Planning and Transport Research Centre (PATREC)

Planning intermodal and general logistics infrastructure for the future needs of Perth:

Global Supply Chain Trends and Local Perspectives

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EXECUTIVE SUMMARY

1. Overview

The larger project of which this report forms a part, comprises a suite of related research streams to support the state of Western Australia (WA) and the Westport Taskforce in particular, in the planning for landside logistics infrastructure and services, including a possible new container berth in Kwinana, to support container trade growth. This major long-term infrastructure planning process provides an opportunity for the development of logistics infrastructure including road and rail corridors and terminal facilities to ensure the most cost-efficient and environmentally sympathetic supply chains for businesses depending on imports and exports. Further, it provides the opportunity to consider the impacts of unfolding global trends in logistics and supply chains on the development of port areas and industrial zones throughout Perth. The project also explores the potential to use freight transporters' operational data already being generated via in-cab GPS monitoring systems for public policy purposes, particularly in short-haul urban environments.

The wider project: Planning intermodal and general logistics infrastructure for the future needs of Perth, comprises three components:

- Intermodal Systems for Perth
- **Global Supply Chain Trends and Local Perspectives**
- Telemetry Systems for Tracking Road Freight Activity

This report concerns the second component: Global Supply Chain Trends and Local Perspectives, providing a summary of the various reports into supply chain trends which formed part of the project. Most of the trends identified and discussed have been implemented in very recent times and in fact, many are still in the early stages of adoption by industry. This report briefly summarises the most important trends as they currently appear globally and in the local and national environment, and highlights the major directions of research and development being undertaken by public and private sector players.

This report refers to reports 4.1 (Global Trends), 4.2 (Applicability to Perth and Western Australia) and 5.3 (Commercial Processes and Technological Developments) attached as appendices.

Key research question: What are some of the major global changes in supply chain systems and control, including blockchain technologies, and what are the potential impacts in Perth and WA?

Key findings

- Global trends
    - Container terminals, warehouses and distribution functions are increasingly becoming automated, using machine learning to accelerate processes
    - 'Big data' and IT investments are changing the ways in which firms relate to each other with high levels of control over long sections of the value chain by those who own and manage the data best
    - IT developments including blockchain will bring about cost savings for individual companies. Main impact - reductions in back office cost, greater speed of regulatory approvals and potential to eliminate wasteful handling and transport tasks. Unlikely to impact significantly on the fundamental tasks of container handling and logistics functions in the port city.
    - GPS fleet management systems give transport companies better real time information on freight activity, assisting with cost-competitiveness. The most significant changes from the routine use of GPS trucking data will likely come from roads authorities, in compliance and road user charging.
- Local perspectives on global trends

- Freight activity may decrease due to an increase in local manufacturing supported by technological developments such as 3D printing
- High productivity vehicles (HPVs) could reduce the number of trucks on the road but could equally reduce the rail task due to increased cost differentials
- Air freight, including drones, could increase due to transport of small packages and lightweight goods associated with the growth of online shopping
- Consolidation of shipping lines, vertical integration of large logistics companies and a reduction in road transport owner/operators is expected to continue and will impact on the structure of freight and logistics in Australia
- Automation will continue to be used for repetitive, heavy work and increasingly reduce the number and size of the human workforce. Robotics and automated warehousing will displace manual workers and a larger workforce with technical knowledge and skills will be required. Union resistance could slow these changes
- Shared freight deliveries will become more evident as companies try to "uberise" freight
- Government policy was a concern in relation to imposing constraints on innovation
- Greater collaboration between private and government sectors is a priority.
- The government role is seen as regulating access to infrastructure, providing policy certainty, facilitating data sharing

2. Global trends

This section summarises highlights from report 4.1 (Appendix A) and 5.3 (Appendix C).

The physical nature of freight activity is not showing signs of major disruptive change as yet. The traditional modes of transport - shipping, rail, road and air freight are not yet subverted by new modes (space travel, hyperloops, drones etc).

Logistics functions are similarly essentially unchanged, but are becoming much better recognised as key to international economic activity. Investment in transport and logistics activity is now becoming more generalised, and control over supply chain function is increasingly recognised as central to the business model of many different types of industry. For instance, many successful firms in e-commerce, capitalising on the transition away from traditional retail models, are now essentially in the 'logistics' business, rather than in manufacturing, sales or IT.

