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Assessment of a seaport land interface: an analytical framework

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Executive Summary

Although landside expansions are a cornerstone of strategic port planning, inland infrastructure/ superstructure development plans are usually designed to satisfy the needs of shipping services, e.g. through the provision of container freight stations and marshalling areas to accommodate ships' cargo. Similarly, the segmentation of the port market has traditionally been oriented towards the sea-leg component of the transport chain; with port marketing and competitive strategies being typically formulated to meet the requirements of sea transport and related shipping services**.** This situation is far from being desirable not only because it disintegrates the port system from the total transport and logistics chain, but also because it unnecessarily binds the entire port system to sea transport and impedes ports' potential to integrate land operations and management. This study attempts to analyse ports' potential to develop landside connections and facilities and integrate the land-leg interface of the trade, logistics, and supply chain system. It examines main operational and management practices in international shipping services versus those of land transport systems, and proposes a framework for port's landside integration, with particular emphasis on appropriate tools of assessment and analysis. Finally, a number of policy initiatives, such as organizational reform and technological developments, are put forward with a view to ensure successful landside integration and management particularly for ports in developing countries.

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1. Introduction: Business Logistics and Port Inland Integration

1.1 Importance of Logistics in the Modern Economy

In the past few decades, a world-trading context has emerged where inefficiencies in logistics have become more apparent for a number of reasons. Since the 1970s, a succession of energy crises has made companies more cost-conscious, particularly with respect to the cost of transport. Periods of high interest rates led to a greater awareness of the capital, which could be tied up in unnecessary inventory holdings. During periods of limited industrial growth, companies have been unable to increase their sales. This has made them more interested in productivity or cost-cutting improvements, not only in manufacturing, but also in other areas such as transport and distribution.

At the same time developments in both national and international trading have taken place, which have enabled more cost-effective techniques to be applied. The restructuring of business organizations has also been a factor affecting logistics management. This has been usually done through both vertical and horizontal integration strategies (mergers, acquisitions, ownership, spin-offs, etc.). Very large companies now dominate certain market sectors. Such companies need to manage large amounts of items and goods, which can only be controlled through efficient logistics systems using advanced information technology systems.

Similarly, the growth in size and number of multinational and trans-national corporations throughout the world in recent years, has led to a more global approach to decision-making about topics such as transport decision and stock location. This has been associated with lower customs duties and tariffs in a wide range of countries. As the world economy becomes more and more integrated through an accelerated process of internationalization/globalization of production, consumption and services, the concept of the market place for an increasing number of manufacturers, suppliers, and even customers now covers the entire globe. The scope of globalization runs from foreign sourcing, procurement, and manufacturing, to multi-faceted international marketing and distribution strategies in terms of, *inter alia*, multiple locations of stock and inventory, intra-firm and cross-functional trading, local customization, product sales and after-sale services. The development of trading blocks, such as the EU, NAFTA, and ASEAN, has caused manufacturers and traders to adopt a more international approach to production and marketing. In a single market of several countries, there is often no need for each country to manufacture a particular product or even to hold stocks in that product, provided there is an efficient transport system able to deliver goods quickly from another country.

The widespread use of computer equipment and software programmes have led to efficient scheduling of transport movements and equipment utilization, efficient management of inventory and stock levels, and better communication systems both within firms and between firms and other market players (suppliers, customer, intermediaries, etc.).

There has been a further development particularly relevant to the transport industry and which has encouraged the development of a logistics approach. There has been a more liberal approach to competition, which has led to deregulation and privatization of different modes of transport, both passenger and freight, as well as other related facilities such as seaports, airports, and distribution centres. However, deregulation in other sectors and businesses, such as banking and communications, has had a far more widespread impact than what occurred in transport infrastructure and operations. Deregulation has meant that operators have had the freedom to set their own prices (e.g. fares, tariffs or freight rates), and is normally a prelude to more competition and development of new services. These new services may include novel combinations of transport modes, which is usually not permitted under strict regulation. Privatization of transport organizations has often taken place in conjunction with deregulation, creating opportunities for new company structures and more aggressive negotiating and pricing policies. In ports, the increasing role of the private enterprise has given rise to a large variety of funding and management schemes for port projects and investments, with the most prominent forms being lease contract and concession arrangements (BOO, BOT, BOOT, etc.).

In view of the above, many shipping and transport companies have started to offer a wider range of services than just transport. Such services include warehousing, information processing, and even minor forms of manufacturing and production (e.g. customising products for local markets or particular countries). Consequently, such companies sometimes call themselves logistics providers.

1.2 Impacts of Modern Logistics on Port Operations and Management

Developments in production and trading systems have reshaped the entire transport and distribution industry, calling for further market consolidation, greater integration, and closer collaborative management between the different actors in the transport and logistics chain. The emergence of global production systems, in which raw materials, components, and final products are sourced, manufactured, distributed, and shipped globally, has required a profound restructuring of the transportation industry, with shipping and port services being at the forefront of these changes and mutations. At the heart of these changes, the need to optimize transport chains, manage and integrate them within seamless production, distribution and trading systems becomes the new imperative. The impacts of modern developments in international logistics on the port industry have taken place at more than one level, with the following aspects being the most noticeable:

A. Extension of the port role

The port role today exceeds the simple function of services to ships and cargo. Apart from their role as the traditional sea/land interface, ports are a good location for value-added logistics but also for other related services including industrial, trade, financial, and even leisure and property development activities. Thus, the port system not only serves as an integral component of the transport system, but also is a major sub-system of the broader production, trade and logistics systems. The definition of port core businesses varies greatly and presents a dilemma as to where the demarcation line lies between port and non-port activities, with many ports in the world shifting to more profitable non-maritime business interests such as recreational, tourism and environmental activities. The degree to which port business should be limited to, or associated with, ship/shore, goods transfer or cargo-flows management, and the scope of landside developments and expansions still remain key questions.

B. Strategies of vertical and horizontal integration

With many international shipping and logistics market players undertaking vertical and horizontal integration strategies, involving ports either directly or indirectly, the conventional taxonomy of port institutional players should be fundamentally reviewed. Strategies of vertical integration include ocean carriers and other multimodal providers (e.g. rail operators) engaging in terminal leasing and ownership. Shippers are also sometimes perceived as port owners, such as through dedicated oil or car terminals. Horizontal integration strategies were less common in the past but have gained greater prominence in recent years, such as through port cooperation and mergers and, more particularly, the expansion of certain ports beyond their initial spatial bases. The impacts of such changes on the traditional perception of the port industry are dramatically significant in the sense that today's ports can be owned and managed by many types of institution (both within and outside international shipping and logistics markets), and that the long-established perception of ports as non-moveable assets may no longer hold so much validity.

