USING INFORMATION AND COMMUNICATIONS TECHNOLOGY TO INCREASE PRODUCTIVITY IN THE AUSTRALIAN TRANSPORT AND LOGISTICS INDUSTRY
WHO WE ARE

The Australian Logistics Council (ALC) is the peak national body for Australia’s freight Transport & Logistics (T&L) industry. The aim of ALC is to positively influence government policy decisions to ensure that Australia has a safe, secure, reliable, sustainable and competitive freight T&L industry.
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## Glossary

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<tr>
<td>3G</td>
<td>Mobile communications technology — voice and data</td>
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<td>CBD</td>
<td>Central Business District</td>
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<td>DSRC</td>
<td>Dedicated Short Range Communications — technology for wireless vehicle communications</td>
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<td>EDI</td>
<td>Electronic Data Interchange</td>
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<td>ERP</td>
<td>Enterprise Resource Planning</td>
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<td>GPS</td>
<td>Global Positioning System — satellite based location and tracking</td>
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<td>IAP</td>
<td>Intelligent Access Program — used to manage heavy vehicle road usage</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<td>RFID</td>
<td>Radio Frequency Identification — smart tags read at a distance</td>
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<td>SAP</td>
<td>German enterprise software company</td>
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<td>SCATS</td>
<td>Sydney Coordinated Adaptive Traffic System — traffic light management system in use internationally</td>
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<td>T&amp;L</td>
<td>Transport and Logistics, also known as Freight and Logistics</td>
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<td>XML</td>
<td>Extended Markup Language — used for data exchange</td>
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Executive Summary
Innovation in ICT in the Transport and Logistics Industry

The Australian Transport and Logistics (T&L) industry is the lifeblood of our nation’s economic well-being, generating 14.5% of Australia’s GDP and providing more than 1 million jobs across 165,000 companies. Without it our burgeoning resources exports, our agricultural output, the goods on our supermarket shelves and our commuters cannot reach their destinations, whether that be China, Tamworth or George Street in Sydney.

In order to deliver excellent service T&L businesses need to build excellent relationships with their clients, manage complex execution processes, and manage their own assets and people effectively. Despite being world-leaders in the 1980s and 1990s Australian T&L companies have failed to secure the productivity improvements that can now be gained using existing technologies — information that exists today is not being leveraged as it might to increase the productivity of T&L companies, their customers and the economy in general.

This failure to adapt ignores innovation and new technologies that can deliver significant benefits and customer service improvements, including the latest generation of Logistics Management Systems, Vehicle Tracking and Monitoring, Real-Time Traffic Information, Routing, Freight Matching, and Wireless Communications that can ensure the effective integration of all parts of the supply chain.

In fact, the most efficient supply chains worldwide leverage real-time information and ensure real collaboration between partners, whether this is within a closed-loop, across the industry, or indeed across the entire economy. Impartial industry wide Information and Communications Technology (ICT) solutions will enhance the industry’s ability to deliver predictable and reliable flows of goods and people.

Of course, any future strategy must be sustainable and it is clear that the enhancements that have most economic benefit come with efficiencies that will accelerate the reduction of CO₂ outputs by the industry at both micro and macro levels. This is a true win-win for the broader economy. But there is more that can be done to enhance the reduction of CO₂ with innovative ICT applications.

The case for investment at all levels from single sub-contractors to major corporations is clear — without it Australia will slowly decline in international competitiveness. Inevitably, the industry must collaborate on agreeing and utilising open global standards for information gathering and dissemination, and both State and Federal Governments must continue to play their part in avoiding regulation that would reduce the economic value of the available enhancements.

The Australian Logistics Council calls on all stakeholders to immediately review the opportunities offered by ICT to improve productivity in our Industry. It is clear that the Australian Transport & Logistics industry has enormous scope for productivity improvements enabled by the application of technology. To unlock this productivity bonus:

- Government must provide the appropriate infrastructure;
- Industry must educate its disparate components; and
- Enterprises must determine where and how they wish to position themselves in the Value Chain Maturity Matrix.

Immediate challenge for the industry
The immediate challenge is to identify how to use the technologies described in this Paper to support business processes across the economy, industry and individual organisations. All parties need to:

- identify points of duplication in business processes;

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Using ICT to increase Productivity in the Australian Transport & Logistics Industry

- identify what information is required and where else in the supply chain it might exist;
- audit the capability of current hardware and software systems;
- identify key trading partners;
- discuss collaboration opportunities with those partners;
- identify quick wins;
- identify any potential investment required;
- complete the business case (and get approval);
- implement and review any changes to process and the application of technology.

Importantly, industry-wide issues, such as standards for the transfer of information, must be addressed.

All this should be done with an eye to the Value Chain Maturity Matrix (which appears on Page 6).

Each stakeholder or group of stakeholders should plot their position on this matrix, which identifies the potential impact of deploying specific technologies. In general the Industry needs to trend from the bottom left (Internalised and Reactive) toward the top right (Collaborative and Proactive) of the Matrix. Individual organisations should determine the appropriate position in the Matrix that will maximise benefits to their customers, owners and other stakeholders.

To assist this broad change consideration must be given to moving from the Technology Solutions currently in place to current best practice as listed in Table 1 on Page 21. Future Trends in areas such as Logistics Planning Tools, Mobile Communications, Fuel & Emissions Reductions; and Industry Level Data Sharing identified therein provide clear signposts to further areas that will provide productivity boosts to the Industry.
The Transport and Logistics Value Chain Maturity Matrix

In order to deliver excellent service to their clients, Transport & Logistics businesses need to build excellent relationships with their clients, manage complex execution processes, and manage their own assets and people effectively.

Figure 1 displays a maturity model of T&L business operations. The model can be used to determine the ability of an organisation to collaborate across the T&L value chain.

The vertical axis determines an organisation’s ability to interoperate across the value chain; while the horizontal axis determines the ability to plan and execute activities. Throughout this Paper the Value Chain Maturity Matrix is used to highlight how ICT can support and enhance transport and logistics businesses and the industry as a whole.

