Opportunities for information technology systems to improve port-related supply chain performance

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Opportunities for information technology systems to improve port-related supply chain performance

Report prepared by: Belinda Irwin

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Purpose: To explore opportunities for real-time technology that has the potential to improve efficiencies of port-related supply chains.

Abstract: This paper explores some of the opportunities and impediments to implementing an integrated information and communication technology system across port and related supply chains.

Key words: Technology systems, port community systems, supply chain, ports.

Contact: National Transport Commission
L 15/628 Bourke Street
Melbourne VIC 3000
Ph: (03) 9236 5000
Email: enquiries@ntc.gov.au
www.ntc.gov.au
Foreword

The National Transport Commission (NTC) is an inter-governmental agency charged with improving the productivity, safety and environmental performance of Australia’s road, rail and intermodal transport system.

As an independent statutory body, the NTC develops and submits reform recommendations for approval to the Transport and Infrastructure Council, which comprises transport, infrastructure and planning ministers from the Australian, state and territory governments.

The NTC also plays an important role in implementing planning so that reform outcomes are achieved, and also coordinates, monitors, evaluates and maintains the implementation of approved reforms.

As part of the progress of Australia’s wider national freight plan, a National Ports Strategy was developed by Infrastructure Australia and the NTC, with significant input from stakeholders, which was endorsed by the Council of Australian Governments (COAG) in July 2012.

A national coordinated approach to the planning and development of port infrastructure is essential to Australia’s future economic growth. As an island nation, our ports are Australia’s gateway to the world. Australia’s bulk commodity exports and metropolitan container imports are predicted to double in size every 10 years. Long-term planning will provide greater clarity on how future port capacity will match these trade forecasts.

Information and communications technology (ICT) is vital to supporting a coordinated approach to achieve productivity gains at our ports and across related supply chains. Examples exist in Australia and overseas where ICT has achieved significant efficiency gains for a port and its freight and other supply chains. While there are clear opportunities to incorporate ICT solutions to achieve port and related supply chain efficiencies, more investigation is needed about developing a national system.

As part of the NTC’s role in implementing the National Ports Strategy, the NTC convened a Technology Working Group comprising industry and government experts in port supply chains. The group was created to enable a collaborative approach to technology solutions, driven by industry and supported by government as required.

This paper explores some of the technology options available to the Australian ports-related supply chains investigated by the NTC and the Technology Working Group.
Executive summary

The National Ports Strategy (2012) developed by Infrastructure Australia (IA) and the National Transport Commission (NTC) seeks to improve the future development and planning of Australia’s port and freight infrastructure by encouraging a coordinated national approach.

The National Ports Strategy identified key priorities for Australian ports as:

1. planning for relevant ports
2. ensuring plans can be executed
3. improving landside efficiency, reliability, security and safety of container ports
4. promoting clarity, transparency and accountability

Integral to these priorities are considerations around the use of information and communications technology (ICT). Simultaneously, there is a need for greater supply chain coordination, as well as the need to obtain a greater understanding of regulatory constraints on information sharing.

The NTC convened a Technology Working Group to explore opportunities for real-time technology systems to improve port-related supply chain performance, as described in the National Ports Strategy.

This paper discusses the development of Port Community Systems and examples of other similar systems used in Europe and Asia. Specifically, this paper addresses the role of government in the development and use of ICT and Port Community Systems in Australia that have the potential to extend across port-related supply chains.

Commonwealth, state and local governments play an important role in supply chains as major infrastructure owners and managers (NTC 2012a) This role is becoming increasingly complex as outsourcing and leasing of infrastructure to the private sector increases.

Government involvement in the use of ICT systems in supply chains, may improve the efficiency of the total logistics chain by setting protocols or standards for systems. Government should at least ensure it does not impede development and use of technologies across supply chains.

The next steps outlined in this paper represent the view of the Technology Working Group that industry should drive development of ICT systems to improve port-related supply chain performance.

The ports and logistics industry requires substantial information for its daily operations in an increasingly complex economic environment. The ability for all elements of the supply chain to communicate with each other can, and has been, realised through the use of ICT systems.

While there may be integrated supply chains sharing a common ICT system, it is likely that many more supply chains have different ICT protocols for information sharing between shipping agents, transporters (road and rail), customs, consignors, ocean and inland carriers, stevedores, port authorities and consignees. In addition, despite organisations having integrated ICT systems, interfaces are still required with government agencies such as customs and with end customers (container and parcel tracking).

Facilitating coordination between industry and government aims to build the capacity of supply chains to collectively achieve efficiency and productivity goals where individual players acting alone are unable to accomplish them.

One solution is a single window or portal to provide a single point of access to aggregated information. Current software available can provide access to various data in a single window to customers that would normally originate from multiple sources. In Australia, several products currently available can deliver real-time information for components of the chain including:

- truck/wharf/container park bookings
- container number
- container location
- ship arrival times (planned and actual)
- container weight
- container contents
- customs clearance status
- delivery order details.

Specific performance indicators can be obtained from the data collected, including truck turn times in a terminal, the total transit time, the number of staged movements (such as for a freight forwarder), truck queue times outside (and inside) a terminal, and container dwell times. As this information becomes available, organisations are using this data to achieve greater efficiencies.

Many examples in Australia and overseas exist where ICT systems have achieved significant efficiency gains for a port and its related supply chains.

A key barrier (beyond the fragmentation of operational components) to achieving a fully integrated supply chain through ICT systems relates to concerns around confidentiality and commercial sensitivity. However, this can be overcome as demonstrated by the best practice case studies presented in this paper.

Supply chain parties are keen to achieve maximum efficiencies through a collaborative approach, but they are also driven by individual businesses to develop commercial advantages over competitors. Control of data is thus important.

Ports in Australia are separated in their operations, with relatively little competition or common ownership arrangements between them. It may be more beneficial to consider integrated systems tailored for individual regions rather than attempting to achieve a completely national approach, without losing the vision of a national system.

Ultimately the success of an integrated technology system relies on the level of value that can be identified by and for industry, and the capacity to provide an integrated solution but allow individual entities or components to use the integrated model.

Many ports around the world have overcome the challenges of developing an integrated approach. It is clear there are many opportunities to improve port and related freight and supply chain efficiencies using ICT systems in Australia. The joint project between Fremantle Ports and the Chamber of Commerce to undertake a strategic assessment for a Port Community System in Australia is an excellent next step.
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1. Introduction

Infrastructure Australia (IA) and the National Transport Commission (NTC) developed a National Ports Strategy (2012) as part of Australia’s wider national freight plan. This strategy was endorsed by the Council of Australian Governments (COAG) in July 2012.