C. Redefinition of the port hinterland and foreland

Traditional spatial concepts of port hinterlands and forelands (cargo generation, gravity model, location quotient, etc.), along with the related port-marketing terminology (captive, dominant, competitive, uncompetitive, etc.) have become less relevant. Not only are ports no longer immoveable (if not as fixed assets, at least as institutions), but also the impacts of globalization, deregulation and privatization have shifted port competition to the cross-border, cross-industry levels. The instigation of new logistics patterns of maritime and multimodal transportation, such as in terms of hub, transhipment and network models, means that modern ports, wherever they are, or could be, located, can now compete for far-reaching cargoes with far-distant counterparts. Similarly, the increasing channel control and bargaining power of ocean carriers in international shipping and logistics, including as port owners and managers, means that modern ports will bear a higher risk of footloose relocations, and hence recurrent changes in institutional, spatial and functional features. At the same time, ports (or port operators) seeking to integrate either horizontally (merge with, manage or own terminals beyond the homeport) and/or vertically (offer a wider range of logistics services) should be aware of possible channel conflicts as they can also be the subject of footloose arrangements, market and spatial losses.

D. Reassessment of the port customer

Whilst ports have always been perceived as an integral part of the shipping and maritime business, the extensive portfolio of port operations traversing production, trade and service industries makes it particularly difficult to approach world ports homogeneously under the same market category. This, compounded with the substantial restructuring of international shipping and logistics markets, actually blurs the demarcation lines between previously separate markets for logistics services. For instance, today's mega-ocean carrier functions are not restricted to the sea-leg transport, but are widely extended across logistics and supply channels, including as port operators and multimodal transport providers. Similarly, many non-sea activities, such as warehousing, multimodal and distribution activities as well as trading and financial services, are increasingly locating their businesses within or around port locations. This means that the current portfolio of port users no longer consists of sea transport operators and their intermediaries, but is being extended to a new type of customers representing landside operators and service providers.

1.3 The Logistics rationale of the port business

The need has always existed to move goods from one place to another, and sometimes through water transportation. The demand for maritime transport is traditionally justified by the need to trade, and thus maritime transport has usually been dealt with as a "derived demand". In other words, the demand for transport is derived from the supply of the goods being carried. If these goods are not needed in the market, then there is no need for transport to carry them. In the past, industrial and trading firms (manufacturers, merchants, service providers, etc.) treated transport as an afterthought, i.e. something to be accomplished after the ‘main’ activities of the company, such as production and selling have been completed. As the bulk of sea transportation is performed internationally, shipping or maritime business can therefore be regarded as a service sector entirely dependent on the demand and supply of world trade. The word 'shipping services' is a generic term, but refers in the context of this paper to the providers of sea transport services. In this approach, the port activity is considered as a sub-sector of the maritime industry, with its main role being restricted to the provision of services to ships and their cargoes, and the facilitation of the movement of goods and passengers between land and sea. A seaport is therefore seen as nodal point between land and sea, or as a modal interface between shipping or sea transportation system on the one side, and the land transport network on the other side.

Nevertheless, in the context of logistics management, the above approach is based on the false premise that freight transport is somehow separate from other activities of the firm (the shipper) and, in the context of supply chain management, from the activities of a network of firms and businesses. With the development of modern production and trading systems, freight transportation has become part of an integrated logistics system. The logistics approach treats transport as an integrated part of an overall planned system which links purchasing, production, inventory management, and marketing. In this context, ships and vessels can be considered as ‘moving warehouses’, whereas ports may be conceived as “logistics and distribution centres”.

The basis of logistics is the integration and optimization of a firm’s different functions for the purpose of overall cost reduction and customer satisfaction. Supply chain management (SCM) extends the logistics concept to a network of organizations by advocating closer collaboration and partnership, rather than traditional ‘arm’s length’ trading arrangements. The main benefit offered by the logistics concept lies in the fact that it offers an integrated approach to business where total costs and cost trade-offs analyses are used taking all logistics factors into account. Common trade-off analyses include transport against inventory costs, production against transport costs, and production against inventory costs. For instance, a high level of customer service is not only achieved by using a good transport service to deliver the goods to the customer. In fact, faster, and accordingly more expensive, transport services are often used to ‘rescue’ a consignment which has been delayed for reasons unconnected with transport, possibly as a result of a production breakdown or a lack of stocks caused by bad inventory management.

The key concepts behind this definition are planning and control, flow (transport) and storage of goods, information management, integration of all such activities, and customer service. From this perspective, transport is a key component of the logistics system, and should be planned and performed as part of an integrated logistics process involving all related activities, and not in isolation. The terms ‘inbound transport’ and ‘outbound transport’ are frequently used to describe respectively the transport of raw materials and other components from upstream suppliers to the company, as opposed to the transport of the company’s finished goods and products to downstream customers. The term ‘physical distribution’ is sometimes used restrictively to denote goods outwards transport, but physical distribution normally includes associated activities such as storage and warehousing of finished goods. In fact, many products are the result of long supply chains where raw materials, semi-finished goods, and finished goods move from one company (or one location) to another before reaching the final consumer. Therefore, one company’s finished products may be the raw materials of its customers.

Within this context, ports should be approached as an integral component of the international logistics and distribution system, and not just as a sub-system of the maritime transport industry. In this way, ports can integrate and optimize the various operations and activities so as to reduce costs and add value to customers and users. The contemporary role of ports often extends from providing services to ships and cargo at the traditional sea/land interface, to being a good location for value-added logistics services and standing as a perfect networking site where various market players can meet and interact. Such a diverse portfolio may require a redefinition of port's functional and spatial dimensions as it entails a different strategic and management orientation to accommodate new type of port customers and users. Today, it is imperative for ports to address issues as extensive as integrative channel processes and to communicate with as many as far-reaching and distant channel members.

1.4 Towards the inland integration of port services

Seaport development strategies, design and planning schemes have traditionally focused on seaside links such as nautical constraints, seashore infrastructure, ship/cargo handling equipment, and other related superstructure facilities. As a result, much of port operational and management concepts and practices, were developed around the seashore interface, rather than the landside connections and related value-added logistics activities. Port operations and planning, marketing and competition, performance measurement and monitoring systems, were almost entirely directed towards sea transport and shipping services, with little or no emphasis on inland transport services, and much less on landside logistics operations, services, and facilities.

The integration of the land logistics interface may prove beneficial to ports at more than one level. First, it allows a diversification of the portfolio of port services, hence reducing the quasi-dependence of port income on shipping services. Second, it redirects part of port investments and financial capabilities towards improving landside networks, which in turn can stimulate employment generation and regional development. Third, landside-oriented strategies provide ports with a prevailing competitive advantage over neighbouring ports and other rival competitors. Last, but not least, such strategies will enable ports to fully integrate the logistics and transport chain, hence providing for an effectual and central role for ports in international logistics and distribution systems.

One of the typical arguments used against landside integration is the unavailability of financial resources to undertake investments in land expansion or to purchase the required superstructure equipment. But landside investments are not always as capital-intensive as those required for seaside or seashore interface developments (jetties, dredging, berths and terminals, cranes, pavements, etc.). The planning for land development may sometimes prove less complex, in terms of engineering constraints, legal or organizational arrangements, than the planning needed for nautical and seashore infrastructure. Land expansion is less restricted by congestion, urban, or environmental constraints — particularly in developing countries — and this offers a real opportunity, but also a great challenge, for ports to develop dedicated services for inland logistics and transport systems.

Therefore, it seems that the major obstacle against land interface integration stems less from financial or spatial constraints than from a poor understanding of the logistics dynamics of land interface operations and management. In fact, seaports, particularly those situated in developing countries, have no accumulated knowledge in the field of land logistics planning and development, let alone in the aspects of inland logistics operations and management.