Logistics investment is now all about automation and systems, and their ability to reduce costs and consolidate market share.

Automation

Container terminals, warehouses and distribution functions are increasingly becoming automated, and using machine learning to accelerate the process. New container terminals throughout the world (including Australia) are adopting automation to remove human labour from berths and to reduce safety risk. Algorithms direct the container stacking and allocation operations at these berths, and the systems governing these operations can learn from experience, thus optimising operations more and more over time.

The cost of retro-fitting existing terminals with automation, however, is quite high, in both machinery and human terms, and this will limit the speed of take-up. Older Australian terminals will gradually move in this direction but will be restrained by labour relations and also the lack of clear commercial motive (relative to terminals in ports in other parts of the world which compete more directly with each other).

Some of these terminals have already migrated to using simulators for crane driver training, thus eliminating some of the safety risks associated with stevedoring work. This type of technology is now routine in many transport fields such as aviation, train driving and forklift operation.

Warehouses are also become increasingly automated. Nowadays, whenever a new distribution centre (DC) is commissioned, most activity within it is fully automated, with only a small number of people supervising computer systems and maintaining the equipment. Intelligent systems now exactly determine where consignments are stored as well as the process of storing and retrieving the items. Road transport functions at the DC are also managed by these systems, driving out inefficiency and reducing supply chain cost.

Automation will rapidly become the norm in warehousing as the larger logistics firms, retailers etc invest in new facilities. Warehousing assets are recycled fairly quickly, and the costs of automation are falling, so this change should be fairly rapid.

Realignments in the value chain

Many of the most important recent supply chain trends can be best understood as altering traditional flows of value and information. Physical supply chain activity is not changing as rapidly as the behaviour of firms at different points within these chains. The rise of 'big data' and prevalence of IT investments are changing the ways in which firms relate to each other.

Some symptoms of this:

- Consolidation of shipping lines
- Shipping lines extending activity into landside logistics
- Integration of freight forwarding and land transport operations via IT developments
- Emergence of payment platforms and retail disrupters (eg AliBaba and Amazon) as major logistics firms
- Development of blockchain-based solutions to revolutionise the roles of finance houses in international trade, and also in bulk commodity exporting
- Development of vertically integrated urban logistics supply chains (eg Qube/Moorebank, NSW)

To some extent these developments are symptomatic of the constant volatility of trade and global markets. There is a general sense, though, that the current pace of change in the logistics industry is more rapid now than in the recent past, largely led by IT developments, which promise high levels of control over long sections of the value chain by those who own and manage the data best.

Potential of blockchain

The rapid recent adoption of potentially disruptive IT developments has led to excitement about the potential to greatly improve the efficiency of international trade. Blockchain has become a symbol of this potential, and will no doubt become an important tool in smoothing out complex, fragmented supply chains, especially in regard to finance transactions and information dissemination.

Blockchain technology will assist in reducing the cost (in dollars and in time) of facilitating imports and exports, and will further unlock some savings through reducing the capacity for errors to be transmitted through the chains due to bad data entry.

The experience of several recent trials suggests that the technology is powerful enough in theory to achieve these benefits. The issue that limits the impact of the technology is the lack of incentive of commercial players to jump on board large ambitious over-arching systems.

Major companies in the shipping, container handling, logistics and transport industries will continue to implement new technology within their own business environments and there will be improvements in some relationships throughout the chain. Software companies will continue to fight for dominance within individual sectors of the chain, but will not seek to develop true end-to-end oversight systems that would bring all players and transactions under one single system.

Blockchain technology will be used by shippers (ie importers and exporters) and their banks to streamline cumbersome letter of credit arrangements. It will also be a part of operational systems to resolve complex real time issues such as the positioning of containers within stacks at the berth for minimisation of forklift, gantry and transporter activity.

Blockchain will also be particularly useful for bulk exporters with a high degree of ownership or partnership along their supply chains (eg large mining companies and commodities traders). These companies are very likely to continue implementation of blockchain-based solutions as the internal benefits will be readily visible to all parties. The container trade is much more fragmented, which makes this type of IT investment more difficult to justify, involves more risk through openness and dilutes the benefits to each company.