The National Ports Strategy is an important piece of work which focuses on the planning and development of efficient and sustainable ports and connected infrastructure in a coordinated national approach. Its key objectives are to apply best-practice policy-making and planning and also to achieve safety, environment and national security objectives such as defence, border management and transport security.

One action of the National Ports Strategy was to explore opportunities for real-time IT systems to improve port-related supply chain performance. Specifically, it outlined considerations for exploring:

- how to achieve more reliable movement of freight within ports, among ports and on land transport systems
- the benefits of Port Community Systems to increase the scope of information sharing across a wider variety of transactions
- barriers to early completion of regulatory formalities by traders
- the compatibility of our port information communication technology (ICT) systems with international trading partners
- incorporating empty container parks with intermodal terminals into the systems
- achieving interoperability across Australian container ports
- conforming with relevant regulatory provisions
- whole-of-port business continuity

To assist in delivering the best available advice, the NTC established a Technology Working Group comprising industry and government experts in port supply chains. The group’s primary objective was to inform COAG on opportunities to improve the efficiency of port-related supply chains by adopting and integrating new ICT technologies and systems, driven by industry and supported by government as required.

The Technology Working Group focused on identifying improvements that link the movement of goods from the port boundaries to the extended land-based component of the entire supply chain.

The group identified five key streams of work needing further evaluation and ongoing consideration to identify opportunities to improve the efficiency of ports and related supply chains:

information and material flow
measurements – current and future (of good practice/efficiency/benchmarking)
technology – what is currently happening, what is emerging, the future, and how ports can benefit from increased use of ICT
fragmentation of the industry – its current structure and governance arrangements.
possible intervention options (if necessary) – current and potential, regulation, policy decisions

ICT systems are well recognised as critical to successful supply chain management and for improving materials and information flow by enabling efficient processes.
Businesses do not operate in isolation, but work within a system of complex supply chains, often with multiple participants. Supply chain management enables companies to achieve major changes in performance rather than just focus on individual elements in the transport chain. Lambert (1994) developed a definition for supply chain management:

*Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders.*

Vital to the effective operation of any supply chain, especially one as fragmented as port-related supply chains, is continuous and streamlined information flow. This requires a change from managing individual functions to integrating activities into key supply chain processes. Traditionally, upstream and downstream portions of the supply chain have interacted as disconnected entities receiving sporadic flows of information over time (Lambert & Cooper 2000).

Improving information sharing across multiple organisations in a supply chain is critical to businesses seeking to reduce their costs and improve services for an advantage over competitors. Issues identified with non-integrated systems and processes include:

- error-prone repetition of data entry into different stand-alone systems
- inability to accurately monitor performance due to a lack of Key Performance Indicators (KPIs) or the inability to collate accurate data on KPIs
- inability of customers to access real-time information on the status of their job, which can lead to inefficient forward planning and scheduling
- differing stand-alone systems used by companies that may provide different answers to the same question.

A single system is not necessary to address these issues. Most can be addressed by integrating ICT systems with the ability to ‘talk to each other’ and provide real-time, accurate information. This type of technology is described as ‘Intelligent Transport Systems’ (ITS), which refers to the use of ICT in a transport network. The term ‘Cooperative Intelligent Transport Systems’ is often used and refers to a particular subset of ITS where different elements of a transport network (vehicles, roads, infrastructure) share information (NTC 2012a).
2. Importance of information

A key contributor to sub-optimal supply chain performance is often poor information sharing (Kaipia 2009). Having access to accurate and relevant information when you need it can improve business processes, boost productivity and increase profits. Information sharing along a supply chain can influence the behaviour of supply chain members and decision-making as well as their performance within the supply chain (Omar et al. 2010). Alignment of supply and demand relies on the ability of organisations to receive and share information so they can operate efficiently and effectively in a changing and sometimes volatile environment.

Locating and collating information from multiple sources can be expensive for businesses and add costs down the supply chain line (time and direct costs). Manual data handling increases the risk of error or loss of information through repeated re-keying, which also affects resourcing. Information flow across supply chains is multi-directional, with detail transmitted across various sources including suppliers, freight companies, resellers and final consumers. There is also the issue of receiving imperfect information – when information is known to exist in a supply chain but when the costs of obtaining it outweigh the benefits (DPI 2009).

A key factor in achieving successful information flow is strong collaboration between organisations which mostly share common values and goals. At times, an independent company or coordinator can facilitate this.

One international example is Connekt, an independent network of companies and governments in the Netherlands that commits parties to work towards improving mobility. Connekt focuses on themes such as ITS, logistics and public transport. The mission of Connekt is to create a strong network of trust with a well-oiled process, based on its vision ‘Connekt & Share’. Connekt organises activities for and with its members to exchange knowledge and facilitate working together.

Applying specialised ICT can significantly improve information sharing, allowing organisations access to vital data that enables effective business decisions. This facilitates greater supply chain efficiencies by improving integration and coordination of physical flows as well as the various information flows required.

While a streamlined information flow is vital to the effectiveness of an individual organisation and the numerous companies that comprise a supply chain, success is achieved only with information quality. Information quality can be defined as the degree to which the information meets the needs of an organisation. It includes many aspects such as relevance, accuracy, timeliness, believability, understandability, ease of access, credibility and compatibility. To be as useful as possible, data should be in an efficient and effective form for its end user, delivered at the right time, and for the right purpose (Kaipia 2009).

A paper by the Australian Logistics Council (2010) sets four key tasks an ideal logistics information system must perform:

1. hold all route information including direction, weight, width, length, height, speed, and cargo restrictions, making this available in real time to those who must navigate the route
2. track each physical element (not just goods) in the system in real time, locating it precisely in both space and time, making this information immediately available at every point in the system where it is required
3. monitor each operating element to ensure it is functioning correctly (including following relevant laws/regulations/operating parameters), making this information available in real time to those who need to act on it
4. monitor the flow (such as by including traffic on the Principal Freight Network) so the whole system is working as it should, providing real-time information to those who need it

Information sharing should improve the efficiency and productivity of a supply chain. The Australian Logistics Council (2010, p. 6) provides a collaboration model that demonstrates the ability of organisations to collaborate across the transport and logistics supply chain (see Figure 1).
Several ICT products are available that allow easier access to relevant information and help facilitate information exchange between supply chains.
3. Role of government

Commonwealth, state and local governments all play important roles in port and related supply chains as major infrastructure owners and managers. These roles are becoming increasingly complex as outsourcing and leasing of infrastructure to the private sector increases.

It has been argued that given the fragmentation of the port-related supply chain system, government should be involved in promoting technology adoption to improve information and efficiency.