Although both land and sea services are closely connected to the port system, they do not necessarily share the same organizational, strategic, and operational management features. The two systems operate in completely different — and sometimes diametrically opposite markets — with the role of ports being at variance from one interface to another. For instance, ocean carriers inevitably need port services to load and discharge ships, their operational and management performances ultimately therefore relies largely on port efficiency. Moreover, a port is a major cost-item for sea-transportation hence the emphasis on reducing time in ports, and improving the efficiency of ship and cargo handling operations at ports. Conversely, the cost of port services constitutes only a small fraction of the total costs incurred by the inland transport and logistics provider. In fact, the latter may not even need port services as it can operate at inland locations with no sea access.

Another major difference is that while the shipping industry has developed standard practices and procedures; the development of land transport services has been shaped by the domestic/regional regulatory and organizational framework. The intrinsic nature of land transportation prevents it from developing internationally or globally. For instance the size of ships, particularly that of containerships, has increased significantly over the past three decades and has forced ports to invest heavily in infrastructure capacity and superstructure equipment. This trend was not, however, replicated in the inland transportation system as the optimum size of land vehicles is limited by physical (road/rail infrastructure) and legal restrictions (maximum weight, speed, environmental constraints, etc.). A different illustration could be found in the field of intermodal/multimodal transportation. On the one hand, countries that enjoy good infrastructure facilities and support them with appropriate regulatory, organizational, and communication systems, have succeeded in developing first-class multimodal transport arrangements such as 'double-stack' and 'bock' trains. On the other hand, countries where poor surface infrastructure is combined with regulatory restrictions and organizational segmentation cannot accommodate a proper multimodal system. It follows that while the shipping industry has the potential to develop internationally, and sometimes globally, the inland transport industry can only develop on a domestic or regional-level (see table 1 below for more information on the difference between different freight inland and water transport systems).

Table 1: Comparison of major modes of freight transport (excluding airfreight and pipelines)

	Inland transport		Multimodal	Water transport	
	Road	Rail		Sea	Inland waterways
Speed	5	5	4	2	1
Cost saving	3	2	3	5	4
Safety	4	5	4	4	4
Reliability	5	5	4	3	3
Flexibility	5	3	4	3	2
Availability	5	2	2	Various	Various
Environment friendly	3	1	3	5	5
Infrastructure cost	5	4	Various	3	Various
Infrastructure maintenance costs	4	5	Various	2	Various
Vehicle size	<3000 t	No restriction	<3000t	>300 t	<500 t
Door-to-door potential *	5	2	4	1	1
Cargo value	High	Various	High	Various	Low
Cargo volume	Low	Large	Low to moderate	Very large	Low or moderate
Suitable cargo packing	All	All	General cargo	All	All
Economic distance	Short	Short to average	Various	Very long	Long

Compiled from US Department of Transportation (www.dot.gov), and other sources.

Legend: very low (poor): 1, low: 2, fair: 3, high/good: 4, very high (very good): 5
*: Typical 2002 US estimates that can vary with technological development and other factors.

2. Market structure and organization of shipping services

The shipping or maritime business is concerned mainly with the international transport of goods by sea, and as such may be seen as a major component of *international logistics*. The term *'shipping services'* is sometimes used interchangeably, and may be reduced to the sole provision of sea transport or expanded to other logistics and trading services. In this paper, the term is used to accommodate both ocean carriers and other service providers such as intermediaries. Other activities not directly related to sea freight transport are not included in this definition, e.g. passenger and cruise shipping, shipbuilding, supply and bunkering.

Most of the principles and concepts of logistics are also relevant in the international sphere. However, there is a great degree of complexity and uncertainty in international logistics compared with *domestic logistics*. The areas of complexity listed below also apply to international shipping, but are less relevant for domestic services such as short-sea shipping and inland waterways transportation:

- ✓ *International trade complexities*: Different terms of sale and documentation, terms of payment, problems with the use of different currencies and the fluctuations of the exchange rate, etc.
- ✓ *The international and changing nature of markets*: Different tastes, languages, traditions, etc, but also the involvement of a number supranational trading blocs (EU, NAFTA, ASEAN, etc.)
- ✓ *The nature of international supply chains, procurement and sourcing*: Different expectations for customer service, difficulty of control over deliveries and inventories, greater potential for choice of inventory location and management (e.g. the emergence of hub-spoke, transhipment, and other logistics patterns of maritime transportation).
- ✓ *The involvement of multinational and global corporations*: Aspects of channel control and power, problems of footloose strategies: firms (shippers/shipping lines) changing easily

their production or distribution locations (ports), the growth of intra-firm trading between branches of the same multinational corporation, etc.

✓ *The frequent use of transport agents and intermediaries*: including brokers, agents, NVOCCs, freight forwarders, and other intermediaries.

✓ *The general trend of outsourcing transport and logistics activities*: Through contracting out with third and fourth party logistics (3PL/4PL) providers.

2.1 Types of Ships

A ship’s type is determined by the nature of trade (or traffic), and more specifically the type of transported cargo or commodity. The term *commodity* is frequently used in international shipping and logistics, and should not be confused with the word "*product*". The latter normally describes a strong brand name such as Coca-Cola or BMW; whereas the term commodity is used even when there is no difference between the products of different suppliers, e.g. bulk products such as oil and grain, or cargo consignments inside non-branded units of loading such as containers.

Traditionally, seaborne trade has been divided into bulk and general cargo trades, and this subdivision has, in turn, shaped the type and design of ships. Yet, many still confuse the physical features with the economic aspects of the two types of trades. Physical features refer to the physical characteristics of transported cargo, hence differentiating bulk commodities such as crude oil, grain, iron ore and coal from manufactured general-cargo goods. The economic considerations look instead at the economics of cargo size and packaging, and thus distinguish between bulk cargo transported in large quantities, and small consignments transported in unit loads (e.g. containers), or in break bulks.

A typical ship's classification has followed this cargo/trade terminology, with three main categories of ships: dry bulk ships; liquid bulk ships; and general cargo ships. This classification does not include non-cargo ships such as military vessels, cruise, passenger, or fishing vessels. There are other criteria of ship classification, including: size (containership generations, VLCC/ULCC for tankers, etc); market and technological specifications (Panamax, Suezmax, etc.); and safety/security records (class of ships, ISPS security levels, etc.). Either way, port managers must know about the wide variety of ships and their commercial and technical specifications.

2.2 Shipping organization

Another useful way to analyse maritime transport is to look at how shipping services are organized. Traditionally, the maritime transport sector has been divided into two main sectors: liner shipping and tramp shipping (see table 2). Liner shipping refers to a ship plying a regular route in accordance with a published sailing schedule. The term "tramp" comes from the time when vehicles had to travel long distances to seek loadings (i.e. tramping). Tramp shipping is irregular in time and space, but can be performed through three main legal and operational features.