The table above right explains in detail the definitions for each segment of the Matrix.
ICT is continually developing, and businesses across all sectors are looking for collaborative solutions to improve the information flow across their value chains (see Figure 2). T&L businesses are a key component of, and owners of information in the value chain. The current challenge is how to leverage that position to offer improved services and margins.

Figure 2 — Transport and Logistics — ICT Operating Model
We play an essential role in today’s Supply Chains

In order to deliver excellent service to their clients, Transport & Logistics businesses need to build excellent relationships with their clients, manage complex execution processes, and manage their own assets and people effectively.

The use of information technology in the Australian T&L industry commenced in the 1980s with the introduction of computerised job tracking, asset management software, and Customs’ COMPILE reporting system.

During the 1990s the implementation of EDI by retailers and the automotive industry in particular and the continued development of Customs’ EDI systems enhanced the further development of ICT within the T&L industry.

The implementation of the Internet from the mid-1990s onwards, together with the wide use of Microsoft’s Windows 95 operating system, and the application software developed to run on that platform, saw an explosion of uptake and use.

Today, the vast majority of T&L service providers are using ICT technologies that enable them to send and receive email, electronically talk to their customers and suppliers, and have online capabilities.

Productivity can be improved today by using existing technology.

Available and relevant data currently exists to improve the supply chain information flow right now.

There is no reason for T&L businesses not to use ICT to connect to internet.

An improvement in productivity could be realised in the immediate to short term if T&L companies approached their trading partners to explore what information is readily available to be leveraged, using available technologies, to enable effective collaboration.

Organisations can more effectively apply existing hardware and software solutions to increase productivity in their organisations and with external partners.

Firstly, T&L businesses must connect ICT systems to the internet, whether fixed or mobile. Over the past decade the rate of ICT adoption in the general economy has been exponential. With the advent of the Internet and the evolving nature of communications networks such as Telstra’s national NextG™ and NextIP™ networks, the sheer quantity of content now available real-time, on-demand across a range of devices is unparalleled and continues to push new boundaries.

The on-line service channel is now steadfastly integrated into our daily lives and is often the preferred service option: banking, entertainment, investments, shopping, research, education — the list is ever growing. Commercially, there are virtually no businesses without the fundamental
business basics of at least one personal computer with on-line connectivity and a mobile phone.

Whether small or large, every business has at its disposal an array of ICT options to drive the promise of improved productivity by being better, faster and cheaper in their service delivery endeavours. Transport & Logistics companies hold a rather unique position in the supply chain because they are typically high users of existing information, if not necessarily high generators of new information. This fact matters because opportunity abounds for T&L providers to leverage data that already exists across the supply chain and to use it to drive productivity improvements for themselves and their stakeholders.

Most supply chains already generate at source a myriad of relevant information that could easily be leveraged to improve the supply chain information flow. Data such as customer and shipment details including locations, quantities, volumetric information, etc. exists, if not in the T&L provider systems, most certainly in a trading partner’s. Yet transport providers are typically compelled to re-generate much of this information for their own purposes. This is often done manually and on paper, recording the very same information already available. The opportunity is for logistics companies to leverage this data today, hence saving significant time, effort and cost.

Shipment volumetric data such as pallet configurations can be used to influence decisions about truck and load capacity requirements. Better visibility of this information across the supply chain would facilitate long term gains if trading partners collaborate more effectively and investigate the possibilities of what can be achieved.

Based on the assumption that devices for capturing information and processing it for a purpose exists to at least some degree in the vast majority of companies the questions to be answered are: what data is relevant, and how can it be utilised to deliver a benefit? A recent case study demonstrated that Cadbury Schweppes\(^2\) was able to achieve significant savings (up to 40%) in delivery costs, while increasing the efficiency of the delivery operations. This was achieved by exporting information on daily delivery requirements from existing back office systems to a third party route optimisation system.

Importantly, considering our industry operates on a huge continent, a single wireless voice and data network, Telstra’s NextG™, provides a fast, consistent national service — allowing a single vehicle or device to transit the vast majority of Australia’s transport networks, all the while retaining the same high level of connectivity and service whether in a major CBD or in the far outback. Recent upgrades to that network provide maximum download speeds of 21Mbps. In January 2009 Telstra announced it would continue to build on its commitment to speed and deliver peak network speeds of 42Mbps in the coming twelve to eighteen months. In effect this means T&L suppliers can remain in mobile voice or data contact with their partners at almost all times and locations and therefore feed data to and from vehicles and locations conveniently and in real-time. Lack of quality connectivity is no longer a reason not to link real-time supply chain data.

A 2005 Transport & Logistics industry pilot project\(^3\) confirmed that Australian freight companies and their customers could make quantum leaps in administration and time savings by “replacing the flood of every day paper work with electronic messaging”. Utilising the GS1 system of numbering, bar-coding and XML messaging standards as the foundation for automatic data capture and exchange, the project, involving Kimberly-Clark Australia as the supplier and Toll Transport as the carrier, demonstrated a significant reduction in reconciliation errors. Time spent creating consignments and managing accounts receivables was “slashed from four hours to twenty minutes”.

There are already many companies in the Australian market who are able to provide routine information to their transport providers; companies who use global standards as a basis for information exchange and are therefore very well placed to

\(^2\) Jeppesen Cadbury-Schweppes Case Study (see page 13)

\(^3\) Toll-Kimberly Clark Case Study (see page 13)
share regular data such as shipment information to reduce duplication and manual processing at the various points of goods exchange.

Information, Communications and Technology (ICT) is well developed, widely available and, in many cases, cost effective to implement — these enablement tools are accessible today and are proven to increase productivity when implemented correctly. The challenge is in the identification of how to use these tools to support a business process both within an organisation and with external partners.