Market failure (i.e. where markets fail to achieve the most efficient outcomes) is justification for government involvement and public funds investment. While responsibility for this intervention can rest with multiple levels of government, Rama and Harvey (2009) point out:

...if there is no market failure, there is no case for government intervention on efficiency grounds. The presence of market failure is necessary but not sufficient to justify government intervention.'

Government can be involved in a number of ways:

- information – development and funding of studies and/or research into performance elements, impediments and solutions
- facilitation – as a catalyst or as a general support for a movement
- regulation.

Governments can facilitate improvements rather than impose them. Greater planning of developments and state-owned infrastructure to support private investment can achieve this, by improving and rationalising regulation, and by working closely with industry to clearly identify objectives and requirements for coordination in relevant areas. The NTC’s Working Technology Group identified many examples of this, and several are referred to in this paper.

The NTC paper, National in-vehicle telematics strategy: the road freight sector (2011) outlined the role of government in transport technology. It was based on principles endorsed by the Australian Transport Council (now restructured as the Transport and Infrastructure Council) as part of the Australian Strategic Transportation Agenda for Research and Technology (ASTART). These principles can guide the alignment of initiatives driven by industry and government with a national objective:

1. The role of business is to develop innovative technological solutions – the private sector has the ability to drive development of new technologies, and the incentive and resources to innovate in-vehicle telematics.
2. The role of government is to provide policy certainty by setting the regulatory framework, creating an environment for business to invest with confidence.
3. Technology is a tool to enable policy – policy should not be designed to fit a technology.
4. Interoperability standards and platforms must be public, transparent and performance based. They should encourage innovation and facilitate multiple uses. Governments should provide standards and policy directions to help facilitate supply chain interoperability and in-vehicle telematics uptake.
5. Telematics-based compliance monitoring should be voluntary wherever practical.
6. Uptake by industry should be encouraged rather than compelled.
7. Mandating in-vehicle telematics applications requires transparent and consistent evaluation, considering the needs of all relevant stakeholders in accordance with best-practice regulatory principles. It should ensure any new technological requirements deliver demonstrable benefits to individuals and the community.
8. National approaches for telematics use – national consistency delivers economies of scale and drives greater uptake within industry.
In general, the role of government can be viewed as minimalist or leading (Booze & Company 2008):

- **minimalist** – where government provides only the necessary infrastructure such as the road and rail network. Industry then develops its operations in a way it believes is most appropriate. Regulatory constraints related to competition concerns should be removed to enable Australian logistic businesses to develop sufficient scale to compete against major international logistics companies.

- **Leading** – where government sets the role of the intermodal industry as part of its wider policy on freight and logistics. Government would identify where logistic activities would take place, provide protection for logistic land and transport corridors, and work to enable a whole-of-government approach in dealing with freight and logistics policies. Interventions, incentives and information sharing are other tools that can be used in this environment.

Government should ensure it does not impede the development and use of technologies across supply chains. One way that government could assist in enabling technology adoption that facilitates a ‘whole-of-supply chain’ approach could be the development of guidelines that articulate standard definitions which software developers could take into account. These standards should be based on user requirements. Common standards to enable information sharing will reduce the risk of replicating long-term national problems such as the rail gauge mismatch. Closer cooperation between government and the private sector before any systems are introduced can achieve this.

Notwithstanding this, better collaboration and cooperation between government and industry will generally enhance the evolution of integrated and compatible technologies to improve efficiency and productivity. The Hunter Valley Coal Chain is a good example (see below). Chain of Responsibility laws relating to the transport industry have also likely contributed to more efficient port supply chains (see below).

### 3.1 Hunter Valley Coal Chain

The Hunter Valley Coal Chain demonstrates how industry-led collaboration can generate positive results through greater information sharing.

Located in central New South Wales, the Hunter Valley Coal Chain is the largest coal export operation in the world. A mix of Commonwealth, State and privately-owned organisations operate individual components of the coal chain.

Until 2003 there was no central planning and coordination process for the movement of coal through the Hunter Valley Coal Chain. All planning was done at the individual service provider level, often resulting in:

- inefficient planning and scheduling of coal through the coal chain
- lack of coordinated planned maintenance activities
- excessive levels of cancellations
- excessive rework.

There was a large disconnect in the scheduling of train movements between the numerous coal companies. The key issue for the supply chain’s efficiency was the lack of shared information and low levels of organisation and management cooperation over scheduling between the mines (Hull 2012).

In early 2003, an Industry Review Team recommended a centralised Coal Chain planning function to generate enormous benefits to the Coal Industry (Hunter Valley Coal Chain Coordinator 2009).
This saw the Hunter Valley Coal Chain Planning Group (HVCCPG) established in June 2003. By 2005, all Coal Industry Service Providers had adopted the centralised planning model and formalised the HVCCPG, and the name was changed to Hunter Valley Coal Chain Logistics Team (HVCCLT). Members of this group represented all organisations responsible for transporting coal from the Hunter Valley mines to the port and to ships for export:

- PWCS as the operator of the cargo assembly and ship loading terminal
- Pacific National and QR National as the train operators
- Australian Rail Track Corporation as the track owner
- Newcastle Port Corporation which manage all vessel movements in the Port of Newcastle.

The HVCCLT has provided a single point of coordination for all planning decisions and has increased throughput and achieved coordinated investment.

3.2 Chain of Responsibility laws

The NTC pioneered ‘Chain of Responsibility’ (CoR) laws which came into effect in Australia in 2005 that ensure impose legal liability on operators in Australia’s transport chain for different activities (see Figure 2).

The laws are similar to the concept of ‘duty of care’ that underpins Occupational Health and Safety (OH&S) laws.

The aim of CoR laws is to make sure everyone in the supply chain share equal responsibility for ensuring that breaches of road transport laws do not occur. Key aims of CoR laws are to improve road safety, reduce damage to infrastructure, promote a level playing field for industry, improve deterrence and enforcement and improve business efficiency and compliance.

Figure 2: Chain of responsibility

While the link between CoR laws and efficiency is still unconfirmed, there is anecdotal evidence they have generated operational performance along supply chains.

For example, grain exports at the Port of Brisbane experienced substantial growth in 2009 after good rain following years of drought, which saw large truck queues form outside Graincorp, often stretching over a kilometre up the major road to the port causing delays of up to five hours. This placed pressure on the port, Graincorp and truck drivers, who often breached their driving hours and fatigue management requirements by waiting in the queues.
In responding to its CoR obligations, Graincorp worked with the Port of Brisbane to address the problem (Rankine 2013), including by:

- leasing the land adjacent to their facility and redeveloping it as a proper truck park with appropriate facilities
- instituting, in collaboration with the grain carriers, a Vehicle Booking System (VBS) to control the volume and timing of trucks entering the port. While the VBS began as a rudimentary phone booking system, it is now more sophisticated and internet-based and is integrated with the truck park and loading points along the supply chain. The integration with load points in particular has improved efficiencies at both ends of the supply chain.