Table 2: Differences between tramp and liner shipping

	Tramp shipping	Liner shipping
Operational features	Bulk cargo in big quantities, irregularity of service in time and space	General cargo in small consignments, regularity in time, fixed prices & ports of call
Organizational features	Small companies, each with few ships	Structured organization: system of agency network
Contractual features	Charterers as customers, charter party: negotiable, open, etc.	Shippers as customers, bill of lading acting as a receipt, document of title, & contract of carriage
Contractual features	Voyage-freight rate or time charter hire*, (despatch money < lay time < demurrage)	Commodity-based tariff (Tariff = basic rate + surcharges - rebates)

* For oil transport, a world scale rate system is used instead.

Table 3: Different types of tramp shipping

	Voyage charter	Time charter	Bareboat/demise charter
Capital costs	Owner	Owner	Owner
Operating costs	Owner	Owner	Charterer
Voyage costs	Charterer	Owner*	Owner
Time duration	Simple or consecutive voyage	Stated period of time	Long period of time (> 10 years)

* Port costs according to the clauses of the charter party

2.3 Operating and Service Characteristics

Unlike tramp ships that go everywhere at anytime, regular liner shipping is composed of pre-fixed maritime routes linking various ports. The routes are normally those between two markets (supply and demand) separated by sea, with a range of ports being called on either side of the route. The main classifications used in this respect are the containerized and non-containerized routes, the east-west and north-south routes, the intercontinental and intra-regional routes, and the mainline and feedering routes. From a logistics perspective, such trade categorization is less relevant given the rapid change in market structure and ship's technology. For instance, traffic may not be balanced on the two directions of a route, or could be stable on some routes but variables on others. Similarly, the growth in the size of containerships makes it less profitable for shipping lines to call at every port on their route. Today, few ports in the world have the capacity or are equipped to accommodate large containerships and their cargo. Shipping routes are therefore designed to meet all these requirements, including the cost and quality of service at the chosen ports of call. Presently, six logistics patterns are widely operated in liner shipping, namely end-to-end routes, hub-spoke networks, pendulum services, double-dipping routes, triangle links, and round-the-world services.

2.4 Cost Structure

The cost structure in shipping is generally perceived in terms of fixed and variables costs, capital and operating costs, direct and indirect costs, commercial and maritime costs, etc. The most common way to undertake cost analysis for sea transport services is to breakdown the total costs into three main categories, namely capital costs, operating costs and voyage costs.

- ✓ *Capital costs*. These are fixed costs relating to the price of acquisition of the ship, including interest and depreciation.
- ✓ *Operating costs*. These normally comprise labour costs, both for crew and shore-based staff, repair and maintenance costs, and insurance costs. They also should be considered as fixed costs regardless of the nature of ship's voyage or operation.
- ✓ *Voyage costs*. These are variable costs combining fuel and supply costs (bunkering, food and water supply, etc.), and port costs for both ship operations and cargo handling.

2.5 Competition and partnership

Tramp shipping is a spot and open market, with most ship owners operating one or few ships. Cooperation in tramp shipping is driven purely by commercial considerations, and usually undertaken as a variation of pool grouping arrangements. Liner shipping is, on the other hand, a very structured market, with each company owning a fleet of vessels. Both commercial considerations (market coverage, service frequency, cost control, etc.) and operational arrangements (vessel space utilization, container deployment, etc.) have forced shipping lines to organize themselves in close cooperative and partnership arrangements, e.g. liner conferences, alliances, consortia, join-ventures and mergers. In getting together, ocean liner carriers increase their logistics capacities and enhance the value-added services they offer. Table 4 lists the principal reasons underpinning cooperation among liners and the implications this has on logistics arrangements:

Table 4: Principal motives for cooperation among liners and logistics context

Motives for liner cooperation	Corresponding logistics concepts
Economies of scale………………………..	Total cost reduction, multi-user distribution
Market access……………………………..	Market penetration, global services
Less investment in physical assets…….	Assets sharing
Market coverage…………………………..	One-stop shipping/shopping, global services
Service frequency…………………………	Scheduling, JIT, order processing, lead time
Marketing capability………………………	Customer service management, value added
Cost control………………………………..	Cost reduction and control
Vessel space utilization…………………..	Inventory planning and management
Container deployment…………………….	Warehouse operations, inventory control
Operational know-how…………………….	Communication systems and Information sharing

2.6 Multimodal and logistics integration

The advent of containerization in the 1960s revolutionized the liner shipping business. Containers, as the main unit of cargo packaging, have shaped not only the nature and the volume of transported cargo, but also the size of ships and specialization. Yet, the main advantage brought about by containerization is the development of door-to-door and multimodal transport arrangements.

In a similar vein, globalization of business has had a tremendous impact on the way companies operate today. For shipping lines, this meant a requirement for global coverage, enhanced marketing capability, reduced costs, and superior service quality. Liner shipping has an existing advantage in breadth and depth of service, and is probably the most capable of providing global and integrated logistics services. The latter may include, but are not limited to, door-to-door and global transportation, warehousing and inventory management, forwarding and agency, communication and IT services, and even port operations and management.

2.7 The Role of Information Technology

Information technology (IT) is an extremely broad subject area. Basically, it could be described as anything dealing with computers and communications, and in particular the handling and processing information and data. In shipping, operators are sometimes overwhelmed with the vast amount of data available to them. Information systems are designed to collect, process and use these data to portray meaningful information to decision makers, but also to facilitate transport processes between different market players. IT business applications in shipping can be grouped into three main segments:

- ✓ *Electronic documentation and transfer of data*. EDI, cargo-tracking, electronic documentation, etc.
- ✓ *E-commerce or e-business*. On-line registering and chartering of ships, electronic procurement of supplies, on-line booking and e-payment systems, etc.
- ✓ *E-marketing*. Also called dot.com business, and is gradually taking over EDI. Services may include tracing and tracking, 'virtual deal rooms' for document transaction and processing, on-line publishing, etc.

3. Land transport services and network organization

Land transportation systems are extremely difficult to comprehend universally given their complex domestic dimensions, and the wide variety of institutions involved in their operations and management. Land freight transportation is not a single industry with defined set of management practices and procedures. It is the dynamic interaction of different market players ranging from road hauliers and motor carriers, railway or railroad companies, multimodal transport providers, to a countless number of special carriers and operators. To these is added a large cluster of transport intermediaries, property brokers, and logistics providers. For the purpose of this paper, we will limit our discussion to two major land transport operators, namely motor carriers for road freight transportation and railway companies for rail freight.

3.1 Road Freight

In many countries road haulage or trucking constitutes the most dominant form of freight transportation. Even in the case of remote and relatively small locations, road transport is an essential transport mode, particularly for domestic and short-distance freight movements. Road freight is probably the most specialized among all other forms of transportation. The most common division is between own-account versus hire and reward carriers (or private vs. for-hire in North America). As in the case of industrial shipping, own account carriers are corporations who own and run their own fleets (own-account carriage of goods), while hire and reward operators provide services to the general public against the payment of a fee for the service. Another distinction can be made between common and private carriers. Typically, a common carrier is an operator who has not limited his liability against claims for loss or damage to goods, whereas a private carrier operates under conditions of carriage as normally established by Governments or carriers' associations.

The hire and reward industry usually serves three main markets: contract distribution, shared-user distribution, and express delivery. Removals may be a fourth market, but are not considered in this paper.

