Inland intermodal terminals and freight logistics hubs

Gerard de Villiers
Logistics Specialist
Arup (Pty) Ltd
gerard.devilliers@arup.com

James Mackay
Executive Manager: Group Commercial
Transnet
james.mackay@transnet.net

Luigi Serafino
Container Terminal Specialist
CNR Logistics
lserafino@telkomsa.net

INTRODUCTION

Transport planning and land use management are intricately engaged in the spatial design of nodes and links from origin to destination in the supply chain. Martin Christopher (1) states that leading companies are aware that the real competition is not between companies, but rather between supply chains. Thus location and modal links to and from intermodal nodes are critical components in ensuring that the overall logistics costs are minimised in the supply chain and the node itself becomes a long-term viable and sustainable economic development.

The node consists primarily of an intermodal freight terminal, and freight logistics services which provide intermediate locations where logistics value is added to the movement of containers and ultimately the associated cargo. The modal links are usually dominated by road and rail, but inland air- or waterways are other common connectivity modes. The node and links form the crucial mobility fabric on freight logistics corridors that connect sea ports with hinterland cargo origins and market destinations.

South Africa, in common with many of its neighbours, has a larger portion of its industry in inland areas and is well suited to follow a support strategy for inland terminals to improve the efficiency of getting trade cargoes to inland industrial and economic hubs.

THE INLAND INTERMODAL TERMINAL OR DRY PORT CONCEPT

The inland intermodal terminal or dry port concept has been developed to integrate various individual components in adding logistics value at a facility that acts as an intermediary in the supply chain. This concept works on a "hub-and-spoke" principle, where containers are received from various origins by unit or block trains to the intermodal terminal at a central hub, and are then distributed to the final destinations, usually by road. Benefits accrue to all parties by offering consolidation services for both imports and exports, as well as utilising the unit or block train concept, which streamlines the rail transport side significantly.

The rail service provider benefits by creating concentrated rail flows with high levels of planning repetition. This provides a stable and consistent operating plan with the high utilisation rate required to make rail systems competitive and financially viable. Such a rail system naturally results in the cargo owners receiving better service levels at lower per unit cost. A clear objective in the South African environment, as outlined in the National Development Plan, is to reduce the cost of doing business, and further to reduce the transport component as a percentage of total logistics costs through more competitive rail offerings. Peripheral value-adding services supporting an inland intermodal terminal or dry port can include the following:

- **Basic services** such as container repair and refurbishment, container cleaning and maintenance, empty container storage, and in-bond warehousing.