Freight companies could better manage their CoR requirements with ICT systems to increase information they can obtain, such as route and road traffic information, real-time updates on working hours of drivers, and real-time updates on delays that may occur. This data will enable organisations to better plan for their fleet, including time management when booking jobs, and provide greater control of fatigue management.
4. Role of industry

Ports are the vital interface in export and import activity and in information flow. They are also linked to government functions such as customs and security. Ports are thus key players in the development and promotion of ICT along supply chains.

Ports spend billions of dollars on infrastructure (including wharfs, terminals, roads and rail lines) to enable efficiency and productivity. Inefficiencies may be attributed to sub-optimal use of this infrastructure, or a disconnect between the parties that share or in many cases interact at different points along the infrastructure.

The complexity of today’s supply chains and the number of transactions they generate demands real-time responses. The need to react to unforeseen actions efficiently and effectively drives the need to use information effectively. Companies now manage supply chains within their businesses in terms of planning inventory, relationship to sales, delivery methods and sourcing materials. Understanding the status of the total chain is now vital for successful daily operations, time management and cost reductions.

While ICT in industry is generating greater integration and collaboration between supply chain components, an overarching framework that could lead to a whole-of-community approach still appears lacking. Key participants of supply chains want improved transparency of information. This might be achieved through the use of a single portal to ‘glue’ separate systems together, allowing timely exchange of information between all users and on an equal basis (Australian Logistics Council 2010).

These benefits are demonstrated in some overseas examples of ports discussed in sections five and seven.

The ports and logistics industry requires substantial information to operate efficiently and ICT can improve the ability for all elements of the supply chain to see progress through the chain and share information. For example, a single container movement will progress through a shipping system, a stevedore system, port operators information, the transport carrier, the shipping company container system, users of inventory, government compliance systems, and road managers systems. ICT that enables better data connectivity and auto transmission can improve efficiency, time management and compliance. It also reduces operating costs.

However, some barriers do exist. While integrated processes may exist in supply chains it is unlikely they share a common ICT system. There may be other supply chains in which several ICT protocols are used between shippers, transporters (road and rail), depots and importers. In addition, despite organisations having connected ICT systems, interfaces are still required with government agencies such as customs and also end customers (container and parcel tracking). These groups are key influencers on processes, yet are often separate in terms of information flow.

As demonstrated in the Port of Valencia example, the use of ICT systems to develop information platforms open to all data users in a supply chain benefits both industry and consumers. These systems eliminate data duplication, manual entry and streamline the process required to shift goods from ship to dock to land transport. This, however, recognises there are differing commercial relationships which need to be managed appropriately in terms of confidentiality and privacy issues.

The example of the Port of Valencia in Spain demonstrates how technology has enabled seamless integration of information between parties in a supply chain.
The Port of Valencia (Spain)

The Port of Valencia is one of the world’s leading ports in container traffic, with approximately 80 per cent of its traffic being containers. It is ranked 5th in Europe and experienced a 4.3 million TEU throughput in 2011 (meeting with the Port of Valencia Port Authority, 7 September 2012).

It is the natural port of Madrid and well known for efficiency in port services as a result of the Seal of Quality Guarantee and technology innovation.

Like many other ports over the world, the Port of Valencia has experienced a consistent increase in container traffic over recent decades. This has led to a similar increase in the volume of ancillary activities related to the movement of containers, particularly land transport.

This surge of activity and related requirements for information sharing highlighted the need to develop systems to address the existing shortcomings in processes.

The Valencia promotes its strong belief in ICT solutions to achieve operational goals (PortStrategy 2009):

*For every single Euro you invest in this kind of system, you are saving more than €100 in infrastructure investments. It may seem simpler and easier to provide the infrastructure but the best thing is to work efficiently.*

Key challenges for the Valencia port include:

- fierce competition between leading sea ports due to the high number of companies using maritime transport routes
- management of complexities
- ability to handle the maximum volume of containerized cargos
- a highly fragmented industry with a large number of agents
- compliance with international security and safety requirements
- the need for accurate information for planning and operations.

The Port of Valencia addressed these concerns by developing valenciaportpcs.net, an IT platform covering a wide range on functions. This platform builds on the SIC (Community Information System) and EDI-based (Electronic Data Interexchange) applications for information sharing between the agents of the port community and port authority (Guerola 2009). Valenciaportpcs.net provides users with information across its operations and logistics processes:

**Sea:** sending and confirming documentary procedures relating to transactions, confirmation of booking and shipping instructions.

**Port:** the electronic processes involved in port of call requests, dangerous goods declarations, pre-loading cargo manifests and summary declarations

**Land:** processing of haulage orders, cargo acceptance and delivery orders as well as rail loading orders.
Developing this integrated ICT system has improved performance of operations (which improves quality and customer service). It has increased the efficiency of transactions and enabled a one-stop-shop for access and communication with carriers.

Much of the Port of Valencia’s success lies in its strong spirit of collaboration, achieving a balance between public and private partnership.

Research undertaken by the Global Institute of Logistics (2009) found this enabled integration of the whole supply chain in its cluster. A Quality Committee, a Quality Guarantee on service levels, and a comprehensive IT portal linking all port stakeholders support this collaboration.

The three key lessons learned from valenciaportpcs.net were:

1. integration of all the agents operating at the port improves productivity and helps to boost efficiency
2. error-free processes help to reduce costs
3. integrating different systems and making sure they run smoothly can ensure that information is provided faster and more reliably.
5. Port Community Systems

A Port Community System (PCS) has been described as a central point for an organisation to deliver or receive information. Its objective is not necessarily to create new information systems, but to effectively link existing databases and management systems, particularly through the conversion of different formats (Rodrigue 1998-2014).

Services and features of a PCS are summarised by the European Port Community Systems Association (www.epcsa.net) as:

- easy, fast and efficient electronic data interchange (EDI) information exchange, re-use and centralisation, available 24 hours a day, 365 days a year.
- customs declarations
- electronic handling of all information regarding import and export of containerised, general and bulk cargo
- status information and control, tracking and tracing through the whole logistics chain
- processing of dangerous goods
- processing of maritime and other statistics.

The European Port Community Systems Association (www.epcsa.eu) promotes the multiple benefits of a PCS. These include the enabling of intelligent and secure information sharing between public and private entities which can improve the competitiveness of ports by optimising, managing and automating port and logistics processes with single transfers of data that connect transport and logistics chains.