Port community and trade community projects are less likely to succeed in their aims to develop umbrella systems that all players will feed their data into. The bodies seeking to develop these systems do not have the budgetary muscle or the commercial power to bring disparate supply chain companies into such systems. The companies do not have realistic incentives to buy into these systems, while also investing in their own proprietary systems that manage their core operations. Supply chain companies do not share the community benefit incentive that port authorities and managers have.

Port authorities will have more success in developing overarching systems, strategies and frameworks aimed at providing the conditions for improved efficiency, especially as it relates to neighbouring communities.

IT developments will certainly bring about cost savings for individual companies operating in the container port environment. The main impacts will be in reductions in back office cost, greater speed in achieving regulatory approvals and the potential to eliminate wasteful handling and transport tasks. In general, these types of systems developments will not impact significantly on the fundamental tasks of container handling and logistics functions in the port city.

Freight transport

The basics of road and rail transport are not changing significantly. However, the use of technology is helping road transporters cut costs and increase efficiency. GPS fleet management systems give transport companies much better real time information on freight activity and assist with cost-competitiveness. This type of data is also of interest to IT companies and more significantly, transport regulators.

The most significant changes arising from the routine use of GPS trucking data will likely come from roads authorities, in two fields – compliance and road user charging.

In the near future, it will be possible to devise regulatory systems which allow regulators to use real time GPS data to police truck speed, weights and driver behaviour. It will also be possible to introduce user-charges on the road network, in place of traditional registration charges. In practice, political resistance would suggest that these developments will not be instantaneous or rapid, but will be incremental. Automatic tolls are now commonplace around the world (though not in Perth) – this is arguably a stepping stone.

Autonomous vehicles are also being developed and introduced to Australian roads, though perhaps not as rapidly as has been predicted. Freight vehicles are likely to be well behind passenger vehicles in terms of general acceptance on the road. As with passenger vehicles, certain functions such as braking and parking are most likely to be automated before full autonomous operation is permitted.

Autonomous road freight transport may well commence with various forms of platooning, under which manned vehicles in convoy are controlled to a large extent via automatic synchronised braking,

acceleration, steering and collision avoidance systems. Trials of many variants of this technology are continuing in many locations.

Rail freight is more cumbersome and less responsive to technological innovation, especially in relation to urban freight, where any competitive advantage over road transport is minimal. Rail assets have longer lives than road transport vehicles, which are used intensively and then replaced typically within a decade – allowing for regular technological upgrading. Rail operators are typically not strong IT developers, and often fall behind their supply chain partners and customers.

The next level of innovation in rail networks will come in busy urban environments such as Sydney and Melbourne, where population growth demands new routes, rollingstock and safe-working (signalling) systems. Freight operators on longer haul regional and interstate routes will wait longer for these developments.

3. Local significance of global trends

This section summarises key points from report 4.2 (Appendix B).

Practitioners in the freight and logistics industry in Perth and around Australia were interviewed to ascertain their views of the emerging global trends and whether they would be significant in the local context.

Change in mix of road, rail, sea, and air freight proportions

Freight mode decisions are largely dependent on cost. Factors such as road usage charges, increased security and inspection costs, penalties for port use and fuel costs could influence how freight moves in future but there is little agreement on what the changes could be.

Congestion on the roads and population growth could increase the desirability for more rail transport.

Increasing use of high productivity vehicles (HPVs) could reduce the number of trucks on the road but could equally reduce the rail task due to increased cost differentials.

Air freight could increases due to transport of small packages and lightweight goods associated with the growth of online shopping.

All types of freight activity might decrease due to an increase of local manufacturing activity supported by technological developments such as 3D printing.

Changes in supply chains

The growth of global supply chains is expected to put pressure on the Australian industry for greater efficiency. Increased digitisation and electronic tracking will change the way freight is handled but slow responses to these changes would result in a negative impact on the Australian economy.

Growth in demand for small parcels and packets will be supported by the continued expansion of automated sorting and distribution systems

The impact of trade embargos, protectionism, cross border flow of goods and security threats is uncertain but they have the potential to disrupt supply chains throughout the world.

Changes in freight and logistics

Consolidation of shipping lines, vertical integration of large logistics companies and a reduction in road transport owner/operators is expected to continue and will impact on the structure of freight and logistics in Australia. Developments in technology and information processing could see a decrease in the number of third party logistic providers (3PL) as customers, shippers and suppliers can be more closely connected.