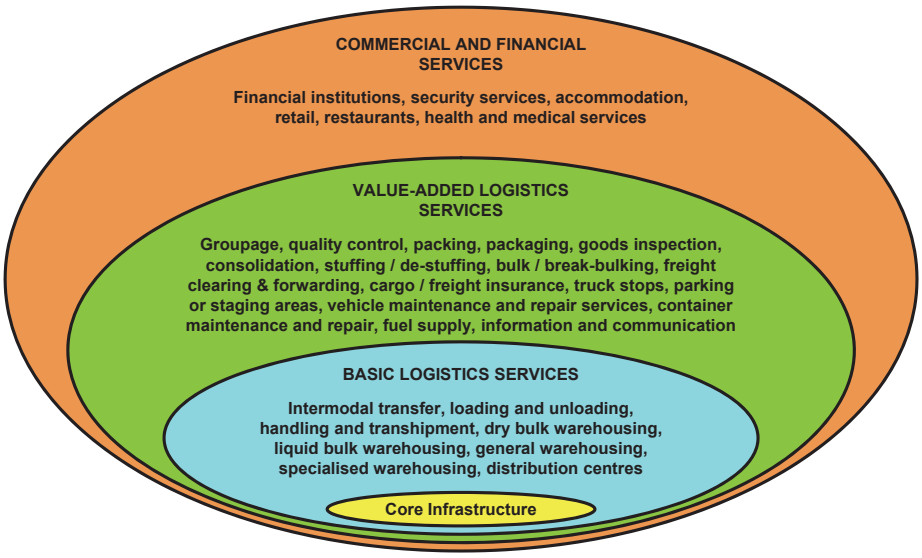

Figure 1: Value-adding logistics services around the core infrastructure

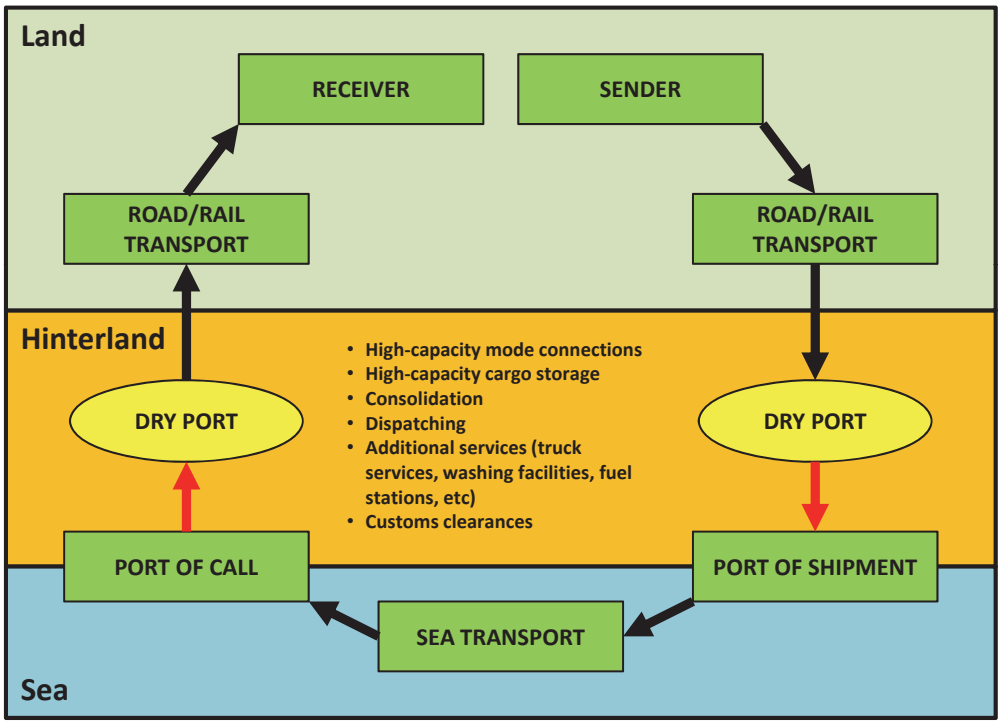

Figure 2: Product flow diagram (2)

- **Intermediate services** such as specialised warehousing (e.g. refrigerated, high-security, liquid/bulk handling and storage), general warehousing for less-than-container loads (LCLs), cartage, delivery and pickup, grouping (consolidation of loads), and shipping line container parks.
- **Specialised services** such as export packing, insurance, freight forwarding, 4PL management and commercial services.

These value-adding logistics services are depicted in Figure 1 as spherical surfaces extending outward from the core infrastructure.

The core infrastructure is traditionally supplied by the public sector, as it is costly with relatively low profit margins due to the low level of value added by merely placing the cargo in the right location. This area has high capital barriers to entry and is also often impacted by other regulatory controls within the public sector. Controlling the enabling infrastructure and regulatory environment, however, has the benefit of determining the long-term growth direction and focus of the overall node, which is usually associated with public sector delivery mandates.

The further outward one moves in the value circles, the more one moves into the traditionally more specialised private sector space, with lower capital barriers to entry and strong competition. The long-term economic multipliers resulting from such a development node are also related to the value circles, where establishment of each service level enables the next level of service and economic development.

Benefits to the terminal operation occur because the terminal serves as the central point or hub around which all container movements and operations gravitate within the area. The flow of containers to and from the target area becomes more cost effective and thus benefits the importer or exporter, increasing competitiveness in the global markets.

Because the terminal in itself is very capital- and volume-intensive it delivers a relatively lower return on investment. The peripheral services of the value circles which are linked to the terminal with its inherent efficiencies and economies of scale, however, can create significant return on investment. Aggregating benefits across these value circles can therefore create a long-term financially sound investment opportunity for the entire intermodal development node.

Benefits to the main stakeholders include:

- **Freight managers and owners:** The ability to get cost-effective and reliable service at affordable rates. This allows for improved freight planning, resulting in reduced need for stock carrying, less carrying costs and reduced demurrage charges.
- **Shipping lines:** Shipping lines are prepared to accept the inland port as a final destination and issue shipping line Bills of Lading to and from the inland port. This implies that change of ownership and responsibility for goods can occur at said port, thus ensuring more reliable shipping patters and payment terms.
- **Container managers:** Centralised control of containers within the target area increases the possibility for reduction to total number of containers needed in the area to satisfy the demand. The central hub allows concentration of container movements, specifically for receiving empty containers and preparing them for export movements. It also facilitates container repair, maintenance and cleaning services to be centralised at the terminal.
- **Rail operators:** High infrastructure utilisation with concentrated traffic patterns to fewer destinations.
- **Transport service providers:** The terminal makes it easier for the transport service providers, both on rail and road, to achieve economies of scale by operating from one central hub. This reduces unnecessary shunting, with significantly improved turnaround times for rolling stock as well as road equipment, as the central hub allows for efficient loading or off-loading of the container.
- **Terminal facilities:** Integration of the supply chain from hub to hub is achieved by greater cooperation and pre-planning for consignments. It also helps to reduce congestion at the seaside ports, as containers can flow seamlessly to and from the inland port under the authority of a through Bill of Lading.

