifying the limits of the data collection task in the context of the broader efficiency objective that is of interest to DIRDC:

- In general, collecting detailed, accurate and timely data is likely to be both costly and/or intrusive for freight industry participants. There are therefore trade-offs to be considered between the potential benefits that could come from requiring certain participants to collect and submit certain data, and the potential costs that this would entail for these participants. At a minimum, concerns about placing onerous data obligations on participants would imply that any such data would be purposive, in the sense that there is a clear benefit – in terms of the information that can be gained – from collating and assembling them.

- Information, such as the cost or time required to transport goods between point a and point b, will provide interested parties with a comparative metric that might indicate how efficient or inefficient a freight service is. However, in many if not most cases, the data (alone) are unlikely to be helpful in identifying the cause of any identified inefficiencies. Thus, high $ per tonne-kilometre ($/t-km) haulage costs relative to some comparator route may be a function of transport-related factors, such as infrastructure characteristics that require trains to travel at low speeds or particular crewing arrangements, or of external factors, such as high fuel prices.

- Relatedly, a focus only on productive efficiencies alone may obscure the fact that there are often interdependencies between operational and investment outcomes. Thus, high costs and delays on a particular freight route may have as an underlying cause a failure to invest in capacity expansion in a timely manner. Alternatively, the absence of any delays or congestion may mean that the route may have been 'overbuilt', in the sense that there is always excess capacity.

- Finally, although dynamic efficiency is perhaps the most important aspect of efficiency since investment in transport infrastructure is often very costly, data collected by participants that is, by definition, historical may be of limited use in this regard. Investment decisions are forward-looking and based on freight and other projections. Past trends in throughput and costs play an important role here, in the sense that they provide an indication of historical trends, but ex ante, whether an investment is efficient or not depends on its costs as well as its benefits, all of which need to be forecast.

- However, broader public policy considerations are also relevant here, including questions around intellectual property (IP). The collection and curation of data is costly, and would only expect to be undertaken by private businesses if it supports their enterprise objectives in some way. Furthermore, to the extent that private businesses have invested resources into data collection as part of the competitive process, these businesses may be concerned that a sharing of proprietary data might offer competitors and advantage.

- The case for government 'intervention' in the collection and curation of data essentially rests on the 'public good' characteristics of data. While collecting and administering data is costly, at least a share of that data potentially confers some wider benefit on users and the general public, for instance, in terms of the ability to discern longer-term trends in freight traffic and planning transportation networks to the benefit of the wider community.

- Individual businesses' commercial considerations would also support an active role on the part of government. Businesses may be more inclined to share data with an independent and commercially disinterested party, who may be in a position to assemble individual datasets into a meaningful large whole while preserving confidentiality. The objective of putting data to good use in the furtherance of the public interest would then also provide a justification for government funding of the collection and administration of (transport-related) data.

5.5 An evaluation framework for freight data

5.5.1 Focus on indicators of productive efficiency

The discussion in the previous section then suggests that the primary focus of collecting freight supply chain data should be on indicators that provide information about the operational efficiencies of freight supply chains and their components. Indicators, such as cost metrics, but also time and other meaningful quality metrics (such as reliability or delays) will give an immediate, high-level indication of how a particular supply chain or component operates relative to comparable freight supply chains, either in Australia or overseas. Such information can then form the basis for a closer assessment of any underlying issues that are apparent in the data, whether they relate to investment requirements or inefficient (past) investments, the effects of complex regulations, or other issues that may play a role.

5.5.2 Focus on a minimum of high-quality, comparable and timely data

How detailed that data should be reflects a trade-off between collection costs (and potentially other issues, such as concerns about information that is commercial-in-confidence) and the additional insights that might be gained. For instance, including data on staffing levels might provide additional insights on labour utilisation levels that may go to the source of certain inefficiencies, but requiring participants to collect data on labour inputs may well be considered both arduous and intrusive. A more practical option may be to ensure that a minimum amount of quality and comparative data is collected across all (important) freight supply chains and their components. This approach would then represent a starting point in the sense that it would provide a high-level indication of performance.

In addition, in order to be meaningful as a basis for comparison and policy-making, such data should be:

- as far as possible, comparable – that is, using consistent definitions for different metrics – across freight supply chains and their components;
- comprehensive across freight supply chains, in the sense that an end-to-end assessment can be made with reference to cost or other indicators; and
- timely, so that information that is collated is reasonably up-to-date and therefore useful.

5.5.3 Focus on data that is fit-for-purpose

Given that Australia's freight supply chains tend to be relatively unique, comprise different modes of transport, and serve distinct markets – for instance grain versus coal versus general road haulage – it is also possible that a 'one size fits all' approach will not be workable, and that, to an extent at least, the data that is collected is relatively specific to the freight service in question. The recent National Freight Supply Chain Priorities Report (NFSC 2018a,b) identified three main supply chains of interest:[12]

- import/export freight;
- inter- and intra-state freight; and
- urban freight.

BITRE, in contrast, investigated suitable supply chains for study in order to develop a 'supply chain performance dashboard' (BITRE 2018, unpublished). The six supply chains identified were:

1. Beef – Rockhampton to Brisbane;
2. Containers – Port of Melbourne to metro Melbourne;
3. Passenger motor vehicles – Port Kembla to metro Sydney;
4. Fresh produce – Hume Highway to Sydney Markets;
5. Wheat – Kwinana; and
6. Petroleum – Exxon Mobil Altona to retail distribution hubs.