Smit 2003/2004 (pp. 6–7) illustrates a traditional communication pattern in a port (see Figure 3) and the transformation of information flows that a PCS can achieve (see Figure 4).

![Figure 3: Traditional communication pattern in the port](image-url)
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Figure 4: Communication pattern with a Port Community System

The first countries to adopt a PCS in the 1970s were Germany, France and the United Kingdom, with the Netherlands and Spain following in the 1990s. These countries are refining these systems and spanning them across multiple ports.

ICT can take many forms and extend beyond the port where ports have recognised the value in improving logistics efficiencies. For example, Hamburg’s Port Authority in Germany has established an ICT system called DIVA (Dynamic Information on Traffic Volumes) to help improve its surrounding road efficiencies to enable fluid movement to and from the port. (NTC 2012b) illustrates DIVA (see Figure 5).

In many international ports such as Valencia and Hamburg, the PCS was developed and is owned by the port authority.

Traffic management und informationen (Port Road Management – PRM)

Figure 5: Port Road Management System – DIVA – Port of Hamburg

At a minimum, a PCS should provide a single window of shared data and improve communication between supply chain parties. This alleviates issues associated with the double-handling and duplication of information, reduces the time spent retrieving data, and removes errors associated with human-processing of information. At its maximum potential, a PCS can be an...
all-encompassing real-time information system that is reliable, fast, focused, flexible and multi-faceted.

A PCS can enable improvements to various practices along the logistics chain, including ship line manifests, vessel discharging, loading operations, customs clearance, and movement of goods through a terminal and out of the port to its final destination.

A NTC paper on a pilot study of the intermodal supply chain (2009) supported the case for greater transfer of information along Australia’s supply chains:

*The transparency and transfer of information along the chain should be enhanced by the introduction of a common national IT platform for information exchange. Further detailed analysis should be undertaken to identify appropriate implementation mechanisms. This is a necessary precursor to potential future development of a more integrated, industry-led logistics management.*

*Such systems require collaborative development with a number of participants including road authorities, freight companies, customers, planners, government, and community. In order to achieve full collaboration, the benefits to each supply chain participant must be clear from the outset. Total benefits of the use of any system must outweigh the costs of implementation.*

The Port of Rotterdam employs a highly sophisticated technology platform to share information between organisations including customs.

The system has been developed and refined over 12–15 years and is being expanded across other European ports which are adopting the same platform, including the Port of Amsterdam.
6. Benefits and beneficiaries

Adopting information communication technology (ICT) to improve information flow and sharing can benefit multiple supply chain parties in many different ways. Obtaining accurate and timely data from a single source can lead to greater efficiencies and transparency to enhance work flow processes that benefit many participants, rather than benefits accruing to a single or just one or two participants. Multiple organisations along the supply chain can reduce their outgoing costs and increase profits.

Ultimately, the aim of ICT applications are to:

- increase efficiency in operations
- improve the use of infrastructure
- reduce congestion and queues caused by delay in receiving information
- improve utilisation of infrastructure and port planning and management.

A vital success factor is the type of data that is collected and shared between supply chain participants. Just some of the data that might be shared includes:

- truck/warf/container park bookings
- container number
- container location
- ship arrival times (planned and actual)
- container weight
- container contents
- carrier picking up or dropping off container
- whether a container is moving via road or rail
- customs clearance status
- delivery order details.

Hard copy documents that a Port Community System (PCS) enables conversation into electronic format for sharing include:

- manifests and associated amendments
- customs release notes
- ship’s out-turn/discharge reports and amendments
- bonded removal documents (for example, interport, ICD, CFS)
- local trans shipment documentation
- lines’ commercial release
- acceptance of rent/storage charges
- delivery instructions to transport operators (road/rail)
- export delivery advice and arrivals
- export load list
- loading reports
- customs scanning/examination/sealing requirements
- port health/quarantine and other government department activities
- requests to out-turn in sheds/warehouses (devanning)
- shed/warehouse out-turn reports and amendments
- customs declarations for exports
- ship planning notifications and amendments
- dangerous/hazardous goods reporting.(Long 2009)

The Investment Climate Department of the World Bank (2013) lists the core services expected from a PCS (see Figure 6).
Figure 6: Core services expected from a PCS

The Port Botany Landside Improvement Strategy (PBLIS) is a good example of successful technology integration to improve operational performance. In 2008, the New South Wales Government initiated PBLIS, and Sydney Ports led and coordinated the strategy. PBLIS aimed to maximise the amount of trade passing through Port Botany by making the landside supply chain more efficient, transparent and consistent and allowing for 24/7 operations.

The PBLIS has been in place for over three years and has delivered multiple benefits. Supporting PBLIS is the Operational Performance System (OPS), which integrates data from the stevedores and truck tracking data of a character to provide an independent and overarching record of operations at the landside interface.

Port Strategy (2013) reported that benefits delivered through an OPS include:

- an independent data source
- truck tracking
- information to assist with traffic and congestion management
- transparency and visibility for carriers and stevedores
- user capable reporting and online training.

This level of detailed information is also likely to drive key performance indicators and reporting of the businesses involved, generating efficiency initiatives and presumably cost and service benefits.

At a port, technology can help mitigate productivity issues outside the control of port authorities. For example, Port Strategy (2013) reported the PCS that operates at the Port of Antwerp in Belgium allows terminal operators to pre-plan most of their work in advance, almost eliminating late-minute surprises.

Table 1 sets out some of the benefits to a number of users of an IT system that can provide the listed data.
Table 1. Potential benefits for ITS users based on a selection of data currently collected in the market