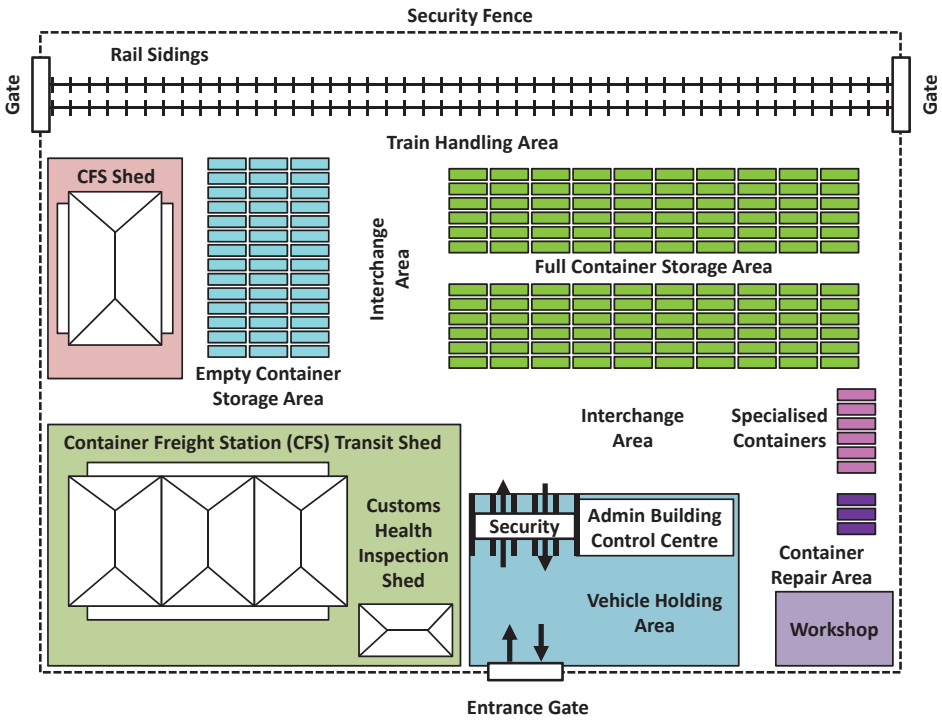

Figure 3: Typical layout of a dry port – adapted from UNESCAP (4)

Jaržemskis and Vasiliauskas (2) provide valuable background to the development of the dry port concept as intermodal node, and they explain the different terms used, such as inland clearance depot, inland container depot, intermodal freight centre, inland freight terminal and inland port. Their definition of a dry port is "a port situated in the hinterland servicing an industrial/commercial region connected with one or several ports by rail and/or road transport and is offering specialised services between the dry port and the transmarine destinations. Normally the dry port is container and multimodal oriented and has all logistics facilities, which are needed for shipping and forwarding in a port."

The function of transport terminals, their location and terminal governance are covered by Rodrigue *et al* (3) where they explore the role and importance of terminals with specific attention to port sites, airport sites, rail terminal sites and the difference between hinterland and foreland. They are of the opinion that there is a clear trend involving the growing level of integration between maritime transport and inland freight transport systems.

Jaržemskis and Vasiliauskas (2) suggest that the increasing problem of transporting goods to and from the port through the city, together with the expensive costs of establishing new docks, have created pre-conditions favourable to establish hinterland terminals or dry ports. The activities and product flows of such dry ports are explained in Figure 2.

Imported goods have to be consolidated in intermodal transport flows, and exported goods have to be collected and consolidated into international transport. Thus the dry port (or inland container terminal) has to provide hinterland warehousing, management of container flows (full and empty containers), reduced transport costs due to consolidation and various value-adding logistics services usually offered at the coastal port.

It is clear that dry ports have clear and definite roles for both import and export of products to and from destinations located in the hinterland. The intermodal interface facilitates smooth transfer of goods and contributes towards cost reduction in the supply chain. It should be emphasised that, due to the competing nature of supply chains, there will be competition between the transport modes linking the port of call and the dry port. This will primarily be between road and rail, which will

find equilibrium based on a combination of service reliability and per unit cost. It is therefore natural that some cargos will naturally be more rail-friendly and deliver higher benefits on rail than other cargos which may favour road.

A critical success factor in the development of an intermodal node is to design for the correct service mix that maximises the intermodal exchange and value at the terminal.

CONCEPTUAL DESIGN AND LAYOUT OF AN INLAND INTERMODAL TERMINAL OR DRY PORT

UNESCAP (4) presented a paper on the technical and operational issues related to the development of dry ports at the Regional Expert Group Meeting on the development of dry ports. It provides useful guidance on the main functions and classification of dry ports according to the function and services rendered at the respective facilities. It also provides guiding principles for the development and operation of dry ports, and stresses the need for standards in design and layout.