These supply chains were subsequently simplified to three key supply chains; these being:

- exports – grain and containers;
- imports – containers; and
- urban freight and ecommerce supply chains.

[12] NFSC 2018a.

The NTC in turn considered the key focus for data from the perspective of modes and infrastructure.[13] From a freight perspective, this classification encompasses:

- the rail mode (freight trains);
- the road mode (light vehicles and heavy vehicles);
- land-side services; and
- intermodal terminals.

5.6 Summing up

When working through the 52 proposals identified, several factors are important. Our evaluation framework focusses on the following nine key elements:

1. Economic efficiency, in particular productive efficiency
2. High quality, comparable, accessible and timely data
3. Fit-for-purpose collections (over a wide net approach)
4. An absolute commitment to open data principles, such that the public good value of data is maximised
5. Facilitating private sector innovation, not crowding it out
6. Where possible, piggy-back off existing trials and pilot programs, especially state-level programs that could be expanded nationally
7. Clearly separating technical, standards, hosting, governance and regulatory proposals
8. Separately identify short-term 'low-hanging fruit' from longer-term objectives
9. In terms of longer-term objectives, identify and address the root causes of the slow rate of take-up of new data technologies

Based on these key guiding principles, we then made a high-level evaluation of the programs identified, which is discussed in the next section. This evaluation subsequently informed our overall set of recommendations to DIRDC.

[13] National Land Transport Productivity Framework (NTC 2017b).

6 Taking Action

This section brings together the key points from the earlier sections and moves forward with two streams for consideration: (i) core elements and (ii) priority projects.

6.1 Bringing it all together

Following a brief overview of data in general and the different types of data, a review of the activities, reports, literature, projects and initiatives was undertaken.

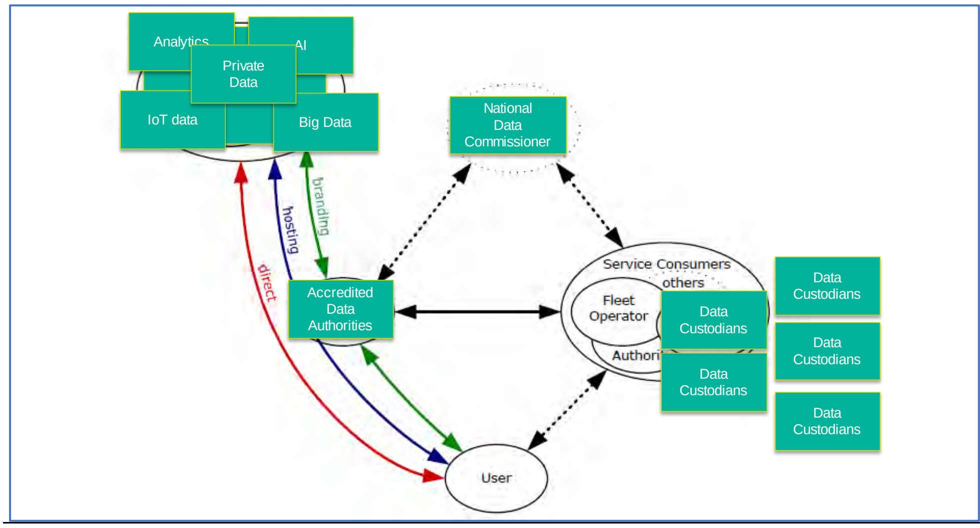
Freight and logistics data have many sources, users and players. We can learn from their experiences, understand the current state of the freight data environment and draw some key observations in the earlier chapters of this report.

Frameworks, key requirements, best practice learnings have been reported elsewhere and the next step is to consider the pathways for moving forward.

6.2 Core elements in the System

Earlier we attempted to represent the system as shown in Figure 3-25. We noted that the system operated within a regulatory and operational framework and was funded by various business models (for government, industry and the community), and that within the ecosystem there are certain core elements necessary.

Figure 3-1: System for freight data



Source: ARRB analysis 2018.

It was identified that within each freight data project there was a data core and governance core. For the data core, it would be standards, protocols, definitions, etc while for the Governance core, it would be legislation, agreements, system manager, accreditation and agreed operational processes, eg., data exchange. The specific areas of attention for the core elements are:

1. Standards[14]
2. Agreements / MoUs
3. How to establish trust
4. Accreditation
5. Governance

Work has begun on national legislative arrangements which can apply to freight data collection and this should be expanded to include industry freight data if not already done so. These include the roles of data custodian, national interest datasets, accreditation and the supporting processes.

[14] Such as GS1 EPICS common label format, ISO 15638 – Framework for co-operative telematics applications for regulated commercial freight vehicles, ISO 26683 – Freight Land Conveyance – content identification and communication, ISO 17427 – Roles and Responsibilities in the context of C-ITS.

References

Aberdeen Group 2013, Supply Chain Visibility, A critical strategy to optimise cost and service. Bob Heaney, Aberdeen Group, MA, USA.

AEOLIX 2018, AEOLIX Architecture for European Logistics Information exchange, ERTICO – ITS Europe, Brussels, Belgium, Nov.

Australian Government 2018, The Australian Government 's response to the Productivity Commission Data Availability and Use Inquiry, Department of Premier and Cabinet, Canberra, ACT, May

ACS 2017, Data sharing frameworks – Technical White Paper, Australian Computer Society, Sydney, NSW, Sept.

ALC 2014, The economic significance of the Australian Logistics industry, ACIL Allen Consulting, , Australian Logistics Council, Sydney, NSW.