Automation will continue to be used for repetitive, heavy work and increasingly reduce the number and size of the human workforce. Union resistance could slow these changes.

Technological developments

There is overall consensus that technology will impact on logistics and supply chains at a global level through digitization of processes, automation of tasks and the development and adoption of autonomous/semi-autonomous vehicles.

Blockchain technology will provide benefits but progress will be slow as it is a significant task, there is a reluctance to share data and there is considerable potential for business disruption. A simpler form of digitization could focus on freight interchange documentation that is stored on the 'cloud'.

Robotics and automated warehousing will displace manual workers and a larger workforce with technical knowledge and skills will be required.

The use of autonomous and semi-autonomous cranes and vehicles for loading/unloading, moving/stacking will continue to expand especially where access can be easily controlled and safety concerns can be mitigated.

Collaboration between freight and logistics companies

Using infrastructure well and collaboration is essential in Australia where distances are great and population is low. Large-scale collaborations, joint ventures or consortia arrangements, however, complicate decision-making.

Customer centric business models can evolve from sharing information, either by a simple electronic document exchange or a block chain system.

Shared freight deliveries will become more evident. Companies trying to "uberise" freight.

Government policy

Government policy was a concern of all informants particularly in relation to constraints policy imposes on innovation. The need for government adaptability and flexibility was highlighted.

An increase in policy on environmental issues is expected. Government policy has to recognise who is responsible for environmental impacts.

Government policy concerning safety and operation of autonomous vehicles on public roads is a major issue.

Industry/government collaboration

Greater collaboration between private and government sectors is considered a priority. The government role is seen as regulating access to infrastructure on an equitable basis.

Data sharing is an issue that has to be addressed. Government is attempting to provide information and more open data but industry seems to be less invested in a two-way exchange.

Concern over policy uncertainty was also raised as an issue preventing industry investment, which would be reduced by better communication.

Government leadership was seen as imperative to support renewable energy initiatives and investment in the use of electric vehicles.

4. Future supply chain research directions - Australia

Australia relies heavily on international trade, especially containerised imports and bulk exports. Supply chain research should be targeted towards improving efficiency and capacity and reducing costs in networks and systems supporting these trade types.

Some suggested themes for future investigation:

Development of national distribution networks

Imports of household goods and manufactures make up a majority of containerised trade. The entry ports are in the five major Australian mainland cities. Consequently distribution centres and systems are based on these cities. Each importing company makes its own decisions about whether to use national, regional or local distribution networks. These decisions are based on factors including:

- availability of well-serviced industrial land on rail and road networks
- scale of operation
- cost of long distance transport by sea, road and rail
- demographic and market factors

In the recent past, there has been evidence of a transition from national distribution models to regional models (with more direct sea freight into each state). However, this situation is fluid and could reverse in the light of technological developments affecting warehousing and logistics and transport costs.

A broad-based study of these factors would be useful in relation to long range planning of industrial precincts in Australian cities.

Use of technological advances in road transport administration

As technology becomes readily available, logistics companies have acquired it for commercial ends. Regulators and road managers are usually slower on the uptake. There has been some adoption of technology for road safety uses and compliance purposes (cameras and sensors etc) but no large scale efforts to use in-cab GPS monitors for enforcement or charging purposes.

National and state agencies have made some efforts in this direction, but political support for change is limited. The time will soon arrive when it will be feasible to mandate in-cab GPS usage for a range of purposes. Western Australia often lags other states in this type of research and in running trials of new technology or regulatory approaches. A high level study considering how the state and the road transport industry could adopt the available technology for these purposes could be useful.

Integrating intermodal rail systems

Intermodal rail services will take on a more significant role in capital cities as population and road congestion continues to build. Rail companies often lag behind their logistics partners in maintaining and integrating their operational information with systems that track consignments (containers and their contents) for the ultimate customers. Successful intermodal operators in future will need to invest in software developments which tie their operational data with data from elsewhere in the international supply chains.

A project which supports rail operators by addressing this issue in light of new opportunities presented by blockchain technology etc could be a useful resource towards keeping intermodal operators in step with their supply chain partners and competitors.

5. Acknowledgement

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