A basic analysis process would follow these steps:

- identify points of duplication in business processes, i.e. where is information being re-generated and/or manually entered?
- what is this information and where else in the supply chain might it exist?
- audit the capability of current hardware and software systems;
- identify key trading partners;
- discuss collaboration opportunities with trading partners and suppliers;
- identify the low hanging fruit, i.e. quick wins;
- identify any potential investment required;
- do the business case (and get it approved)
- implement, and review.

The impetus to engage trading partners in the service process, to explore and ask the question has yet to reach the tipping point. Therein lays the opportunity for the industry and its stakeholders to make the decision to take advantage of what is available today and realise productivity gains in the immediate to short term.
### Schweppes Vehicle Route Optimisation

- **Approach**
  - Use Vehicle Routing Optimiser, Travel Time Calculator and Geocoder in a proof-of-concept project to optimise a month’s deliveries for each of the Melbourne and Sydney regions.
  - Having proved the efficiency gains, model the rules in more detail and deploy optimiser as a daily planning tool within Cadbury Schweppes.

### Results

- The objective of the proof-of-concept project was to demonstrate that the modelling approach was suitable and to demonstrate savings. Operations were modelled to a moderate level of detail in order to achieve this aim. The project was successful, revealing that:
  - there was a significant reduction in delivery costs associated with an increase in efficiency of their delivery operations
  - savings in excess of 40% could be achieved. A number of further challenges were fulfilled when optimiser was deployed. To ensure a firm basis for the routes calculated by the system, each customer was geocoded. The Geocoder associates a latitude/longitude coordinate with each customer, based on their street address and a set of spatial map data describing the state-wide street network, including boundaries for suburbs and postcodes.

### Kimberly-Clark and Toll Logistics

Health & Hygiene products manufacturer Kimberly-Clark Australia and its carrier, Toll Logistics, worked together towards replacing the flood of everyday paperwork that flows between the two with electronic messaging.

The results have been impressive: reconciliation errors were reduced, and those which remained were able to be resolved in just two days versus the prior ten, while the time spent creating consignments and managing accounts receivables was slashed from four hours to twenty minutes.

The pilot was part of a wider industry project managed by GS1 Australia called ‘Demonstrating the Benefits of Adopting Global GS1 Standards by Logistics Service Providers in the Retail Grocery and General Merchandise Supply Chain’.

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See Case Study link on Page 30

See Case Study link on Page 30
Innovation will continue to deliver significant benefits and service improvements

It is important to examine the specific role technology plays in logistics and the trends that will provide an increasingly capable set of available systems and solutions. The following sections deal with key areas of opportunity.

**Logistics Management Systems**

Logistics Management Systems are required to manage three unique but integral flows, utilising transport, information, and communications infrastructures:

- Physical
- Information
- Fiscal

These flows are deeply inter-connected, with the flow of information and payment generally running in the opposite direction to the physical flow.

The ideal Logistics System smoothly delivers goods where they are needed, when they are needed with the least amount of cost, energy, carbon, pollution, noise, congestion and harm. This involves minimising **wait time** and **handling** during the transport of goods to their final destination.

For most freight, speed between nodes (e.g. freight hubs) is not as important as consistent flow. This is different to passenger transport where speed between nodes (e.g. stations) is a key requirement.

This difference in requirements highlights the need to have dedicated freight corridors (linking key nodes) that can run large volumes of freight at steady speed, timed to load/unload at each node. This has the added advantage of keeping down total cost, energy, carbon, pollution and noise, as well as reducing congestion and improving safety, including on passenger networks, which may currently be operating on the same infrastructure. Ideally, a dedicated freight corridor should be physically separate from passenger corridors, enabling 24 hour a day operations. As an interim measure this can be achieved by a dedicated time of day use of common infrastructure.

The design of this network of freight corridors and hubs is a key determinant of overall system efficiency.

Increasingly, it is also recognised that the different modes (road, rail, sea and air) must work together to maximise efficiencies. Integrated planning is key to maximising efficiency.

The first step is the design of our cities to include a Freight Network linking designated inter-modal terminals and freight hubs for:

- **point to point** mass transfer of freight between districts, with the hubs acting like a switch to route freight destined for other areas along the next leg (corridor) and, ideally, to its final destination along local roads without any transfers between modes; and
- where necessary, cross docking at the hub into smaller loads for immediate distribution within surrounding areas, or direct into warehouses on the hub for later distribution.

In a welcome development, the Council of Australian Governments (CoAG) December 2009 meeting agreed to national objectives and criteria for the future strategic planning of Australia’s capital cities.

The required airports, ports, hardstand, rail and road networks, as well as the associated transport equipment and warehousing, cross dock and support facilities, together form the physical infrastructure.

In recognition of this, the Victorian State Government has already begun to map out a

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6 COAG Communique 7 December 2009.
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Principal Freight Network, including key hubs, as part of its Freight Futures strategy⁷.

To date, Australia’s information and communications networks and associated software have not been regarded as a key part of our logistics infrastructure. It is the contention of this Paper that, in future, an integrated common user portal will be a vital part of an effective logistics environment. Optimally, proprietary systems will be linked and will provide open access to critical information.

**Physical Flows**

Physical flows involve the movement of:

- materials, packaging and goods; as well as
- transport assets (trucks, ships, planes, containers, pallets, etc); and
- people

Transport assets and people are the operating elements in the logistics eco-system. In the past, both were largely neglected from a systems management viewpoint. However, with the technology now available it is widely recognised that to get the best out of the entire eco-system we must monitor and manage our transport assets in real time. More recently, with fatigue management laws and a greater focus on safety, people (operating staff and passengers) are now regarded as part of the whole Logistics Eco-System that must be effectively managed.

**Information Flows**

The smooth physical flow of freight is impossible to achieve without a smooth flow of all operating elements and this is now next to impossible to achieve without a smooth flow of information (the right information, at the right place, at the right time).

The ideal logistics information system must perform four tasks. It must

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, etc.), again making this information available in real-time to those who need to act on it.
4. monitor the flow (e.g. including traffic on the Principal Freight Network) to ensure the whole system is working as it should, again providing real-time information to those who need it.