The physical layout often depends on the intended design capacity and transport modes that are engaged, but the paper suggests a typical functional layout for rail-based dry port, shown in Figure 3.

Road trucks enter and leave through the entrance gate where receipt or delivery operations take place. A container freight station (CFS) provides for stuffing and de-stuffing of containers, and facilities are provided for customs and other examinations. The container yard area includes a CFS shed and workshop with container repair area, as well as the usual space allocated to empty, full and specialised containers.

Import and export flow processes, operational requirements, suitable cargo and container-handling equipment, with specific reference to the tractor-trailer system, lift truck system (front-end loaders or reach stackers), rubber-tyred gantry crane and rail-mounted gantry crane systems are discussed in the paper. From a rail-road interface point of view it is important to note the need to keep the entrances of both modes apart so as to prevent the impact of the traffic of one mode on the other and to allow for safe shunting of incoming and outgoing trains. The two modes will, however, engage around the container storage areas.

This proposed layout can be recommended, as it fairly accurately reflects the typical operations of a dry port. There could be a need for customisation of specific operations due to topographical restrictions, design capacity and available modes, but this can work well in principle.

Technical design standards, and operational procedures and guidelines affect the performance of dry ports. Careful analysis and evaluation is needed to design the most effective system for the volume and type of containers to be handled. Figure 4 shows the typical operation of a rail-mounted gantry crane in combination with a reach stacker.

This operation is used in most recently developed dry ports, although it is important to note that rubber-tyred gantry cranes and straddle carriers are used in addition to reach stackers. Some smaller terminals work with trailer operations where containers are not stacked but kept on skeletal trailers. This is not possible with higher volumes.

CONCLUSION

The National Development Plan for South Africa (5) recognises the role of inland intermodal container terminals and freight logistics hubs. The importance of such facilities is understood, and the way forward in support of the government's development targets in South Africa will indeed include the effective implementation and operation of these facilities as part of infrastructure development.

REFERENCES

1. Christopher, M 2011. *Logistics & Supply Chain Management*. Pearson Education Limited, Harlow, pp 13–15.
2. Jaržemskis, A & Vasiliauskas, A V 2007. Research on dry port concept as intermodal node. *Transport*, Vol XXII, No 3, pp 207–213.
3. Rodrigue, J, Comtois, C & Slack, B 2009. *The Geography of Transport Systems*, Routledge, New York, pp 164–191.
4. UNESCAP 2010. Technical and operational issues related to development of dry ports. *Regional Expert Group Meeting on the Development of Dry Ports along the Asian Highway and Trans-Asian Railway Networks,* Bangkok, pp 1–9.
5. National Planning Commission 2012. *National Development Plan 2030*. Pretoria, pp 278–282.

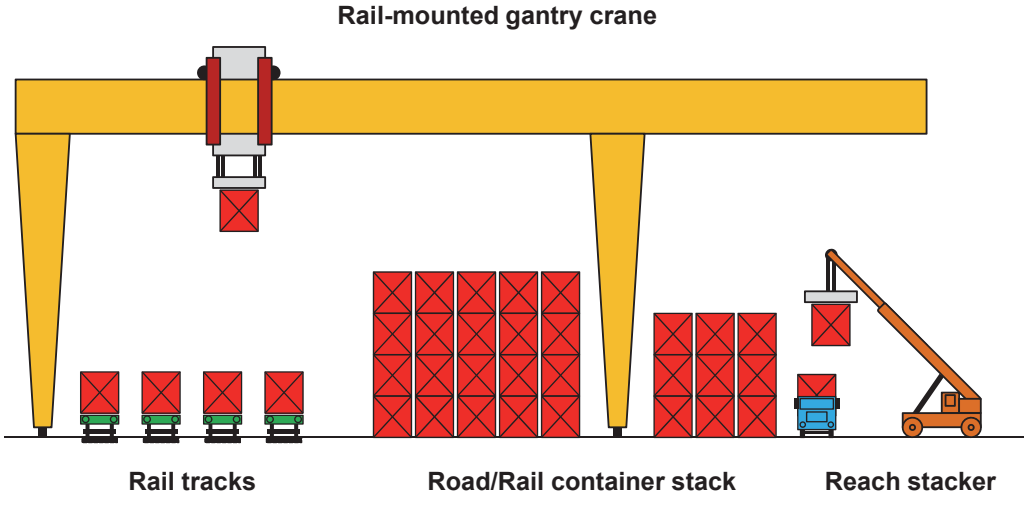

Figure 4: Intermodal container terminal operation

Source:

http://www.saice.org.za/downloads/monthly_publications/2013/2013-Civil-Engineering-September/files/res/downloads/book.pdf