- ✓ *Contract distribution* is the provision, under formal tailor-made contracts, of dedicated logistics services (not just transport), normally to retailers or manufacturers. Under these contracts, hire and reward carriers are described as *contract carriers*, and can even be considered as third-party logistics (3PL) providers. Much of their services are provided under truckload (TL) arrangements, i.e. when a shipper has a sufficient truckload volume, or is willing to pay the required amount for it.
- ✓ *Shared-user (or multi-user) distribution* is designed for shippers with insufficient business for a dedicated service. Operators under this denomination are usually considered as *common carriers* in that they serve the general public without discrimination. They usually work on a less-than-truckload (LTL) basis, and therefore need to consolidate small shipments of different clients into economically-viable vehicle loads for particular

destinations. TL and LTL arrangements in road transportation are equivalent to FCL and LCL consignments in container shipping.

✓ *Express delivery* has grown dramatically since the 1970s and consists of *same day* or *next day* deliveries. Much of this industry is run by parcel-delivery operators (TNT, FedEx, DHL, etc.) transporting LTL shipments either as common or contract carriers.

Trucking systems are so diverse and are dominated by smaller vehicles and a wide variety of special equipment. The list in table 5, although neither exhaustive nor definitive, depicts the main types of freight road vehicles currently in use.

Table 5: Major types of road freight vehicles and equipment

Vehicle types by commercial attribute	
Pick-up and delivery (PUD)	Collection and delivery of shipments heading to more than one destination, also called multi-stop step vehicle
Line haul	Collection and delivery of a one-destination shipment, which may be deconsolidated and reloaded into a PUD vehicle.
Vehicle types by technical attributes	
Straight truck	One-unit track
Truck trailer	Straight truck + one trailer
Truck tractor	Used with a converter dolly to haul a different set of trailers, sometimes double or even triple trailer units
Other descriptions	
Platform and flatbed, pole and logging, dry van, open top, high cube, dump truck, grain body, tank trailers, refrigerated vehicles, livestock van, and other special vehicles.	

From an operational perspective, trucking vehicles are either line-haul used to transport freight over long distances, or local transport services within a limited spatial area. The latter are mostly performed for LTL shipments and consist mainly of pick-up and delivery (PUD) services or delivery of freight on peddle runs. These are routes driven daily out of the PUD terminal so as to collect/deliver freight for outbound or from inbound movements. There are two main components of a peddle run, the stem time and the peddle time. Stem time is the time elapsed from when the driver leaves the terminal until he makes the first pick-up or delivery, or from when the driver makes the last pick-up/delivery until returning to the terminal. This is a non-revenue-producing time as trucks run empty throughout the stem time. Peddle time is the time during which the driver is actively involved in the pickup, transportation and delivery of freight. Thus, hauliers will seek to minimize the stem time and maximize the peddle time. Such a feature of road transportation shapes much of motor carriers' routeing, strategies, and terminal selection.

3.2 Rail Freight

Rail freight has relatively longer transit time than road services, although suitable for longer distance journeys in larger countries such as the USA, Canada or Australia. Many countries have a single national railway company, which owns and operates both rail infrastructure and superstructure equipment (rail vehicles), which is very similar to the service model in the seaport context. Issues over labour arrangements, operational efficiency and competitiveness have somehow retarded the industry's privatization process in comparison with other transportation modes. Railways in the USA have always been privately owned and provide a good model of an efficient privately managed rail freight system. In the US model, each railroad company owns the track over which it operates, sometimes jointly with another operator. In recent years, several countries have either partly or totally privatized their freight rail system, but with different degrees of operational and management success.

Wagonloads (also called trainloads or carloads) form the basic unit of freight handling in the rail system. They can vary in size, capacity and dimensions depending on the type of transported shipment and equipment being used. Nowadays, wagonloads are highly specialized and designed to meet the requirements of individual shippers. The most frequently used carloads are boxcars (plain or equipped), hoppers (covered or uncovered), flatcars, refrigerated cars and tank cars. Services for most rail freight tonnage are arranged by contract between carriers and their customers. Contracts are normally written on predictable levels of cargo moving at predictable times and recurring conditions, e.g. predefined rate. A fraction of rail freight tonnage, essentially low volume shipments hauled on the spot market, is priced through *common carrier rates*, i.e. price lists that are the same for all users.

Routing and logistics patterns in the rail system are quite straightforward, the only possible exception to this is the use of relay terminals and intermodal platforms. The introduction of *piggybacking* has revolutionized intermodal transport system, and is behind most of the rail/road intermodal successes. Piggybacking consists of purpose-built road semi-trailers capable of being bottom lifted when fully loaded on to specially built rail wagons (pocket, swing-bed, or spine wagons). The system operates both trailer-on-flatcar (TOFC) and container-on-flat-car (COFC) traffic. The *shuttle service* is another operating system used in this mode, although they may be seen as part of a *combined transport* system. A shuttle service, also called rolling motorway, is a system whereby complete road vehicles are carried on special drive on/drive-off low-height rail wagons so as to ensure the transport of freight on a regular basis over short mile-track distances, e.g. the shuttle service under the English Channel. Interlining between different rail freight operators is another feature of the rail freight system, although this is only practiced in few countries or regions (e.g. North America and western Europe).

3.3 Competition and partnership

The inland transport competitive environment is quite complex as it may range from fierce competitive moves to very close cooperative arrangements. Rail freight services face competition from two main sources: the road system for short shipments and high-value cargo, and the short-sea shipping/inland waterways systems for low-value cargo over relatively long distances. Road services, on the other hand, face competition from airfreight for high-value commodities and from railroads for lower value goods. Both rail and road freight services cooperate very closely with international ocean carriers; their relationship is somewhat complex relationship as, at the same time, they can generate freight for one another and compete to keep the business for themselves. When rail and road transport services compete, each tries to capture more traffic at the expense of the other; however when they cooperate, they provide each other with intermodal services.

The cost structure of each of the two modes largely shapes such a relationship. There are relatively low operating costs associated with rail freight, but high entry costs. It also lacks good access and connectivity because many locations are not rail-connected and therefore transhipment is necessary. Rail operators could also incur higher fixed costs if they decide to own or invest in private railroads, inland terminals, or equipment facilities. The cost structure of the road freight system is, however, dominated by variable costs. This is explained by the carrier's ability to utilize a publicly provided *right-of-way*, where roads/highways toll charges vary from a place to another. Road freight is also very labour-intensive and has a limited potential for economies of scale. Nonetheless, the general characteristics of road transport in terms of accessibility, speed, reliability, and lower loss and damage rates, have given motor carriers an advantage over other transport operators.

3.4 Inland services and the role of IT systems

Whether domestic or international, every commercial shipment requires certain supporting documents, such as bills of lading, manifests and other shipping papers. Information technology has greatly improved the accuracy of shipping data and the speed with which this information is transacted among different trade and transport partners. But the role of information technology does not stop at facilitating the transfer and exchange of shipping transactions, but goes further to include navigation equipment (ECDIS, VTS, GMDSS, INMARSAT, etc.) and a range of business applications (bar-coding, smart cards, e-commerce, etc.).