Over the last decade, the world has seen an exponential increase in the number and power of computer systems on offer. These include specialised systems which are designed to manage the flow of containers and goods (such as Maximas), through to ERP systems (such as SAP) that control the manufacture, warehousing and distribution of materials, goods and packaging along the whole supply chain. A multitude of other systems covers each part of the chain (freight forwarders, customs brokers, shippers, etc.). In addition, many major transport companies have developed very sophisticated in-house systems to control both the flow of goods and the transport assets used in the task.

With GPS and RFID technology, the Internet, and sophisticated fixed and mobile communications networks becoming all pervasive, major corporate systems are migrating to provide broad-based information where and when it is needed — to customers, suppliers and within the business. This is in turn facilitated by the increasing use of Electronic Data Interchange (EDI). By removing the need to re-key information from one system to another, EDI is the link that is turning individual

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⁷ Fig 10. The Metropolitan Freight Terminal Network vision, p36.
“Freight Futures” Victorian Freight Network Strategy.
systems into a single community wide ‘portal’ — but at present only for selected users. In fact the great bulk of operators are still small businesses that do not yet have access to all technology and more importantly to all information.

However, this gap too is closing fast. Most logistics systems on the market now include a web interface that enables small users to see directly into third party systems. For example Maximas allows the customers of a transport company to book and monitor container movements in real-time, via the web.

Over the coming decade, information will become more and more integrated (both horizontally and vertically) with less and less manual (personal/email/phone/paper) transaction processing required. It will mean greater weight is placed on the value-add of specialist knowledge at each point in the chain. Increasingly, much of this knowledge will also be automated within the transaction rules developed in each specialist computer system.

While the IT products in the market will continue to evolve towards greater integration, there remains a need to consider an overarching framework that will facilitate the development of the community wide portal.

The aim of such a portal would be to glue all these separate systems together, thereby allowing the timely exchange of information with all users and on an equal basis where the information is non-proprietary. An added value of such a portal is in the provision of paperless operations for trading and transport documents, electronic transactions and communications between stakeholders, visibility of supply chain and real time tracking and tracing.

Ideally, such a portal would lead to greater standardisation of data definitions. For instance, an Australian Customs study \(^8\) showed that the 41 government agencies that had an impact on trade required 6793 data items. Harmonisation would reduce this to 693 and would greatly reduce the possibility of translation errors.

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 supported 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.

Alternately, the enabling device may not be a portal if agreement for broad use could not be brokered.

A solution may be as simple as a set of guidelines that spell out what is required by users in each of the four major flows, combined with standard data definitions, so those developing any enabling software take these into account.

There may also be a requirement for legislation to ensure that any potential for monopoly power over the control of the information is limited, vested in an independent authority, or is exempted from competition law. A commercial view determining what elements of the system and what information is required by whom at each stage of the transport task would be fundamental to such a portal or set of guidelines.

For example, every port user should have access to the same information about import and export containers in which they have an interest at the same time, in the same manner. It is not in keeping with an efficient market for some users to get better or timelier information than others, or to have to pay a different cost for that information.

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**Fiscal Flows**

A key to keeping costs down is timely payment. This requires timely acceptance of debt, which in effect means there should be no dispute about the task performed. In turn, this acceptance requires timely information at every step in the process so

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\(^8\) International Trade Single Window Study, April 2008, presentation to CBFCA NSW Convention, Newcastle.
that immediately a task is finished all parties know and have accepted who did what, and who is liable for the cost. Again, Maximas is an example of a system that provides real-time feedback at each stage of a logistics transaction of status, and designated responsibility for any variances from the original order, eliminating the potential for a dispute when an invoice is issued.

Where the job performed and responsibility is clear, payment can be made automatically from a customer’s bank account to a supplier’s bank account — on agreed trading terms. The corollary of course is that without proof of properly completed transaction no payment will be made. There are systems on the market (eg. Compay) that already provide this facility. Compay also includes the ability to directly interface with both parties’ general ledgers, further eliminating administration and the potential for error. Of course, all this presumes all other parts of the system are working properly.

Another important function of payments is in differential pricing for the use of infrastructure (such as the NSW Government’s Peak Period Pricing charge and similar Truck Access Fee proposed by the Victorian Government). These fees impose a cost on Trucks accessing each main Port depending upon the hours of the day and days of the week, with the greatest cost being levied at peak periods. This encourages greater efficiency (larger trucks), higher utilization (back loading) and even work loads (spread across all hours/days of the week). The result is less congestion, as well as lower cost, energy and carbon.

This charge can only be levied at a minimum cost where there is widespread use of ICT by trucks accessing the major Ports. Similar charges could be imposed more widely to encourage night operations and ease congestion across the broad road network.

**Summary**

While it will be many years before it is possible to totally integrate all parts of the supply chain information system, the need and the direction is certain with a driving need for national architecture and standards which ensure systems interoperability.

The smooth flow of information in every part of the system is vital for ensuring the smooth flow of freight. Smooth flow reduces cost, emissions, noise and energy. It also helps to ease congestion and improve safety through inter-vehicle communications and GPS technology.
The previous section examined the overall logistics management task and the importance of having real-time access to information on the location and status of individual elements in the process. This section examines the ICT solutions applied to the task of tracking and monitoring vehicles within the network.

There are several categories of mobile device that are of interest to T&L operators: including for mobile routing; as mobile point-of-contact terminals; for vehicle monitoring devices; and monitoring shipping containers. Variations include:

- Tracking devices. A GPS unit tracks a truck’s location for the support of the logistics operation or to check compliance with permitted road use.
- Mapping devices. This may include information about routes, speed zones and congestion.
- Intelligent Speed Assist uses map data to speed limit a truck based on known speed zones.
- In-truck mobile phone.
- Truck weighing systems — used to correctly distribute weight during loading.
- Mobile terminals — used to track pickup, transit and delivery.
- Telemetry devices — feeding back engine and other data to allow monitoring of driver behaviour, engine performance, and information about goods carried (e.g. refrigeration temperatures).
- Fatigue monitoring glasses. Eyelid motion monitor that warns the driver of drowsiness. Some carriers are connecting this to SMS messages to home base, and to the engine management system to forcibly slow the truck.