ARRB 2011, ITS architecture for assessment of Heavy Vehicle Pricing Options, BAS-004/ITS Architecture, CAOG Road Reform Plan, 003244-1, Australian Road Research Board, Vermont South, Vic, May

ARRB 2016, Freight Movement Data Collection Service, Concept Proposal, Australian Road Research Board, Perth, WA, Feb.

Austroads 2016, Overcoming barriers to the off peak movement of freight in urban areas, AP-R520-16, Australian Road Research Board, Austroads, Sydney, NSW.

BITRE 2018a, National Infrastructure Data Collection and Dissemination Plan, Department of Infrastructure, Regional Development and Cities, Canberra, ACT.

BITRE 2018b, Supply Chain Indicators Report, KPMG, Sydney, NSW, Oct 2018, unpublished

Buyya, R., 2018, New Frontiers in Cloud, Fog, Edge Computing for Internet of Things Applications, Colloquium on IoT and Big Data in Industry and Energy Systems, https://federation.edu.au/icsl Federation University, IEEE Computational Intelligence Society and IEEE Victoria Section, Melbourne, Vic, Dec.

CISCO 2018, Towards a Multimodal Transportation Data Framework, supporting emerging transportation models and services, CISCO White Paper, Melbourne, Vic, Dec.

CWL 2016, Leading technological innovation & productivity improvement across the supply chain, an evaluation of the ALC intermodal visibility pilot of the GS1 Electronic Product Code Information Service (EPICS) standard, Centre for Workplace Leadership, University of Melbourne, Melbourne, Vic.

Ericsson 2018, Ericsson Mobility Report, Ericsson, Stockholm, Sweden. June.

EPCSA 2018, How to develop a Port Community System, simple, efficient solutions for swift and smooth supply chains, European Port Community Systems Association, Brussels, Belgium.

ERTICO 2018, CO2 measurements using nomadic devices, presentation to ISO TC204 G-ITS Workshop, Budapest, Sept.

IPA 2018, Fixing Freight: Establishing Freight Performance Australia, Infrastructure Partnerships Australia, Sydney, NSW, April.

ISO 2013a, ISO 15638 Intelligent transport systems — Framework for cooperative telematics applications for regulated commercial freight vehicles (TARV) — Part 1: Framework and architecture, International Standards Organisation, Geneva, Switzerland.

ISO 2013b, ISO TS 17427 Intelligent transport systems — Co-operative systems — Roles and responsibilities in the context of cooperative ITS based on architecture(s) for co-operative systems, International Standards Organisation, Geneva, Switzerland.

ITF 2015, Big Data and Transport: Understanding and Assessing Options, International Transport Forum at the OECD, Brussels, Belgium.

ITS Australia 2017, Smart Transport for Australia, Enhancing Liveable Cities and Communities, Report of the 2016 ITS World Congress Melbourne, ITS Australia, Melbourne, Vic.

Karl, C.A. 2003, The Learning Driver: Meeting Traveller Information Needs, doctoral thesis, Swinburne University of Technology, Melbourne, Vic.

Karl, C.A. 2006, A review of road use data pricing, partnerships and accessibility, Austroads Research Report AP-R293/06, Australian Road Research Board, Vermont South, Vic.

McKinnon A. 2015, *Performance measurement in freight transport: Its contribution to the design, implementation and monitoring of public policy*, Paper prepared for the Roundtable on Logistics Development Strategies and their Performance Measurements (9-10-March 2015, Queretaro).

NZ MoT 2016, New Zealand Transport Domain Plan, Ministry of Transport, Wellington, New Zealand, July.

NFSC 2017, Inquiry into National Freight and Supply Chain Priorities, National Freight Performance Framework, working paper, Department of infrastructure, Regional Development and Cities, Canberra, ACT, Mar.

NFSC 2018a, Inquiry into National Freight and Supply Chain Priorities, Report, Department of infrastructure, Regional Development and Cities, Canberra, ACT, Mar.

NFSC 2018b, Inquiry into National Freight and Supply Chain Priorities, National Freight Performance Framework, Department of infrastructure, Regional Development and Cities, Canberra, ACT, Mar.

NTC 2016, Who moves what where, Freight and Passenger Transport in Australia, National Transport Commission, Melbourne, Vic. Aug.

NTC 2017a, Who moves what where, Better informing transport planning for Australians, National Transport Commission, Melbourne, Vic, Jan

NTC 2017b, National Land Transport Productivity Framework, Houston Kemp Economists, National Transport Commission, Melbourne, Vic, April

NTC 2017c, Supporting good decisions to improve transport productivity: Project outcomes report, National Transport Commission, Melbourne, Vic, Aug

NTC 2018, Regulating government access to C-ITS and automated vehicle data, Discussion Paper, National Transport Commission, Melbourne, Vic., Sept

Productivity Commission (2006), *Road and Rail Freight Infrastructure Pricing*, Report No. 41, Canberra, December.

Productivity Commission (2007), *Public Support for Science and Innovation*, Research Report, Canberra, March.

Productivity Commission (2007), *Conservation of Australia's Historic Heritage Places*, Inquiry Report, Canberra, July.

Productivity Commission (2016), *Intellectual Property Arrangements*, Inquiry Report No. 78, Canberra.

Productivity Commission (2017), *Data availability and Use*, Productivity Commission Inquiry Report No 82, Australian Government, Canberra, ACT, Mar.

PwC 2018, Proof of Concept for a National Trade Community System, TCS Pilot Proposal, Pricewaterhouse Coopers, Melbourne, Vic.