<table>
<thead>
<tr>
<th>DATA</th>
<th>Transport Carriers</th>
<th>Forwarders</th>
<th>Importer/Exporter</th>
<th>Shipping Line</th>
<th>Stevedore</th>
<th>Port Corporation</th>
<th>Govt Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck/Wharf/ Park Bookings</td>
<td>Able to obtain booking patterns. Peak, shoulder &amp; Off Peak.</td>
<td>Allows for better customer management. Provides details to be able to improve processes.</td>
<td>Importers and exporters are able to manage labour, stock and their customers better by streamlining bookings.</td>
<td>Gives better container asset utilisation. Can reduce container fleets, and allows for more efficient operations.</td>
<td>By obtaining booking data, Stevedores can manage their labour and capacity planning.</td>
<td>Can have the opportunity to coordinate industry-wide booking patterns. Peak, shoulder &amp; Off Peak.</td>
<td>Industry wide booking patterns. Peak, Shoulder &amp; Off Peak.</td>
</tr>
<tr>
<td>Truck route</td>
<td>Provides for greater asset utilisation. Can help to determine the most cost effective routes. Assists in managing driver fatigue.</td>
<td>Gives ETA of truck at pack/unpack facility. This can allow for better labour management. Can also provide a performance measurement of the supplier.</td>
<td>Gives ETA of truck at pack/unpack facility. This can allow for better labour management. Can also provide a performance measurement of the supplier.</td>
<td>Gives ETA of truck at pack/unpack facility. Provides an accurate delivery location to assist in future planning.</td>
<td>Can give the ETA of a truck within a specified zone which allows contingency planning. Can provide better management of labour.</td>
<td>Provides data to undertake an Origin/Destination study. Can show road utilisation which can assist in Port infrastructure planning.</td>
<td>Can be used for Chain of responsibility requirements (e.g. driver fatigue management). Provides data to undertake an Origin/Destination study. Can show road utilisation traffic pattern / congestion issues and carbon emissions. Could assist in future planning.</td>
</tr>
<tr>
<td>Truck Turn Time</td>
<td>Details asset utilisation. This can assist in cost management of the asset. Can also help in the management of labour.</td>
<td>Provides visibility for determining demarrage/detention times. Gives a performance measurement of the Vendor.</td>
<td>Provides visibility for determining demarrage/detention times.</td>
<td>May be able to assist in performance measurement of the terminal.</td>
<td>Can allow stevedores to better manage the yard and labour.</td>
<td>Allows for greater Port asset management. Can also provide a good measurement for the performance of stevedores.</td>
<td>N/A</td>
</tr>
<tr>
<td>Truck Utilisation</td>
<td>Allows for management of assets &amp; yield. Can provide for better growth planning. Can assist in cost management and monitoring investment requirements.</td>
<td>A good performance measure of the supplier.</td>
<td>A good performance measure of the supplier.</td>
<td>N/A</td>
<td>Can allow stevedores to better manage the yard and labour.</td>
<td>Can provide for better growth capacity planning. Assists in arrangements for truck access. Shows road utilisation. Can assist in comparison studies of truck utilisation based on depot vicinity and company size. This will tell the port corporation where the carriers are that have best utilisation or areas with untapped potential.</td>
<td>Provides data for growth capacity planning. Can assist in arrangements for truck access. Shows road utilisation patterns. Details cargo/container flow by truck type. Can help in combating issues related to carbon emissions. Can assist in management of Chain of Responsibility requirements.</td>
</tr>
</tbody>
</table>

Data selection and potential benefits to users provided by ContainerLive ([www.containerlive.com](http://www.containerlive.com)).
<table>
<thead>
<tr>
<th>DATA</th>
<th>Transport Carriers</th>
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<th>Port Corp</th>
<th>Govt Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Transit Time</strong></td>
<td>Allows for management of assets &amp; yield. Can assist in management of Chain of Responsibility requirements. Is a vital cost measurement.</td>
<td>A good performance measure of the supplier.</td>
<td>Can be a good performance measure of the supplier. Provides on-time delivery % details. Can assist in the management of stock. Allows for better customer management.</td>
<td>Provides for better container asset utilisation. Can assist in fleet management and reduce container fleet numbers.</td>
<td>Provides details for greater capacity planning.</td>
<td>Can be used as criteria for measurement of carriers. Can also be a performance measure of the whole supply chain. Provides details for greater capacity planning. Supply chain measure. Capacity planning</td>
<td>Can be used as criteria for measurement of carriers. Can also be a performance measure of the whole supply chain. Provides details for greater capacity planning. Supply chain measure. Capacity planning</td>
</tr>
<tr>
<td><strong>Number of staged moves</strong></td>
<td>Allows for better management of assets &amp; drivers. Can provide a good measurement of cost.</td>
<td>This information could be used for cost comparison studies. Can be used as a measure of efficiency.</td>
<td>This information could be used for cost comparison studies. Can be used as a measure of efficiency. Could also be used for service level comparison studies.</td>
<td>Allows for greater management of inventory.</td>
<td>Allows for greater Port asset management. Enables monitoring of land/infrastructure investment requirements.</td>
<td>Can be used as criteria for measurement of carriers. Can also be a performance measure of the whole supply chain. Provides details for greater capacity planning. Supply chain measure. Capacity planning</td>
<td>Can be used as criteria for measurement of carriers. Can also be a performance measure of the whole supply chain. Provides details for greater capacity planning. Supply chain measure. Capacity planning</td>
</tr>
<tr>
<td><strong>Truck Queue times</strong></td>
<td>Allows for the monitoring of detention/demurrage.</td>
<td>Allows for the monitoring of detention/demurrage.</td>
<td>Allows for the monitoring of detention/demurrage.</td>
<td>Allows for the monitoring of detention/demurrage.</td>
<td>Provides for greater yard and labour management, and allows for contingency planning.</td>
<td>Assists in short and long term Port Land / infrastructure management.</td>
<td>Provides information on road congestion which can assist in management of road utilisation. Can provide greater detail around carbon emission issues.</td>
</tr>
<tr>
<td><strong>Container Dwell times - wharf/cargo owner/ECP</strong></td>
<td>Allows for management of assets &amp; yield.</td>
<td>May assist in reducing the overall container cycle.</td>
<td>Assists in the management of stock control.</td>
<td>Provides for greater inventory management and has the potential to help reduce container fleets.</td>
<td>Allows for better yard management and contingency planning.</td>
<td>Can provide for better growth capacity planning. Assist in arrangements for truck access. Shows road and property utilisation which can assist in better planning practices.</td>
<td>Can provide for better growth capacity planning. Assist in arrangements for truck access. Shows road and property utilisation which can assist in better planning practices.</td>
</tr>
</tbody>
</table>
The data and benefits of sharing it listed in Table 1 is not exhaustive; a variety of other data can be collected to benefit users.

Technology can now provide for more accurate recording of hours worked (useful in terms of fatigue management), the collection of data important for origin and destination studies, route planning and better time management. This can generate safety and other benefits for the general public. The use of road traffic information by freight companies has the potential to reduce road congestion by allowing for re-routing of trucks during peak periods.

Greater use of vehicle booking systems and the receiving of live updates on any delays occurring at a wharf may reduce delays at the port resulting from queuing outside the gate and may also reduce the number of trucks on roads. Increasing asset utilisation in this context offers many benefits to multiple participants (stevedore – less movements; road operators – less congestion; public – less vehicles; transport companies – lower operating costs). Additionally, less trucks on the road will also lower emissions and noise, improving community amenity.