For point-of-contact, mobile devices exist in a wide range of configurations that combine GPS, telephone and computing functionality. Drivers can signal electronically the completion of a stop to their depot and fleet management systems can allocate new appointments or pickups as and when they occur. The Tracking Systems section which immediately follows expands on these options.

Mobile vehicle monitoring devices monitor the driver’s usage of the vehicle, engine parameters and geo-tracking. Newer technologies are emerging that can monitor driver alertness, lane tracking and provide clear health and safety advantages to operators.

Mobile devices that monitor the status of transit containers for temperature, humidity and geographical position can be used to ensure compliance to their delivery arrangements for sensitive goods. Such real-time information is also of use to supply chain managers in better managing their inventories.

The purchase of such mobile devices should be combined with operational management software that can both interpret and give operational efficiency benefits through dispatching and vehicle routing. Only when the use of mobile devices is integrated within the business operation will the full commercial benefit be realised.

The advent of satellite-based positioning systems, most notably the US-supported GPS network, has revolutionised the real-time tracking of vehicle position at any point on the face of the globe. Since the early 1990s operators have been able to access commercial systems and services to support the management and despatch of response vehicles as well as the optimising of logistics operations. A typical service incorporates:

- A GPS satellite receiver and positioning calculator in the vehicle. These can be supported by a gyroscope or measurements of wheel rotation and steering direction to support position calculation when satellites are not detected (for example in a tunnel).
- A means of communication of the position calculated in the vehicle to the home-base, generally over a cellular network.
A computer at the home-base, which consolidates the information and presents the vehicle position on a map-based display. Algorithms which then take the position information and provide further calculations, such as optimal delivery routing, preferred despatch instructions and estimated arrival times.

While the technologies for these services have been available for some time take-up has been variable. Many larger operators have been able to justify the investment in systems dedicated to their operations alone. Smaller operators have found it harder to justify investing in their own systems and bureau services have often required lengthy commitments for rental of on-board systems.

However, we have entered a new era in which GPS systems for basic navigation are becoming a standard item in mainstream vehicles. This, combined with an increasing connectivity of the vehicle to the surrounding environment, promises a new level of universal vehicle tracking for large and small operators.

One of the drivers for a universal solution for large vehicles is the application of the Intelligent Access Program (IAP). This has been developed as an AustRoads initiative\(^9\), in order to provide an Australia-wide application of GPS-based tracking, with a focus on permitted road-use compliance. While the scheme has initially been applied to over-sized and dangerous goods vehicles it is now moving into more general application as it becomes a prerequisite for accessing Higher Mass Limits in certain states. The scheme is based on a principle of multiple suppliers and operators using a standards-based accreditation framework. The technology and tracking solutions developed for the specific IAP tasks are likely to find their way into broader commercial application, particularly at the heavy vehicle end of the market.

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**Real-time Traffic Information**

The logistics management and tracking solutions outlined above have traditionally used average travel-times in a network to estimate time-to-arrive for vehicles in the managed network. There is an increasing demand for better use of real-time traffic information to accommodate the high levels of variability under congested conditions, as well as to incorporate alerts in relation to incidents and road works.

There are several methods of deriving real-time traffic information, including:

- Extracting traffic density and travel-time information from information gathered from the traffic-light control network. In Victoria and NSW, this is done by the SCATS systems, operated by the respective road authorities. At least one commercial operator (SUNA Traffic) has negotiated access to this type of information.
- Calculating travel-times from an observation of the transitions of cellular phones from one cell to another. By averaging observations and removing outliers, a good estimate of the speed of travel along main arterial roads can be determined. This is delivered as commercial services in Europe and the US and has been trialled in Sydney. Cellular phone identities remain anonymous in the process.
- Aggregating information from vehicles that have GPS systems across the network. For example, Honda in Japan draws information from its overall customer fleet and packages this with other information, to provide traffic and incident information back to users of its InterNavi service.

It can be projected that commercially packaged solutions of integrated real-time traffic information will soon enable logistics management solutions be enhanced and deliver “smooth flow” under the actual changing conditions of the road network.
Electronic Route and Speed Maps

Mobile navigation devices are best suited to T&L operators when they support multi-stop route planning and integrate well with fleet management software. Mapping information is currently not completely available to support some T&L related operational needs. Information such as loading zones, vehicle height/weight restrictions, low-bridges, turning restrictions and cargo carrying restrictions need to be provided and integrated.

In Europe the number of accidents involving vehicles crashing into low-bridges has increased after the wider introduction of route navigation systems. The provision of T&L relevant datasets for navigation should be given priority as part of the national infrastructure.

Fundamentally the logistics industry is about where pick ups, deliveries and assets are located at any given time, thereby requiring quality spatial information to be a core component of initiatives in the industry.

Freight Matching

A number of technology providers are looking to the more complex organisational issue of matching freight to empty vehicles. Such systems can provide the immediate notification of jobs available using SMS, fax, email or the internet. Online web sites also provide the ability for members to search for jobs and bid for potential consignments.

Further technology break-throughs are imminent for technologies that automatically determine the best overall matching strategies for members to optimise the freight allocation as a cross-industry portal.

Freight matching is also a multi-mode logistics problem that involves rail, sea and air as well as road freight. Optimising the movements of containers around key infrastructure hubs as a whole will reduce congestion and help balance the movements of empty containers to where they are required.
Using ICT to increase Productivity in the Australian Transport & Logistics Industry

Wireless Vehicle Communications via DSRC

DSRC (Dedicated Short Range Communications) is an emerging technology that enables vehicle-to-vehicle and vehicle-to-infrastructure communications in very short time frames (faster than human response). Vehicles use GPS and transmit their location and speed to surrounding vehicles and infrastructure. DSRC’s primary application is safety, e.g. collision avoidance. In effect it enables vehicles to ‘see around corners’, over hills and beyond visual obstructions to know all about the movements of surrounding traffic. Each vehicle can ‘watch’ and communicate with all vehicles for more than 100 m in all directions as well as monitor the status of traffic lights, variable speed signs etc. Similarly, it enables infrastructure to know about the traffic and communicate with vehicles.