The rail industry has been the leader in creating standardized systems (e.g. interactive tags and readers) to track and monitor rail equipment and vehicles. On the other hand, the complex nature of their market, and the fact that they do not operate on fixed routes, road hauliers use a wider variety of technologies (satellite, cellular, microwave, etc.). The use of satellites allows carriers to pinpoint the location of the truck and relay this information to the customer. Freight road users also use a computing and communications system known as Telematics to promote the development and implementation of more efficient and safer transport. Typical examples of such technology include smart card ticketing, electronic tolling systems, and on-board vehicle information and navigation systems. The intermodal system is probably the most information-intensive, since technology is used to integrate every component of the intermodal transport into one cohesive system. Compatibility among the different transport modes is achieved through standard systems such as EDI for Administration, Commerce and Transport (EDIFACT), and the Automated Broker and Manifest Systems.

4. Nodes of the international transport and logistics system

4.1 Terminals and interchange points

Both physical and non-physical flows of cargo movement are linked to the location and activities of terminal networks. Terminals are the nodes in a shipper/carrier system and perform various functions to facilitate the movement of freight (and also passengers). All modes of transportation use terminals in one context or another. This discussion will address terminals of rail, road and sea transportation and their scope as logistics and distribution centres, particularly with regard to seaports and marine terminals.
A terminal can be any point within a transport chain where the movement of cargo is stopped or paused for a modal interchange, a value-adding activity, or both. As discussed later in this paper, terminals can also be seen as *nodes*, interchange or *articulation points*, linking different transport links. While maritime terminals (ports) have been always bounded by sea access, inland terminals can virtually be located anywhere, provided that there is an inbound/outbound transport link.

A. Rail terminals

The most common form of rail terminal is called a hump or marshalling yard. This is an interchange point that allows the switching between freight cars (wagonloads), trains, and tracks in a coordinated way. The hump is an artificial point that uses gravity and readers to direct or reclassify cars to a new train or a new track. For intermodal movements, the railroad industry uses what is usually referred to as trans-loading terminals, whereby both TOFC and COFC units are moved to and from rail flatcars.

B. Road terminals

Most truckload (TL) movements are performed on a one shipment-basis between two destinations, and as such do not require interchange points or intermediate handlings. TL terminals, when they exist, only provide dispatching, maintenance, and fuel/supply services, and are reducible to truck stations or truckstops. On the other hand, LTL movements require the use of one or multiple terminals, as they usually fall within the scope of hub-and-spoke systems. The most common type of terminals found in the LTL system is the pickup and delivery (PUD) terminal as described above. These are also called satellite or end-of-the line (EOL) terminals. The PUD terminal serves a local area and provides direct contact with both shippers and receivers. The basic service provided at this terminal is the pick up and/or delivery of freight on peddle runs, which are routes driven daily out of the PUD terminal so as to collect/deliver freight for outbound or from inbound movements. The relay is another type of terminal used by LTL networks. Relay terminals do not handle freight, but provide a layover between two PUD terminals, or between a PUD and a final destination. They are more or less equivalent to truckstops for TL movements. Other types of terminals can be found as LTL networks can be very complex given the diversity of inbound and outbound movements, the range, size, and special features of cargo consignments. Finally, important to notice that road transport networks do not offer intermodal /multimodal terminals, and much of these facilities are located at sea, air, or rail interfaces.

C. Water terminals

Commercial seaports are the predominant category of water terminals, and are sometimes combined with other purpose-built terminals (e.g. military ports, leisure ports, etc.). Their primary role is the provision of services to both ships and their cargo, but the main feature of ports is that they act as an interface between land and sea, and a gateway between international and domestic trade. They also act as an intersecting location for the various interests and different players of the international (and sometimes domestic) logistics and trading system. Such features provide ports with a proven advantage and considerable scope not only to develop first-class unimodal and intermodal facilities, but also to diversify and expand their business activities across multi-functional attributes of the transport, logistics, and trading system. These issues will be the subject of much of the remaining of this paper.

4.2 Warehousing

Warehousing originally refers to the storing of goods. In essence, warehouses are stop-off points as inventory makes the journey from raw materials to semi-finished products to finished goods ready for distribution to the final consumer. There are several reasons for holding inventory including for speculation, matching seasonal demand, cost reduction through the achievement of scale economies, and protection against uncertainties. Another way of defining inventory is according to its form or function. The following list is a composite of various textbooks classification:

- ✓ *Stock in the pipeline*: this category may be subdivided into work in process and goods in transit
- ✓ *Speculative stock*: undertaken for various reasons such as against fluctuations in foreign exchange, and in anticipation of an unusual event (strikes, lockouts, wars, etc.)
- ✓ *Cycle stock*: to meet regular demand
- ✓ *Safety or buffer stock*: to overcome any short-term uncertainty

✓ *Promotional stock*: to respond for marketing promotions

✓ *Dead stock* (obsolete) or *shrinkage stock* (lost or stolen): this is the residual value of the stock, and is not desirable to have it.

Modern logistics attempts to reduce inventory levels and cycle times, whilst at the same time providing a high level of customer service. This has resulted in a need for shorter periods of storage. The role of modern warehousing has much to do with transfer or switching as it has to do with storage in the traditional sense. The holding of stock or inventory has traditionally been treated as a buffer or safety measure *just-in-case* something goes wrong. The logistics approach identifies inventory as a major cost item, which unnecessarily ties up a considerable amount of capital, and thus the holding of inventory should be minimized, or even eliminated. The old approach of *just-in-case* is replaced by the logistics approach of just-in-time (JIT), meaning that deliveries should arrive just-in-time to be used for manufacturing, production, and distribution purposes.

Just as with transport, it is possible for manufacturers or traders either to undertake their own warehousing or employ the services of a third party. Warehouses can be owned or operated by shippers, carriers, receivers, intermediaries and independent third parties, as well as by firms whose sole function is the provision of warehousing space and services. Correspondingly, the terminology alternates between private and public warehousing, but a distinction should be drawn between the two when considering warehouse activities:

Table 6: Main functions of private and public warehouses

Private warehouse	**Public Warehouse**
✓ Receiving goods inwards (purchasing and procurement) ✓ Putting away goods into reserve stock or bulk storage ✓ Replenishing: transfer of goods from the reserve to the picking stock ✓ Picking or order selection from the picking stock ✓ Order assembly or consolidation of separate order items ✓ Despatch of goods by transport	✓ Storage ✓ Handling ✓ Consolidation of orders for despatch ✓ Specialized services

As far as warehousing is concerned, the seaport can undertake two functions:

✓ A public warehouse function, where the port owns, operates and manages a warehouse for the storage and handling of customers' goods and cargo, and /or

✓ A landlord function where port sheds and open spaces are rented or leased to either direct customers (shippers, shipowners, or inland transport operators) or third party operators.

4.3 Logistics Centres

Logistics centres may perform a number of functions, including, but not limited to, traditional terminal and warehousing activities. This section describes some of the key functions, all of which may be performed at seaports, although they are not necessarily associated with maritime transport. The functions listed below are neither inclusive nor exhaustive and other activities, such as teleport and IT services, may well be performed by logistics centres.