TCA 2018, National Telematics Framework - Application Builder, Document Number: TCA-G39, Transport Certification Australia, Melbourne, Vic., May

TIC 2016, National Policy Framework for Land Transport Technology, Action Plan: 2016-2019, Transport and Infrastructure Council, Department of Infrastructure and Regional Development, Canberra, ACT, Aug.

Attachment 1 – Data elements

Application Data
- Application Usage
- Application Non-Usage
- Application Alarm Code
- Application Log On Method

Authorised Officer Data
- Authorised Officer ID
- Days Driver Data Records Requested

Axle Data
- Axle Count
- Axle Group Count
- Lift Axle Status

Breath Sample Data
- Breath Alcohol Concentration
- Breath Sample Flow Rate
- Breath Sample Flow Volume
- Breath Sample Duration
- Breath Test Result
- Breath Test Type

Comment Data
- Comment Code
- Comment Name
- Comment Text

Date and Time Data
- Date
- Time

Device Data
- Device Count
- Device Hardware Version
- Device ID
- Device Sequence Number
- Device Software Version
- Movement Sensor Status
- Terminal ID

Distance Data
- Distance Travelled
- Odometer Reading

Driver Data
- Driver ID
- Driver Licence Number
- Fit for Work Status
- Name

Event Data
- Event Code
- Event Description
- Event Name
- Event Severity

Fatigue Management Data
- Work Diary Number
- Work Hours Option
- Work Rest Status
- Two-up Driver Status

GPS Data
- Direction of Travel
- Horizontal Dilution of Precision
- Latitude
- Longitude
- Satellite Count

Hire and Engagement Data
- Hire Status
- Price Component
- Price ID
- Price Total
- Vehicle Engagement

Jurisdiction Data
- Issuing Authority
- Jurisdiction

Location Data
- Locality
- Address
- Postcode
- Radius
- State or Territory

Mass Data
- Axle Group Mass
- Axle Group Mass Quality
- Gross Vehicle Mass
- Load Status
- Mass Sensor Unit Count
- Mass Sensor Unit Sequence Number
- Mass Status
- Self-Declared Mass

Object Data
- Object Description
- Object ID
- Object Name

Organisational Data
- Name
- Street Address
- Telephone
- Web Address

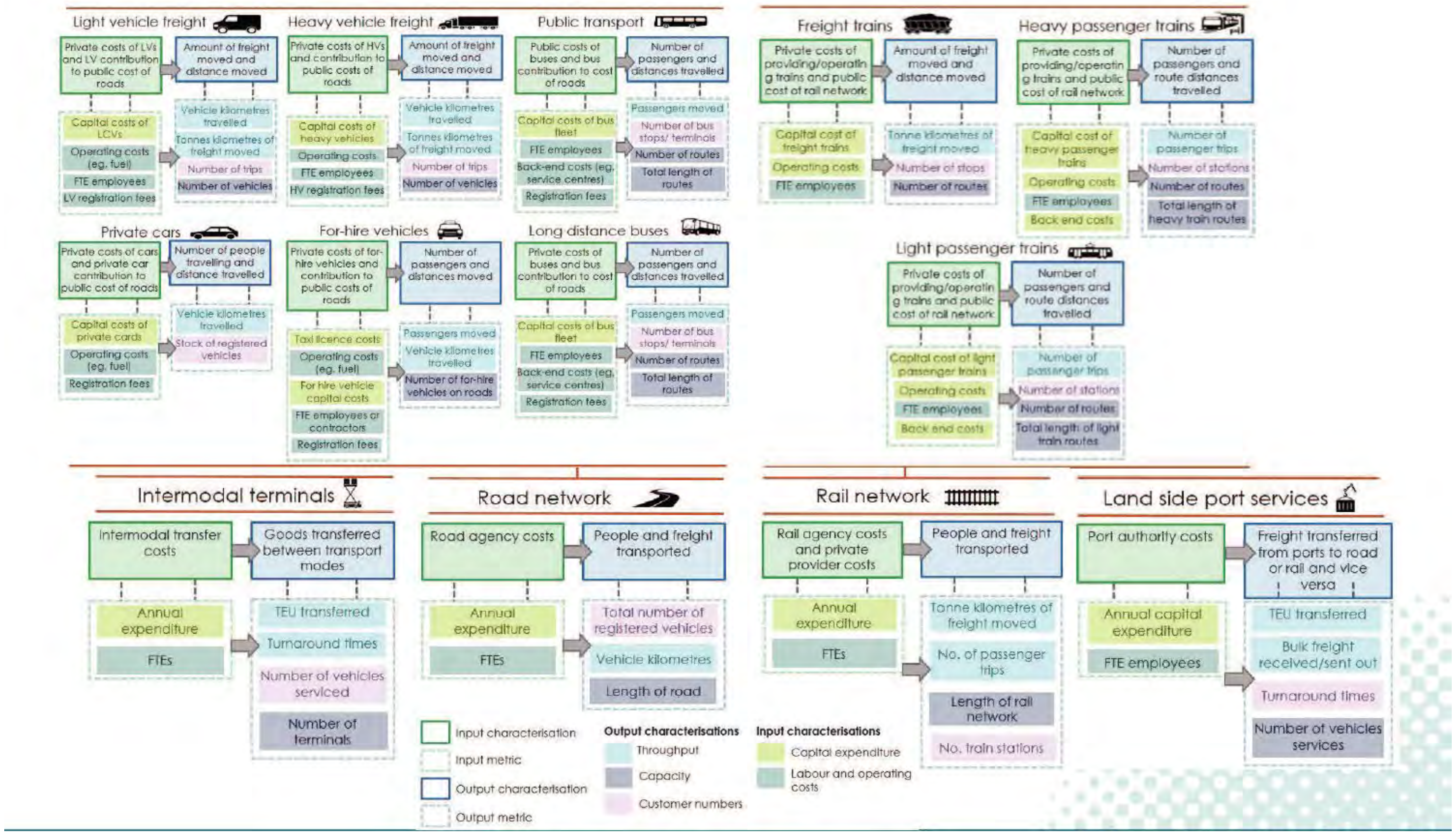
Speed Data
- Speed Threshold
- Vehicle Speed