Wireless Vehicle Communications via DSRC has already undergone extensive testing overseas and is on the roadmap for vehicle manufacturers. Australia has world leading intellectual property in DSRC wireless design and has already participated in 10,000 km of overseas trials. Allocation of dedicated spectrum for DSRC is well advanced in Europe and USA and is being championed by the AusDSRC consortium in Australia. In Australia, wireless vehicle communications via DSRC is planned to operate via an open standardised platform that, together with mobile phone communications, will provide a transparent and flexible means to address communications with trucks, drivers and cargo. Rollout, however, will not be a fast process and the technology may not be installed in new vehicles until the 2012-15 timeframe.

Drivers for the uptake of DSRC in Australia are:

- Safety — primarily via collision reduction.
- Greenhouse emissions and fuel reduction — via advisory speeds and dynamic engine management

Emerging Technologies

Table 1 (which appears on the following pages) captures development stages for trucking carriers and shows a progression in:

- Complexity as businesses grow;
- Technology adoption;
- Sophistication;
- Savings;
- Collaboration with:
- Competitors; and
- Government.

Many of the categories are inter-related. However, it is possible for organisations to be well advanced in some while lagging in others.
<table>
<thead>
<tr>
<th>Area</th>
<th>Current Typical Solutions</th>
<th>Current Best Practice</th>
<th>Future Trends</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logistics Planning Tools</td>
<td>One or Two Analysts using spreadsheets or paper based processes</td>
<td>Optimiser software decision support (Typically 20% Benefits Case)</td>
<td>Improvements in operation as tools extend across all inbound/outbound and all modes of transport to release 30% savings</td>
<td></td>
</tr>
<tr>
<td>Logistics Management Technology</td>
<td>Typically using basic ERP tools to manage transport operations</td>
<td>Asset and resource optimise software including workflow and RF and Barcode technologies</td>
<td>Using management information and transactional information to shared data with trading partners to further improve asset utilisation</td>
<td></td>
</tr>
<tr>
<td>Industry Level Data Sharing</td>
<td>No data sharing as seen as confidential information</td>
<td>Limited data sharing where there are definite business benefits for each party</td>
<td>Sharing non-commercial data across industry by vertical sectors where there are direct synergies enabling share used of assets and information</td>
<td></td>
</tr>
<tr>
<td>Bookings</td>
<td>Fixed or own fleet with a handful of subcontractors</td>
<td>Dynamic real-time booking using internet and mobile telephony</td>
<td>Flexible carrier-taxi-style bookings especially for urban and long haul legs</td>
<td></td>
</tr>
<tr>
<td>Use of Sub-Contractors</td>
<td>Zero</td>
<td>Sub contractors used were appropriate</td>
<td>Utilisation of mixed assets to enable improved vehicle utilisation and reduce environmental impact of transport</td>
<td></td>
</tr>
<tr>
<td>Technology in Trucks and Cargo</td>
<td>None</td>
<td>Non integrated devices / proprietary devices</td>
<td>Internet connected devices enabling information sharing with internal and external parties</td>
<td></td>
</tr>
<tr>
<td>Tracking</td>
<td>No tracking</td>
<td>Truck level tracking and Pallet level tracking using barcode technology</td>
<td>Container level tracking using RFID</td>
<td>Goods level tracking using RFID</td>
</tr>
<tr>
<td>Communications with Driver, Truck and Cargo</td>
<td>Communication to driver only</td>
<td>Communication with driver and assets using telemetry</td>
<td>Communication with container</td>
<td>Communication with cargo</td>
</tr>
<tr>
<td>Industry Collaboration with Government</td>
<td>Low collaboration with Road Authorities</td>
<td>Increasing communication with infrastructure as new regulation is introduced to address environmental and</td>
<td>High Collaboration with Federal and State organisations</td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>Current Typical Solutions</td>
<td>Current Best Practice</td>
<td>Future Trends</td>
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<tr>
<td>Accident Casualty Reduction</td>
<td>Limited to few businesses. Driver education; driver fatigue detection; lane departure warning systems; pre-crash detection, e.g. radar.</td>
<td>Gradual adoption of vehicle to vehicle wireless vehicle communications via DSRC.</td>
<td>60% casualty reduction (all vehicle crashes)</td>
<td></td>
</tr>
<tr>
<td>Fuel &amp; Emissions Reduction</td>
<td>Limited to individual players via new technology and vehicle design</td>
<td>Gradual adoption of wireless vehicle communications with traffic lights</td>
<td>Potential to save up to 30–50% fuel costs through energy efficient coordinated traffic flows, new vehicle design and driver aids.</td>
<td></td>
</tr>
<tr>
<td>Truck Utilisation</td>
<td>Based on contract with limited opportunity to share assets</td>
<td>Excess capacity published via shared portal</td>
<td>Integrated with collaborative planning tools</td>
<td></td>
</tr>
<tr>
<td>Backhaul Utilisation</td>
<td>Telephone and opportunistic back haul</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 — Transport and Logistics — Technologies and Solutions.
Today’s most efficient supply chains leverage information and ensure collaboration.

Impartial industry wide ICT solutions for collaborative information sharing of enhance the T & L industry’s ability to deliver predictable and reliable transactions.

The structure of the Industry, with its predominance of Subject Matter Experts, requires active collaboration and co-operation if customers’ needs are to be met. The international maritime sector of the industry averages between 27 and 30 parties for each import/export transaction, with an average of 40 documents per transaction. These documents provide over 200 data elements, of which 60 to 70 per cent are re-keyed at least once, including 15 per cent being re-keyed up to 30 times.