A. Storage

This is the traditional function of warehouses. There are various reasons for storing goods associated with the type of inventory, as described above. Modern logistics focuses more on flow management (or flow-through-distribution) rather than storage of inventory.

B. Materials handling

Materials handing or materials management is usually approached as the opposite to physical distribution. It consists of short-distance flows (movements) usually taking place within one plant or warehouse building. Effective materials management seeks to minimize materials handling, and at the same time making effective use of time and space. Such combinations should enable effective overall logistics flows, reduce costs, and meet customers' variety of needs and orders. Nowadays, the activities associated with materials handling are mostly handled by sophisticated machinery, including through a range of transfer technology equipment at ports.

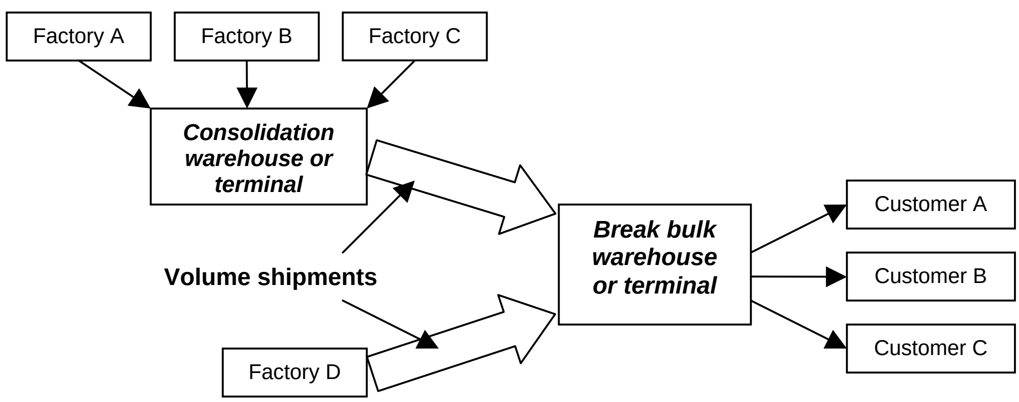
C. Cross docking

Cross docking is associated with product assortment or product mixing in the required combinations for shipment to customers. In this context, the terminal or warehouse is more a transfer location than just a storage point.

D. Consolidation and break bulk

Smaller consignments are consolidated (or concentrated) and subsequently dispatched as a larger volume shipment-unit. The reverse operation is called break-bulk or dispersion, and can be combined with consolidation, as illustrated in figure 2.

Figure 2: A simplified pattern of consolidation and break-bulk operations.



E. Value-added logistics (VAL)

In ports, the term VAL is sometimes used in confusion with value-added services (or general logistics services), which are closely associated with the aspects of storage, consolidation, break-bulk, and cross-docking. In the context of logistics management, added value is being pursued in post-production/pre-distribution process, including, but not limited to, the following activities:

✓ *Postponement*. This refers to the deliberate delay of an activity until the last possible moment, particularly when making (or marking) a general product into a customer/country specific product, e.g. adding a special label or packaging. In this context, breaking bulk can be considered as a variation of postponement when it proves cheaper to transport commodities in bulk over long distances than in consumer-ready packaging.

- ✓ *Reverse logistics*. This is the process of managing the movement and storage of returned goods (e.g. damaged, used or outdated products). Such process is considered as an added value since it deals with the repair and disposal of returned products.
- ✓ *Packaging*. Packaging is also associated with postponement and breaking bulk, and is usually discussed as an aspect of materials handling, e.g. container packaging and handling operations. It is seen as VAL when it adds value to the transport and logistics attributes of a commodity. For instance small, fragile, or dangerous commodity-shipments can be neither safely nor economically transported (and handled) without proper packaging.
- ✓ *Information Technology*. Modern logistics centres also offer information management services to customers such as real-time tracking and tracing for cargo distribution and inventory levels, on-line documentation and payment services, and information related to customs clearance and administrative procedures.

4.4 Intermediaries and Third Party Institutions

A. Third party operators and logistics providers

When the transport service is performed by a party other than the shipper or the receiver (e.g. industrial shipping, private transport, etc.), both shipping and inland transport providers may be regarded as third parties, or third party transport operators. Today, many shipping and inland transport operators are offering more than just a transport service, and could therefore be considered as third party logistics (3PL) providers. 3PL is also called logistics outsourcing or contract logistics. Its main core activities include transport, warehousing, inventory management, information systems, consolidation and distribution, freight management and consulting services. Other functions include value-added capabilities such as pick and pack, labelling and packaging, and telemarketing. A third party may provide any number of these services, including just one service. Traditional third party operators have focused their services on a single operational or managerial supporting service (transport, storage, information management, audit and payment, etc.), whereas recently some operators provide more than one auxiliary service involving or surrounding the flow of goods and products. One of the complaints voiced by shippers and market players in the field is the growing number of vendors identifying themselves as logistics providers. What separates logistics providers from transport carriers, warehouse operators, freight forwarders, and all other providers of a single logistics service dimension is that they render more than one, or sometimes all logistics services.

Table 7: Examples of logistics functions that add value to goods and services

Corresponding logistics functions	Utility or value
Transport, delivery……………………………………………………………...	Place utility
Storage, warehousing………………………………………………………….	Period utility
Materials handling, order processing, consolidation and break bulk, sequencing, picking/packing, etc………………………………………………	Pattern utility
Market intelligence, promotion, facilitating contacts & procedures, etc…...	Management/coordination utility
Buying & selling, credit, financing, passing title……………………………..	Possession utility

Another distinction should be made between *asset-based* and non asset-based providers. The former have tangible equipment or assets (e.g. vehicles, warehouses, containers), which they own or lease. Non asset-based (or *management-based*) providers do not own such equipment, but offer management skills in organization and information systems to the shipper, e.g. through facilitating shipping documentation or coordinating intermodal services. They are usually referred to as *fourth-party logistics* (4PL) providers. Sometimes, hybrid (*integrators*) institutions of the two types may offer both equipment and management services. Although they operate as independent companies, they may be inclined to use their own transport and assets, even though other third parties offer a better service. Such institutional and functional variations are consistently present in the shipping and inland transport system, and thus must be comprehended before soliciting a third party transport or logistics services.

B. The role of intermediaries in shipping services

Many shippers and purchasers think that intermediaries add unnecessary costs to goods as they move through a logistics or distribution channel. Nevertheless, and particularly in the context of international logistics, intermediaries may prove beneficial if not necessary (see figure 3). Intermediaries have existed for centuries in almost all shipping markets, and have proved to be resilient and adaptable. The use of intermediaries can be justified by the advantages of *specialization* and *contactual efficiency*. On the one hand, intermediaries have developed high skills in segmented and niche markets hardly accessible to transport providers. On the other hand, they bridge and facilitate contactual links between different market players, which otherwise could be very complex.