Record Data
- Specification Reference
- Record Number
- Record Type

Vehicle Data
- Ignition Switch Status
- Vehicle Category Code
- Vehicle Category Name
- Vehicle Identification Number
- Vehicle Interlock Status
- Vehicle Registration Jurisdiction
- Vehicle Registration Number

Source: TCA 2018 p.12.

Attachment 2 – Data requirements for land transport, NTC 2017b



Attachment 3 – List of 52 projects reviewed

List of 52 projects in freight data, prepared by ARRB on 6 December 2018. The 16 projects identified by BITRE (2018a) are in the grey shaded boxes.

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
1	Lack of national-level infrastructure asset management measures	Heavy Vehicle Infrastructure Asset Registers	Expand the asset registers.	DIRDC	ARRB			in development
2	Strength, roughness of the road	Road asset data	Planning maintenance, monitoring deterioration, use in HV road pricing	NTC	ARRB	ARRB Systems		commercial
3	Locating and understanding infrastructure datasets, Difficulties in comparing infrastructure performance and activity across infrastructure sectors and metrics	Infrastructure Performance Dashboard	Develop an Infrastructure Performance Dashboard	BITRE	Infrastructure Australia	Data 61		ongoing
4	Consistent national approach for measuring road speed performance and reliability, ability to conduct before and after assessments for road infrastructure projects	Road-Speed Performance and Reliability Dashboard	Expanding road speed performance dashboard	BITRE			Houston Kemp	completed

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
5	Supply chain model for agriculture	TraNSIT - Transport Network Strategic Investment Tool	Transport and logistics options for agriculture to identify potential cost savings	CSIRO				in development
6	Supply chain visibility	Supply chain indicator scoping report	Scoping study for future data collection	BITRE		ACIL	UoW SMART	completed
7	Measuring freight performance	Freight Performance Indicators	Develop a national freight performance framework and associated freight indicators.	BITRE	ARRB	ATDAN (state and territory transport)		ongoing
8	Information on best-practice modelling assumptions	Developing and Promoting Best Practice Modelling Assumptions	Develop best practice and consistent modelling assumptions to improve infrastructure planning and investment	BITRE	ARRB	ATDAN (state and territory transport)		ongoing
9	Limited information on the accuracy of cost-benefit analysis (CBA) predictions and whether projects fulfil their objectives.	Post Completion Analysis for Infrastructure Projects	Conduct more independent post completion (ex-post) evaluations of CBAs for infrastructure projects and make findings publicly available.	BITRE				in development

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
10	Assessing value for money for road and other infrastructure investments.	Cost Benchmarking for Infrastructure Investments	Expand and update cost-benchmarking work.	BITRE	ARRB	ATDAN (state and territory transport)		in development
11	Assessing value for money for road and other infrastructure investments.	Network Optimisation Framework, Reference Guide and Solution Assessment Tool	1. Provide a consistent governance framework which strongly encourages the consideration of network optimisation solution as part of any infrastructure proposal. 2. Collect and document existing network optimisation solutions and provide a growing library of ready-to-implement solutions available to TMR staff. 3. Establish a consistent and efficient method to evaluate network optimisation solutions against traditional infrastructure projects.	QTMR	ARRB		HERE Maps	in development

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
12	Measuring transport's contribution to the Australian economy	Measuring Transport's Contribution to the Economy - Transport Satellite Account	Develop a Transport Satellite Account.	ABS	BITRE			completed / on going
13	Nationally consistent source of non-fatal road injury data.	Non-Fatal Road Injury Data Linkage Project	Providing non-fatal road injury data by linking crash data (collected by jurisdictions), hospital data and deaths data.	Austroads	BITRE, ARRB		Flinders Uni	in development
14	Provision of up to date routing information for road freight	Heavy vehicle routing, Data Analysis Tool	routing information to drivers, agencies and telematics companies	TfNSW	TCA	Boral, Lynxx, C-Track, South Coast Equipment		commence 2019
15	Provision of up to date road infrastructure management information	Road Infrastructure Management (RIM) tool	aggregated telematics data at the road link level based on IAP and other data	TCA	State Road Agencies	TCA service providers		in operation
16	Live permit data to improve driver notification and compliance	Live permit data in truck	ability to access permit data while on board vehicle	TfNSW	RMS, NHVR, TCA	Linfox, Boral, C-Track, South Coast Equipment		commence 2019