Impartial industry wide collaborative sharing of transaction data reduces the amount of duplication and enables customers and suppliers alike to operate within a lower cost structure. GS1 Australia’s GS1net data synchronisation platform is an example of the retail supply chain industry collaborating to enable accurate and predictable product information to be shared by competitors (retailers) and suppliers in a secure and trusted manner.

Similarly, the maritime T&L industry has no one dominant player but downstream service providers rely on large multinational and government corporations to provide accurate and timely information. Impartial industry wide information solutions, e.g. Tradegate’s Smartimports and ExportNet services, enable T&L providers to receive data in a reliable manner, while also supplying this data to their customers.

Without these impartial industry services the cost of providing a predictable and reliable information service would be substantially greater. As much of the information is similar yet required by different customers, a single service provides opportunities to use cutting edge technologies to gain economies of scale, while providing opportunities for companies to compete.

Implementing ICT technologies to effectively collaborate with trading partners will enable T&L companies to achieve a competitive service advantage over those companies that do not.

The T&L industry has operated links with customers to address issues such as Pick Up and Delivery booking and shipment track-and-trace for many years. The sophistication of those links has grown slowly along with technology, sometimes with the industry as leader, and sometimes as laggard. In recent times stronger links have started to emerge between T&L companies and suppliers, particularly the airline industry, but there is clearly massive opportunity for the growth of real-time data transfer, capacity and scheduling planning, and financial transactions between companies ranging from large multi-nationals to single employee companies such as trucking contractors. Recent changes in technology allow better, faster and cheaper linkages in areas such as real-time track and trace, booking systems, and simple human contact through the use of collaboration tools such as unified communications, video and web-conferencing, and sophisticated messaging systems. The great improvement in the availability and performance of the wireless networks in Australia has enhanced this trend.

According to IDC, Customers are constantly demanding more complex and timely tracking data from transportation companies. Because the

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11 www.gs1au.org/services/gs1net/what_is_gs1net.asp
12 Sydney, Australia: IDC, 2009: Australia Vertical Markets 2009-2012 Forecast and Analysis
Transportation business is highly competitive and customers have many options when it comes to choosing a carrier, it is a necessity to be able to provide the customers with up-to-the-minute tracking information on departures and arrivals of shipped goods. In addition, carriers must also be able to provide security for goods from the point of origin to the point of delivery. This means that an integrated network of information is vital.

The freight component of the T&L industry exists to service the ‘supply chain’ of goods traversing the globe, much of which is driven by the manufacturing and retail industries. Again, IDC observes that ... The manufacturers’ overriding goal is to make better, faster decisions to respond to today’s environment of ever-increasing complexity and data. This means that an integrated network of information is vital.

The seriousness of this situation is such that the National Transport Commission addressed the matter early in 2009, making the following recommendations with regard to the intermodal supply chain:

“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.”

Achieving this integrated network of information to a maximum level of effectiveness across the supply chain, which may involve a dozen parties in any one transaction, clearly calls for reliable, real-time and continuous exchange of information. The T&L market will become increasingly demanding — suppliers who fail to utilise collaborative technologies will be commoditised. Failure to collaborate will clearly condemn T&L companies to second-tier status and possibly oblivion — in other words, respond or die.

Effective collaboration is highly dependent on the degree of trust in the integrity of the information being shared between trading partners.

The question of trust in the integrity of shared transactional information relies on the quality of the data being exchanged between two organisations’ software systems. The idea that one party receiving information electronically from another party should be able to trust that the incoming information is indeed accurate and timely is inherent to the effectiveness of any collaborative process, so that business processes can be executed with confidence. If data integrity is in question, so too is the process of collaboration and the intended benefits. The adage of garbage in, garbage out applies, as there is no benefit in processing inaccurate or untimely data. In an automated world, data errors often go unnoticed at the time of occurrence, leading to higher costs to reverse the effect when finally revealed at a later time, very often resulting in adverse business outcomes.

A major challenge for organisations in achieving effective collaboration is that computer systems don’t all speak the same language. Underpinning that is a fundamental requirement to use a common language that provides the ability to interpret information and indeed facilitate the ‘hand-shake’ of information between two trading partners. Adopting open global standards as a discipline for data quality ensures that information shared is sent and received as expected and can be used with confidence for its intended purpose. Data quality is fundamental to the success of any collaborative initiative and thus its effectiveness to deliver such demonstrable benefits as:

- More efficient dispatch and receipting
- Improved delivery performance
- More accurate inventory management
- Reduced inventory levels
- Real time information
- Reduced product lead times
- Improved materials handling

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13 National Transport Commission, Supply Chain Pilots, Draft Position Paper, March 2009, Table 10, page 40
Previous work in the Transport & Logistics sector around the benefits of adopting open global standards to facilitate trading partner collaboration demonstrates how an existing technology investment can be enabled and indeed leveraged to effectively collaborate with trading partners. Many examples also exist in other industries where there is clear evidence to suggest that data integrity is a key element to reducing cost, improving productivity, and increasing the profitability of supply chain activities.

The adoption by industry of existing open global electronic messaging standards can facilitate improved data quality as the data sets and definitions have been clearly defined and documented.
Any future strategy must be sustainable.

By using the right technologies to improve efficiencies we will accelerate the reduction of CO₂

There are three distinct areas in which ICT solutions will support reductions in CO₂ emissions and lead to a more sustainable logistics industry:

1. The use of ICT to optimise overall logistics flow has a natural alignment with CO₂ reduction.

2. ICT at the level of the vehicle and individual driver information supports improved vehicle performance and driver behaviour, thereby reducing fuel burn and emissions.

3. Strategies to minimise energy consumption by ICT applications.

Managing Logistics Flow from a Sustainability Perspective

Assuming a network is running efficiently it would be tempting to conclude that maximising the number of goods carried on each vehicle will lead to an overall reduction in CO₂ production. However, at the detailed level, there is a complex interaction of loading, vehicle choice, route performance and distance travelled. There is no guarantee that an optimum from one perspective will equate to a minimisation of CO₂ emission levels. An explicit tracking or estimation process is required.