The potential for well-designed and implemented ICT systems to coordinate, schedule and track goods cannot be underestimated. Examples like valenicaportpcs.net operating at the Port of Valencia in Spain show how these systems directly influence the success of a port as a business. In particular, the introduction of a Single Window facility in 1992 in Valencia simplified the flow of data between customs and the Port Authority, leading to lower business costs and increasing productivity. Additionally, another two technological aids for customs procedures have profoundly influenced operations at the port. These include a paperless import clearance procedure introduced in 2002, and paperless export control measures introduced in 2007 to simplify documentation exchange between shipping agents and cross-border police (Port Strategy 2012).

Integrating sea and landside communications through ICT systems can determine how well a port deals with increased traffic efficiently. The ability to communicate effectively influences the speed at which shippers, port authorities, Custom officials, container terminals, transport companies and end customers deal with each other.

The following Section 7 provides an overview of some systems currently available in the market in Australia and overseas.

The NTC and Technology Working Group does not advocate or recommend any particular technology vendor. Vendors are mentioned in Section 7 to illustrate their role in improving information flow and sharing.
7. What is currently available in the market?

7.1 Examples of technology currently used in Australia

Industry has increasingly embraced technology in the past few decades. Just a few examples of technology options available in Australia and overseas are listed in this section. When considering opportunities in the Australian context, it is important not to try to ‘reinvent the wheel’, but to learn from leading practices where they currently exist and adapt them where relevant to the Australian port and supply chain environment.

It may not be possible or desirable to create a single national system that covers all aspects. However, it is clear from case studies presented in this paper that a very high percentage of the information requirements can be incorporated into a single system and used by multiple parties.

While this paper does not explore system costs, the initial and ongoing maintenance and upgrading costs of these systems should be considered before decisions are made to implement them. Although it is evident that benefits for organisations and the nation’s economy will likely outweigh these costs, especially if they are driving process improvements throughout the chain. In addition, efficiency gains may also ultimately reduce overall operational costs. This is addressed more in the next steps section later in this paper.

Sydney

Smart technology systems are now used worldwide to deliver efficient and successful business operations. A range of different systems are currently used in Australia, such as Sydney’s Integrated Port System (ShIPS) operating in Sydney’s ports. The system was introduced in 2000, and has developed over the years to also manage ship work permits and bunkering activities. Other features of the system include operational reports, email facilities, a bulletin board and berth, channel, and exempt master files. These are all vital to daily port operations.

According to the Sydney Ports Corporation (2010), from 2000 to 2010, ShIPS has:

- managed 27,200 vessel movements
- received lodgement details for 430,885 containers carrying dangerous goods
- processed 17,148 applications for work to be carried out on vessels in port
- authorised 9,491 bunkering operations (where vessels are re-fueled or waste removed from them).

By 2010, there were 1,100 users from 285 shipping lines, freight forwarders, custom brokers and national government agencies using ShIPS. The system is provided free by the Sydney Ports Corporation, 24 hours a day, seven days a week. It replaces many phone calls and faxes previously required to arrange entry of a vessel into a port. Using the system, the Australian Quarantine and Inspection Service has the ability to approve a vessel’s entry and discharge of ballast water online. ShIPS has allowed Sydney Ports to generate efficiency and transparency in the supply chain.

Brisbane

In 2011, the Port of Brisbane developed and implemented the first fully automated public weighbridge following over 12 months consultation with industry, suppliers and the National Measurement Institute (NMI). The weighbridge was introduced to improve port safety, road safety and reduce risk to all road users by providing trucks with a solution to safely manage their loads 24 hours a day, seven days a week. (Portbris).

The design of the bridge incorporates:

- four separate and independent platforms, which allow each axle group to be weighed simultaneously without moving the vehicle
- ground loop sensors to guide the driver to the right place on the weighbridge
- designated pedestrian walkways, which eliminate vehicle and pedestrian interactions
- ergonomically-designed infrastructure to minimise musculoskeletal injuries, slips, trips and falls to reduce operator fatigue and human error
- a truck parking area at the entrance, removing congestion and vehicle interactions from Port roads.

One key advantage is that the technology used eliminates the need for an onsite operator, allowing for a 24 hours a day, seven days a week fully-automated operation.

**MAXimas**

Software developer MAXimas (www.maximas.com) offers a tailored ICT software system for integrated logistics. MAXimas allows for:

- an online update of all relevant vessel and voyage details, so users know cargo arrival times
- rail operators to notify users when specific containers have been loaded and ready for shipment
- customs to note the status so users know the progress of their shipment
- extensive forward planning, through regular updates
- the management of customs and quarantine requirements
- containers to be stacked and located so they are easily accessible for the next task
- customers and third parties to be given updates on their containers.

P&O Trans Australia use MAXimas software for all aspects of its organisation. The technology has allowed the business to respond to customer requirements as well as its internal needs.

Falling under the umbrella of the MAXimas software is Containerchain (www.containerchain.com). Containerchain is a web-based information and visibility portal for the container logistics community. The portal provides a single window that allows participants to view and transact empty container movements, with the aim to improve efficiency of movements and reduce costs for all port users. Advantages for empty container parks that have joined Containerchain include:

- paperless interaction with transport operators
- improved empty park truck queue management to reduce truck queuing and improve safety
- empty containers managed in a proactive environment rather than reactive
- real-time visibility on export release availability
- visibility on alternate empty park return locations
- real-time container and release number search
- significantly removes capital costs for technology given its web-based application.

### 7.2 Examples of technology currently in use overseas

**Portbase**

In 2009, the Ports of Rotterdam and Amsterdam in the Netherlands combined their previously independent PCS to form a single operating system called Portbase. The single system aims to offer a one-stop-shop for logistics information for both ports. It is anticipated the system will eventually become the national PCS for the Netherlands. Benefits listed on the Port of Rotterdam website (www.portofrotterdam.com) include:

- greater efficiency of port operations as a result of easy access to vital information
- lower costs
- better service provision
- more transparent planning
- more rapid throughput times
- fewer mistakes due to less manual handling of data
- it is available 24 hours a day, seven days a week.

Portbase operates as a non-profit organisation and is owned by the Port of Rotterdam (75 per cent shareholder) in partnership with the Port of Amsterdam (25 per cent shareholder), with each contributing to the financing of the system where services are of interest to the ports. Companies only pay a contribution for the use of services with demonstrable added value. Off-set against the advantages, the costs to the business community are relatively small.
Port of Valencia

The Port of Valencia owns and operates one of the most sophisticated PCSs in operation worldwide. Its valenciaportpcs.net PCS controlled by the Port Authority acts as a complete tracking and trace system for customers, providing real-time quality monitoring and reporting.

The system was introduced in 1980 and has grown and developed over the years and is now used by more than 400 companies in Spain daily, including customs, terminals and the Port Authority. The large investment by Valencia’s Port Authority was largely born from the explosion of trade in marine container traffic.