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
17	Linking and merging of multiple data sources in a standardised format	Traveller information exchange (TIX)	improving journeys by providing better information to HV drivers	TCA		IAP telematics service providers		in development
18	On-board mass systems on HVs	OBM type approval	overcome mass breaches and meet COR duties	TCA		IAP telematics service providers		in operation
19	Improved reliability along 40km of freight routes in Pennant Hills, Parramatta and King Georges Road, Sydney	Freight Signal Priority Trial (CITI)	green light progression for freight vehicles, V2I communications with SCATS system	TfNSW	RMS	Cohda Wireless		in development
20	HV telematics data (Mass, location, classification) with road asset condition data and other data sets as required	ARRB Advanced Technology Lab	Development of a research visualisation platform combining telematics data with Road agency data for research purposes	ARRB	State Road Agencies	Transport Operators, Telematics Service Providers	HERE Maps	Ongoing
21	Real time monitoring, weighing and image acquisition	Next Gen Weigh-in-Motion Infrastructure	use of in-road scales with cameras and laser classifiers	VicRoads	ARRB	CEOS, HARE cameras		in trial phase

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
22	National-level statistics to better understand the movement of freight to and from ports.	Customs freight data analysis project	Develop use case for the Customs freight data	BITRE	NTC, DHA		private port operators	in operation (govts only)
23	Providing timelier and more detailed information about road freight and road freight vehicle movements, more cost effectively.	Road freight telematics data collection	Develop an enduring road freight telematics data collection and road freight telematics-based statistical outputs.	BITRE	ARRB, TCA	Transport Operators, Telematics Service Providers,		in operation
24	Insights on transient population changes.	Insights on transient population changes – Cruise Ship Analysis.	Conduct a pilot study using telecommunications models to better understand changes in temporary populations associated with cruise ship arrivals.	BITRE				in development

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
25	Data sharing guidance, methods and standards	NSW Data Sharing Taskforce	Facilitate data sharing by: providing advice on existing relevant legal frameworks; developing methods and standards for anonymising personal information; and developing methods for testing the existence of personally identifiable data in datasets.	NSW Data Analytics Centre (DAC)		Australian Computer Society		completed
26	Locating, understanding and utilising available transport and infrastructure datasets.	Tracking State and Commonwealth Open Data Developments	Improve visibility of cross jurisdictional open data and data sharing initiatives.	BITRE		ATDAN (state and territory transport)		
27	Open data to support the implementation of Connected and Automated Vehicles.	Road Operator Data to Support Connected and Automated Driving	Identify gaps between the road operator data provided to users (developers) and what is likely to be required in future for CAV operations.	Austroads				completed

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
28	Secure industry data exchange. Facilitate linking between companies and between other global supply chains	Trade Community System / Port Community System	secure platform for information sharing			PWC		trial at Port of Brisbane
29	industry data exchange, data dictionaries built/shared, establish platform rules, standardised data inputs, structuring data to be displayed, sharing rules	Data share platform	centrally processed data repository	TfNSW	NSW Open data platform	CMCC, IBM, Tramanco, Lynxx, C-Track		commence 2019
30	APIs, natural query language, voice query, aggregated insights with artificial intelligence	Data experience	data platform to capture and share insights on roads, permits and assets, improved access to route data and key information. Secured shared access, protect vulnerable assets.	TfNSW	NSW Open data platform, TCA	CMCC, IBM, Tramanco, Lynxx, C-Track		commence 2019
31	Secure access and permitting of HVs, determine suitable processes, develop specific tools	Blockchain	using blockchain to reduce time taken by councils to provide permits for access across bridges	TfNSW	NHVR	Microsoft, IBM, Boral, CMCC, Tramanco, C-Track		commence 2019

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
32	Lack of formats and processes for industry data into agencies	Using industry information	investigate possible reporting formats and processes for industry data for agencies	TfNSW	RMS, TCA	Linfox, Lynxx, Tramanco, CMCC		commence 2019
33	Standardised data	Intermodal visibility of the GS1 EPICS standard	evaluation of the GS1 Electronic Product Code Information Service standard	ALC	GS1	Nestle Australia, One Steel, Reject Shop K&S Freighters, Pacific National		2013-2016
34	Smart sensors connected to vehicles and infrastructure integrated to deliver smart transport services	AIMES (Australian Integrated Multimodal Ecosystem)	living laboratory for delivering integrated transport technology products and services	University of Melbourne	over 40 govt and industry partners			2016 on going
35	Traveller information and traffic management including signal priority for vehicles	Addinsight	provision of network wide performance indicators using Bluetooth technology	DPTI, SA		Sage Automatio n		in operation in SA, QLD and VIC, soon WA
36	Heavy vehicle movement surveys around ports	Port Movement Surveys	detailed various OD pair surveys	Govts and Ports		Consultants		many publications

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
37	Safety applications for vehicles based on V2X communications	utilising CITS for V2X, Connected and Automated Vehicles Initiative (CAVI)	500 vehicle/ 50 intersection trial in Ipswich for day 1 CITS safety applications	QTMR		iMOVE partners	CISCO	in procurement for 2020 start
38	Link travel times	UBER movement data	link travel times in major Australian capital cities	UBER				available in Sydney, Melbourne, Brisbane and Perth
39	Link travel times	TomTom data	link travel times in major Australian capital cities	TomTom				commercial
40	Link travel times	Google movement data	link travel times in major Australian capital cities	Google				commercial
41	Link travel times	SUNA movement data	link travel times in major Australian capital cities	Intelematics				commercial
42	Route mapping with road attributes	HV Road attributes	HV network, restrictions, Hazmat, RAV networks, POIs, Distance markers, rest areas,	ARRB	State Road Agencies	HERE		commercial
43	Mobility data based on mobile phones	Telstra Location Insights	aggregates and anonymises information from proprietary network assets to provide highly relevant analytics and predictive insights, SA2 level	Telstra				commercial