The Australian based logistics company Linfox has been taking a strong lead in explicitly managing the level of CO₂ production in its operations. They have adapted their SAP-based systems to track carbon production and price the impact into operational reporting. This allows explicit evaluation of alternative operational strategies for sustainability performance and has contributed to a reduction in CO₂ levels of 9%.

As part of this process, Linfox has identified that traditional business processes do not always deliver the optimal sustainability outcome. They have shown that cross-docking can lead to increased carbon outcomes, for example, when a manufacturer is close to a customer and both are some distance from the cross-docking location.

The shift in thinking required to balance CO₂ impacts with time and direct cost consideration can be difficult. The Linfox experience points to the value of having explicit tracking of all these elements recorded in financial systems so that rational decisions can be made with a consolidated view of the potential outcomes.

When it comes to optimising performance across multiple operators systems that support the optimal loading and filling of backhaul capacity will directly contribute to CO₂ reduction. Initiatives such as freight exchange websites support this task and an industry challenge will be to build more explicit evaluation of CO₂ impacts into optimisation processes.

Ultimately, ICT capabilities can provide the data to track vehicle and driver behaviour. It will be an individual company decision to choose the best approach to performance improvement and increased sustainability outcomes, in line with its operating approach and culture.
Managing Vehicle Performance and Driver Behaviour Case Study

A case-study published by the UK’s Department of Transport provides a useful insight into the potential of vehicle and driver performance. Thorntons, a Derbyshire-based logistics company with 43 goods-vehicles and 44 tractor-trailers, has been monitoring fuel use and driver behaviour. The approach was largely manual at first, but has become increasingly computerised over recent years.

Overall fuel consumption is tracked by a computerised fuel management system linked to the site’s diesel fuel storage tanks, coupled with an intelligent driver fuel key system enabling operational staff to monitor all fuel drawn on-site. Odometer readings, which are requested by the computerised system when drivers insert their fuel key in the fuel dispenser are verified manually against the drivers’ tachograph charts.

The information from the in-cab data logger is automatically downloaded by wireless on return to base. Driver performance is measured by a penalty points system relative to the following pre-set parameters and is then expressed as a percentage of these:

- **Idling** — the time when the vehicle is stationary with the engine running is recorded. After two minutes idling time, the data logger issues an audible warning to the driver and penalty points are deducted after a total of three minutes
- **Over-revving** — the optimum engine speed level is within the vehicle’s green band. An audible warning is given when the driver approaches the top end of the green band and points are deducted when the green band is exceeded
- **Speeding** — the parameter for vehicle speed is set voluntarily by Thorntons with the help of the equipment supplier at 54 mph and points are deducted when this speed is exceeded
- **Harsh braking** — penalty points are deducted if vehicle speed decreases faster than a given rate. The rate is set voluntarily at 11 km per hour per second (0.3g) by Thorntons with the help of the equipment supplier

Both idling and speeding, which can easily be avoided by drivers, are penalised more heavily than over-revving and harsh braking. However in emergency situations harsh breaking is sometimes the only alternative to avoid accidents.

In addition to these parameters, tachograph recorded driver hours are tracked, service levels are analysed and the driver’s accident record noted. The consolidated results are compared with target performance levels and the outcomes generate financial incentives for drivers reaching and exceeding targets. These measures have led to demonstrable fuel usage reduction with correspondingly lower CO₂ emissions.

“Green Fox” program

An alternative view is taken by Linfox in this area, choosing to avoid detailed tracking of individual driver behaviour in favour of its “Green Fox” program. This encourages employees to contribute to the company’s goals of reducing CO₂ emissions by 15%, using training and rewards schemes. It is designed to make the issue of carbon emissions more tangible to its workforce.

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15 See Case Study link on Page 30
16 See Case Study link on Page 30
Strategies to minimise energy consumption through ICT applications.

Apart from mobile applications such as vehicle tracking and engine telemetry there are many other ICT applications that can assist Transport & Logistics organisations reduce their carbon footprint. Generally energy will equal carbon emissions and of course cost; so the reduction of energy usage is a win-win for the industry.

Among areas that can assist in reducing energy are:

- collaborative technologies (such as audio, video and web conferencing) that assist in reducing travel costs;
- wireless and remote asset and inventory tracking; utility computing (which minimises energy costs in server farms by sharing infrastructure);
- mobilisation of ERP software such as SAP; telemetry managing energy use in the office and depots;
- remote working solutions (mobile and in the home) that allow executives, sales people, customer service and administrative staff to work from home; and call centre optimisation.

While our industry will always focus on the fuel that powers our vehicles we must not miss the opportunity to reduce electricity and other energy costs powering our front office and back-end systems.
The benefits case exists for technology investment across the industry.

The Australian Transport and Logistics industry has been investing in ICT since the advent of the telephone. Each wave of technology has clearly resulted in improved productivity, customer service and profitability for the industry and its customers.

Today, a new opportunity exists for the industry to move towards more collaborative communications models, enabled by the ICT technologies that exist today and the new technologies that will be rolled out in the next few years.

Investment in core ICT technology (hardware, software, devices, communications, and data networks) will serve to make each organisation in the industry more productive and customer focussed. Those organisations that embrace the opportunities have the opportunity to thrive; those who fail to do so may not survive.

Each organisation must compile its own business case to justify each technology but it is clear that:

- Collaborative models are likely to achieve maximum, sustainable results;
- Remaining in touch with the latest trends provides the best opportunity to maintain a competitive posture; and
- There are a myriad of opportunities across the entire industry to improve its productivity through the use of ICT

The Australian Transport & Logistics industry sustains Australia’s economy. All components of it have an obligation to enhance the value that their stakeholders expect and ICT is increasingly one of the key enablers to this enhanced value.
Using ICT to increase Productivity in the Australian Transport & Logistics Industry

References:
2009. IDC. “Australia Vertical Markets 2009-2012 Forecast and Analysis”

Case Study Links:

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