Forecasts over the world have indicated that container traffic will continue to grow, increasing pressure on leading ports. Port Net (2007) has identified issues for ports as:

- strong growth in containerised cargo
- highly fragmented industry with a large number of agents
- increased pressure to comply with international security and safety requirements
- need for accurate information for planning and operations.

New technologies will help alleviate some of these issues, or at the very least improve connectivity within national and international supply chains.

Port of Singapore

The Port of Singapore operates a successful PCS called Portnet (www.singaporeepsa.com). Introduced in 1984, Portnet is the first nation-wide PCS and links Singapore’s entire shipping community. There are currently approximately 9,000 users of Portnet and the system processes 210 million transactions a year.

Some features and benefits of Portnet include:

- real-time container and vessel track and trace, including schedules
- financial EDI
- real-time information on fulfillment services
- service and vessel declaration
- streamlines documentation and business processes for the port community
- information on demand through internet, email and SMS
- includes mobile website
- reduces double entry and transcription errors.

A 2007 World Bank survey (Arvis et.al. 2007) cited Portnet as a key success factor in the ranking of the Port of Singapore as the world’s top logistics hub.
8. Challenges in the Australian context

A key barrier to achieving a fully integrated supply chain supported by effective information communication technology (ICT) systems relates to concerns around confidentiality and commercial sensitivity of data.

Supply chain parties are keen to achieve maximum efficiencies through a collaborative approach, but they are also driven as individual businesses to develop commercial advantages over competitors. The reality of multiple components means a multiplicity of commercial arrangements and subsequent potential confidentiality and privacy issues.

This may cause a lack of willingness to participate in activities that enable the information sharing along the logistics chain and so pose significant challenges to the development of a national and integrated ICT system.

Collaboration and agreement between parties is integral to sharing information successfully. Fundamental to success is also the quality of data. As a paper by the Australian Logistics Council (2010) states ‘…effective collaboration is highly dependent on the degree of trust in the integrity of the information being shared between trading partners’.

The development of supply chain ICT and integration systems will rely on establishing a set of business rules to inform:

- data that needs to be transferred to improve the efficiency of the logistics chain
- processes to be used
- ICT system(s) and any associated interface protocols based on the above processes to support and enhance them
- hardware on which the system(s) is/are hosted
- required level of security and levels of access.

Three key issues pose the biggest obstacle for data integration between parties:

1. Existing systems owned by logistics chain participants that represent sunk costs and/or include data other than that critical for operating the logistics chain – such as customs and security data held by government agencies, integrated payroll management systems used by transport operators.
2. Costs of transfer to a new system – including costs of maintaining parallel existing systems used for other purposes), implementation and ongoing management.
3. Ownership of data (confidentiality).

To alleviate issues associated with confidentiality concerns, consideration about access to data is needed, including the level of access afforded to certain data. This can be addressed by providing mixed levels of access that combine restricted and standard access where appropriate. It is important that users can only access information relevant to their task or that required by law (such as customs accessing container weight declarations).

In regards to who owns and runs the system, a not-for-profit organisation could be formed similar to those operating in Rotterdam and Amsterdam, where several businesses are shareholders and financial backers. This organisation would manage the ICT system on behalf of users.

An Australian Logistics Council paper on ICT systems in the Australian logistics industry (2010) briefly touched on the subject of ownership of such systems:

A community portal could involve either a government sponsored or private service bureau running sophisticated software for users on a fee for service basis. Private options could be sponsored by industry groups, such as the Australian Logistics Council, or be specific to particular sectors, with co-operation amongst key operators a pre-requisite for success. However, the likelihood is that no one portal could cover the entire Australian (and overseas connected) supply chain.
In a model like this, care would need to be exercised in developing a system that accounts for the varying needs and scales of business that can and want to use the system. This will include arrangements on:

- size of contributions.
- whether bigger contributors have preference over smaller business.
- potential data exchange issues that may ask some businesses to change their practices or internal systems more than others.
- government regulations (if any).

In the end, no system will work if the different businesses that make up a supply chain cannot realise tangible benefits from their involvement.
9. Next steps

The key starting point considered by the NTC Technology Working Group to form its views was to identify and explore opportunities to improve port supply chain performance by adopting ICT systems. The contemporary function of ICT applications in materials handling as well as in data and information flow and sharing requires consideration. The Technology Working Group supported the notion that industry should drive technology solutions, and not be impeded by government.

Efficient sustainable ports and related freight logistics are contributors to Australia’s continuing economic development. ICT also contributes to effective supply chain management and improvements in materials and information flow.

Market-driven ICT is rapidly enabling greater efficiencies of port and supply chain operations through information sharing, as well as by providing critical data for adequate planning of current and prospective infrastructure upgrade or investments. Web-based (internet) data flow is particularly enabling the next generation of products in the market, providing easier access to information any time, anywhere.

Industry should take the lead role in the development and uptake of ICT systems to generate benefits to businesses by improving integrated supply chain freight movements.

Government needs to work closely with industry to create a collaborative approach to introducing systems which generate positive outcomes for the national economy. The role of government is to provide policy certainty by setting the regulatory framework, creating an environment for business to invest with confidence. Government can provide standards and policy directions to help facilitate supply chain interoperability (NTC 2011). Government should collaborate with industry to integrate approvals into any PCS where possible.

While this paper provides an overview of some opportunities for ICT to improve port-related supply chain performance, it does not explore all of them. To progress the potential of ICT systems there are further options that should be considered.

Next steps

- Where technology systems are already in use and collecting real-time data, it should be determined if that data can be accessed to establish and measure performance against national KPIs and targets.

  The absence of any collective view on the role that ICT (and PCS) plays in Australia has potentially held back development. There are potential benefits for planning and logistics processes if the information being collected through current ICT systems used by ports can be summarised and made available to industry and government.

- A better understanding of capacity, benefits and limitations of a market-driven web-based system approach needs to be developed. This could be undertaken initially through a trial using a system currently available in the market.

  Fremantle Ports, in collaboration with the Chamber of Commerce and Industry Western Australia, are undertaking a strategic assessment of the potential for introducing a PCS in Australia. The project aims to:

    - identify and, where possible, quantify Australian Port container supply chain inefficiencies and costs resulting from inadequate, inaccurate or untimely information, communication and data exchange
    - investigate how to address these inefficiencies and costs, including the potential role and benefit that a PCS could play
    - if a PCS is a potentially cost-effective solution, determine the quickest and least expensive means for developing one
While it is clear many opportunities exist to improve port and related freight and supply chain efficiencies by adopting ICT systems, more work is needed about the role of a national system. The work underway led by Fremantle Ports in conjunction with the Chamber of Commerce WA and industry will inform this discussion.
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