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
44	Travel time data from 3rd party providers to support post implementation audits	Post implementation treatment network analysis (PITNA)	using travel time to analyse the before and after impacts of pinch point projects	RMS		ARRB		in use
45	Heavy vehicle performance and volume by type	Traffic on Rural Roads model (TRARR)	traffic on rural roads software to analyse and predict the performance of two-lane highways for the implementation of overtaking lanes, principally for HVs	ARRB		ARRB		in use
46	Tools for modelling network operations based on vehicle performances	SMART Roads	planning software used for network operations planning (Movement in place)	Austroads, NZTA	VicRoads	ARRB		in development
47	30s data, location, time and vehicle type to develop operating speed of HVs	Design guidelines for heavy vehicles	review and enhancement of guidelines for various classes of HVs	ARRB	TCA	Austroads		in development
48	HV crash data (Victoria only) on maps with other attributes (speed limits, travel times),road assets and other information	ARRB Advanced Technology Lab and Safe Systems	HV safety analytics	ARRB	VicRoads, VicPol	Transport Operators, Telematics Service Providers	HERE maps	in use
49	New data for IoT sensors	WA DOT MaaS Trial	trial of big data and IoT	WA DOT		CISCO		in development

No	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency	Other agencies	Industry	Third parties	Project status
50	New data for IoT sensors	Liverpool Smart City	trial of big data and IoT	DIRDC	Liverpool CC		UoW SMART	in development
51	New data for IoT sensors	Mornington Peninsular trial	trial of big data and IoT	DIRDC	MPS		RMIT, ARRB	in development
52	Trusted information exchange, Trade/Port Community Systems trial	TCS Blockchain Port of Brisbane	information exchange within Port Community using blockchain	Port of Brisbane		Stevedores	PwC	in development

Attachment 4 – Three groups

Table 6-1. Group 1

	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency
1	Locating and understanding infrastructure datasets, Difficulties in comparing infrastructure performance and activity across infrastructure sectors and metrics	Infrastructure Performance Dashboard	Develop an Infrastructure Performance Dashboard	BITRE
2	Consistent national approach for measuring road speed performance and reliability, ability to conduct before and after assessments for road infrastructure projects	Road-Speed Performance and Reliability Dashboard	Expanding road speed performance dashboard	BITRE
3	supply chain model for agriculture	TraNSIT - Transport Network Strategic Investment Tool	Transport and logistics options for agriculture to identify potential cost savings	CSIRO
4	Measuring freight performance	Freight Performance Indicators	Develop a national freight performance framework and associated freight indicators.	BITRE
5	Information on best-practice modelling assumptions	Developing and Promoting Best Practice Modelling Assumptions	Develop best practice and consistent modelling assumptions to improve infrastructure planning and investment	BITRE
6	Measuring transport's contribution to the Australian economy	Measuring Transport's Contribution to the Economy - Transport Satellite Account	Develop a Transport Satellite Account.	ABS
7	Nationally consistent source of non-fatal road injury data.	Non-Fatal Road Injury Data Linkage Project	Providing non-fatal road injury data by linking crash data (collected by jurisdictions), hospital data and deaths data.	Austroads
8	Providing more timely and more detailed information about road freight and road freight vehicle movements, more cost effectively.	Road freight telematics data collection	Develop an enduring road freight telematics data collection and road freight telematics-based statistical outputs.	BITRE
9	Insights on transient population changes.	Insights on transient population changes – Cruise Ship Analysis.	Conduct a pilot study using telecommunications models to better understand changes in temporary populations associated with cruise ship arrivals.	BITRE
10	Data sharing guidance, methods and standards	NSW Data Sharing Taskforce	Facilitate data sharing by: providing advice on existing relevant legal frameworks; developing methods and standards for anonymising personal information; and developing methods for testing the existence of personally identifiable data in datasets.	NSW Data Analytics Centre (DAC)
11	Locating, understanding and utilising available transport and infrastructure datasets.	Tracking State and Commonwealth Open Data Developments	Improve visibility of cross jurisdictional open data and data sharing initiatives.	BITRE
12	Open data to support the implementation of Connected and Automated Vehicles.	Road Operator Data to Support Connected and Automated Driving	Identify gaps between the road operator data provided to users (developers) and what is likely to be required in future for CAV operations.	Austroads
13	Lack of formats and processes for industry data into agencies	Using industry information	investigate possible reporting formats and processes for industry data for agencies	TfNSW
14	Heavy vehicle movement surveys around ports	Port Movement Surveys	detailed various OD pair surveys	Govts and Ports
15	Link travel times	UBER movement data	link travel times in major Australian capital cities	UBER
16	Link travel times	TomTom data	link travel times in major Australian capital cities	TomTom
17	Link travel times	Google movement data	link travel times in major Australian capital cities	Google
18	Link travel times	Suna movement data	link travel times in major Australian capital cities	Intelematics
19	Route mapping with road attributes	HV Road attributes	HV network, restrictions, Hazmat, RAV networks, POIs, Distance markers, rest areas,	ARRB
20	Heavy vehicle performance and volume by type	Traffic on Rural Roads model (TRARR)	traffic on rural roads software to analyse and predict the performance of two lane highways for the implementation of overtaking lanes, principally for HVs	ARRB
21	Tools for modelling network operations based on vehicle performances	SMART Roads	planning software used for network operations planning (Movement in place)	Austroads, NZTA
22	30s data, location, time and vehicle type to develop operating speed of HVs	Design guidelines for heavy vehicles	review and enhancement of guidelines for various classes of HVs	ARRB
23	HV crash data (Victoria only) on maps with other attributes (speed limits, travel times),road assets and other information	ARRB Advanced Technology Lab and Safe Systems	HV safety analytics	ARRB

Table 6-2. Group 2

	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency
1	Lack of national-level infrastructure asset management measures	Heavy Infrastructure Vehicle Asset Registers	Expand the asset registers.	DIRDC
2	Strength, roughness of the road	Road asset data	planning maintenance, monitoring deteriotation, use in hv road pricing	NTC
3	supply chain visibility	Supply chain indicatior scoping report	Scoping study for future data collection	BITRE
4	Limited information on the accuracy of cost-benefit analysis (CBA) predictions and whether projects fulfil their objectives.	Post Completion Analysis for Infrastructure Projects	Conduct more independent post completion (ex-post) evaluations of CBAs for infrastructure projects and make findings publicly available.	BITRE
5	Assessing value for money for road and other infrastructure investments.	Cost Benchmarking for Infrastructure Investments	Expand and update cost-benchmarking work.	BITRE
6	Assessing value for money for road and other infrastructure investments.	Network Optimisation Framework, Reference Guide and Solution Assessment Tool	1. Provide a consistent governance framework which strongly encourages the consideration of network optimisation solution as part of any infrastructure proposal. 2. Collect and document existing network optimisation solutions and provide a growing library of ready-to-implement solutions available to TMR staff. 3. Establish a consistent and efficient method to evaluate network optimisation solutions against traditional infrastructure projects.	QTMR
7	Provision of up to date routing information for road freight	Heavy vehicle routing, Data Analysis Tool	routing informtion to drivers, agencies and telematics companies	TfNSW
8	Provision of up to date road infrastructure management information	Road Infrastructure Management (RIM) tool	aggregated telematics data at the road link level based on IAP and other data	TCA
9	Linking and merging of multiple data sources in a standardised format	Traveller information exchange (TIX)	improving journeys by providing beter information to HV drivers	TCA
10	HV telematics data (Mass, location, classification) with road asset condition data and other data sets as required	ARRB Advanced Technology Lab	Development of a research visualisation platform combining telematics data with Road agency data for research purposes	ARRB
11	National-level statistics to better understand the movement of freight to and from ports.	Customs freight data analysis project	Develop use case for the Customs freight data	BITRE
12	Standardised data	Intermodal visibility of the GS1 EPICS standard	evaluation of the GS1 Electronic Product Code Information Service standard	ALC
12	Traveller information and traffic management including signal priority for vehicles	Addinsight	provision of network wide performance indicators using bluetooth technology	DPTI, SA
14	Mobility data based on mobile phones	Telstra Location Insights	aggregates and anonymises information from proprietary network assets to provide highly relevant analytics and predictive insights, SA2 level	Telstra
15	Travel time data from 3rd party providers to support post implementation audits	Post implementation treatment network analysis (PITNA)	using travel time to analyse the before and after impacts of pinchpoint projects	RMS

Table 6-3. Group 3

	Data and Information Gap (Data Requirements)	Project	Objective	Lead Agency
1	Live permit data to improve driver notificastion and compliance	Live permit data in truck	ability to access permit data while on board vehicle	TfNSW
2	On-board mass systems on HVs	OBM type approval	overcome mass breaches and meet COR duties	TCA
3	Improved reliability along 40km of freight routes in Pennant Hills, Parraamatta and King Georges Road, Sydney	Freight Signal Priority Trial (CITI)	green light progression for freight vehicles, V2I communications with SCATS system	TfNSW
4	Real time monitoring, weighing and image acquisition	Next Gen Weigh-in-Motion Infrastructure	use of in-road scales with cameras and laser classifiers	VicRoads
5	secure industry data exchange. Facilitate linking between companies and between other golbal supply chains	Trade Community System / Port Community System	secure platform for informaton sharing	
6	industry data exchange, data dictionaries built/shared, establish platform rules, standardised data inputs, structuring data to be displayed, sharing rules	Data share platform	centrally processed data repository	TfNSW
7	APIs, natural query language, voice query, aggregated insights with artifical intelligence	Data experience	data platform to capture and share insights on roads, permits and assets, improved access to route data and key information. Secured shared access, protect vulnerable assets.	TfNSW
8	Secure access and permitting of HVs, determine suitable processes, develop specific tools	Blockchain	using blockchain to reduce time taken by councils to provide permits for access across bridges	TfNSW
9	Smart sensors connected to vehicles and infrastructure integrated to deliver smart transport services	AIMES (Australian Integrated Multimodal Ecosystem)	living laboratory for delivering integrated transport technology products and services	University of Melbourne
10	Safety applications for vehicles based on V2X communications	utilising CITS for V2X, Connected and Automated Vehicles Initiative (CAVI)	500 vehicle/ 50 intersection trial in Ipswich for day 1 CITS safety applications	QTMR
11	new data for IoT sensors	WA DOT MaaS Trial	trial of big data and IoT	WA DOT
12	new data for IoT sensors	Liverpool Smart City	trial of big data and IoT	DIRDC
13	new data for IoT sensors	Mornington Peninsular trial	trial of big data and IoT	DIRDC
14	trusted information exchange, Trade/Port Community Systems trial	TCS Blockchain Port of Brisbane	information exchange within Port Community using blockchain	Port of Brisbane