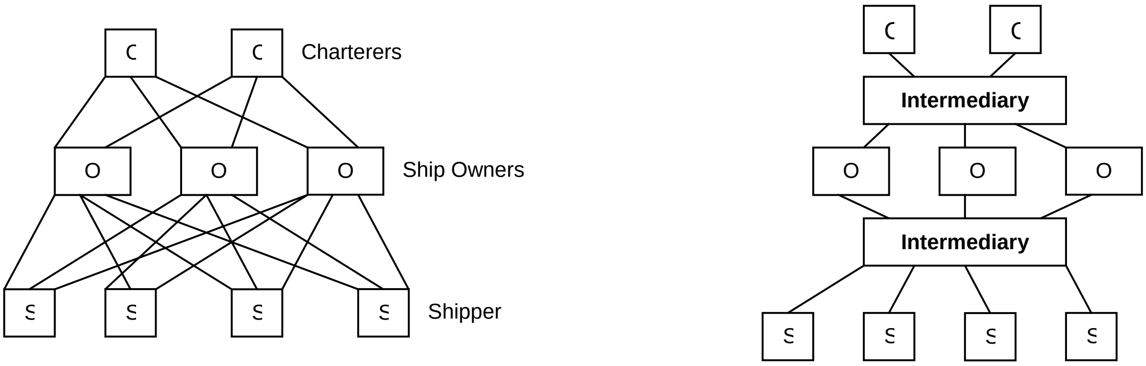
In the context of domestic logistics, it may be possible to integrate the logistics channel by just eliminating or minimising the functions of intermediaries. However, in international logistics, such a possibility is far from being realistic given the complexity of international trade and logistics systems. Depending on the services they provide, intermediaries may be called customs-house brokers, freight forwarders, shipping agents, NVOCCs, shipper associations, export management houses, etc. Intermediaries can act between shipper and receiver, shipper/receiver and carrier, and carrier and carrier. The next section informs about the role of intermediaries in international shipping services.

Apart from industrial shipping where shipowners control their own cargo, shippers and shipowners do not usually meet directly. The same applies in the sale and purchase market between buyers and sellers, and in the freight market between charterers and shipowners. A new role of intermediaries has emerged with the advances in containerization and information technology, as they have developed new functions for the provision of logistics services and IT services. In shipping, three main categories of intermediaries can be listed: shipbrokers, shipping agents, and freight forwarders:

- ✓ Brokers act between two parties for a definitive task. In shipping, a shipbroker may be involved in buying or selling a ship (sale and purchase shipbrokers), or chartering out a ship for a voyage or a period of time (chartering shipbrokers). As such, brokers only act in the tramp shipping market.
- ✓ Shipping agents are sometimes confused with shipbrokers as the two terms are sometimes used interchangeably. There are however two distinctive features of shipping agents. First, they normally represent their principals (shipowners) to discuss with various parties, whereas shipbrokers only act between two parties. Second, their agency work lasts for a longer period of time, while the broker's work often terminates with the conclusion of the deal.

✓ Freight forwarders act on behalf shippers (importers and exporters) as when shipping agents represent shipowners. Non-vessel operating common carriers (NVOCCs) and multimodal transport operators (MTOs) are a variation of freight forwarders, in that they act on their name; i.e. as principals for the goods not as agents. Today, the role of the forwarding has gone beyond the provision of shipper’s agency to include logistics and value added activities.

Figure 3: Example of the number of contacts without and with the use of intermediaries (from 18 to 12)



5. Port’s Land Integration: Analytical Tools and Instruments

5.1 Ports as logistics centres: spatial and functional dynamics

In international shipping and logistics, seaports can be treated as *maritime logistics centres* when they provide logistics services at the seashore and shore-land interfaces. Many ports in the world have an established body of knowledge and experience in providing value-added logistics activities for ship-cargo consignments, but not all ports can claim a logistics centre status. Typical logistics functions of ports include cargo handling and transfer operations, storage and warehousing, break/bulk and consolidation, value added activities, information management, and other related activities. As already mentioned, one must distinguish between value added services (or general logistics services -GLS), and value-added logistics activities (VAL). The latter elements could constitute a good benchmark for ports claiming to operate as maritime logistics centres.

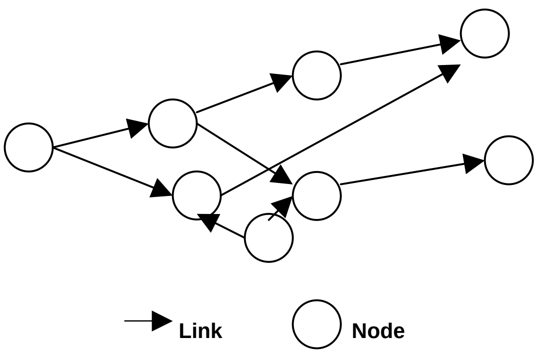
Ports may also be seen as *inland logistics centres*, when they act as nodal interfaces intersecting the different segments of the inland transport system such as for road/rail, road/road, rail/rail, and even rail/road and air combinations. In recent years, there has been some emphasis on the role of inland logistics centres, where all logistical operations not necessarily requiring to be carried out in the seaport area can take place. Opportunities for developing port facilities that can provide logistics-like services at some distance away from traditional seaport locations arose from several experiences around the world. As a result, some new concepts such as regional distribution centres (RDCs), inland terminals, and destriparks have emerged recently. Other generic terms include dry ports and inland clearance depots (ICDs), both bounded by customs presence and common-user service arrangements. Nevertheless, there is no clear-cut separation between all such facilities in terms of spatial dimension, functional, or organizational status.

From a geographical approach, the relationship between freight flows and terminal development is better understood through the concepts of *articulation points*, *corridors* and *distribution centres*.

- ✓ An articulation point is a nodal location that interfaces between different spatial systems and serves as a *gateway* between spheres of production and consumption. It is more than interchange point as it includes the consideration of terminal facilities, distribution, warehousing, and trading centres. In this context, seaports are usually considered as ‘*hard*’ terminals since they are '*immoveable*', whereas inland terminals dispose of a great degree of locational flexibility.
- ✓ A freight corridor, opposed to passenger corridor, is a linear orientation (link) of freight transportation supported by an accumulation of transport infrastructures and activities servicing these flows. Traditionally, flows in freight corridors tended to be fragmented and segmented since each mode tried to exploit its own advantages in terms of cost, service, reliability and safety. Maritime corridors traditionally correspond to geographical trade routes (regional or international), but recent logistics patterns of liner shipping have created new types of corridors and routing.
- ✓ A freight distribution or logistics centre serves as a location for cargo transfer, and distribution to regional or extended markets, depending on corridor links and facilities. Conventionally, many distribution centres were located close to central areas mainly as a factor of market and terminal proximity, but are currently relocating to peripheral areas due to logistics land requirements (namely warehousing and distribution centres), market integration and economic specialization.

Functionally, a freight distribution being located at, or in proximity of, an articulation point involves a concentration of many transport terminals, each servicing its respective distribution system (e.g. transhipment, intermodal interchange, warehousing and decomposition of freight shipments, etc.). From a logistics approach, such patterns can be regarded as node-link systems, whereby nodes are locations for cargo transfer (and eventually storage and warehousing), while links form the transport system. In this context, nodes are equivalent to articulation points, and links to corridors, and ultimately to distribution centres. A basic node-link system is shown in figure 4, but the complexity of node-link systems can vary from being a simple interchange point between two transport links (either unimodal or multimodal), to a complicated pattern involving a varied combination of transport modes and terminal locations.

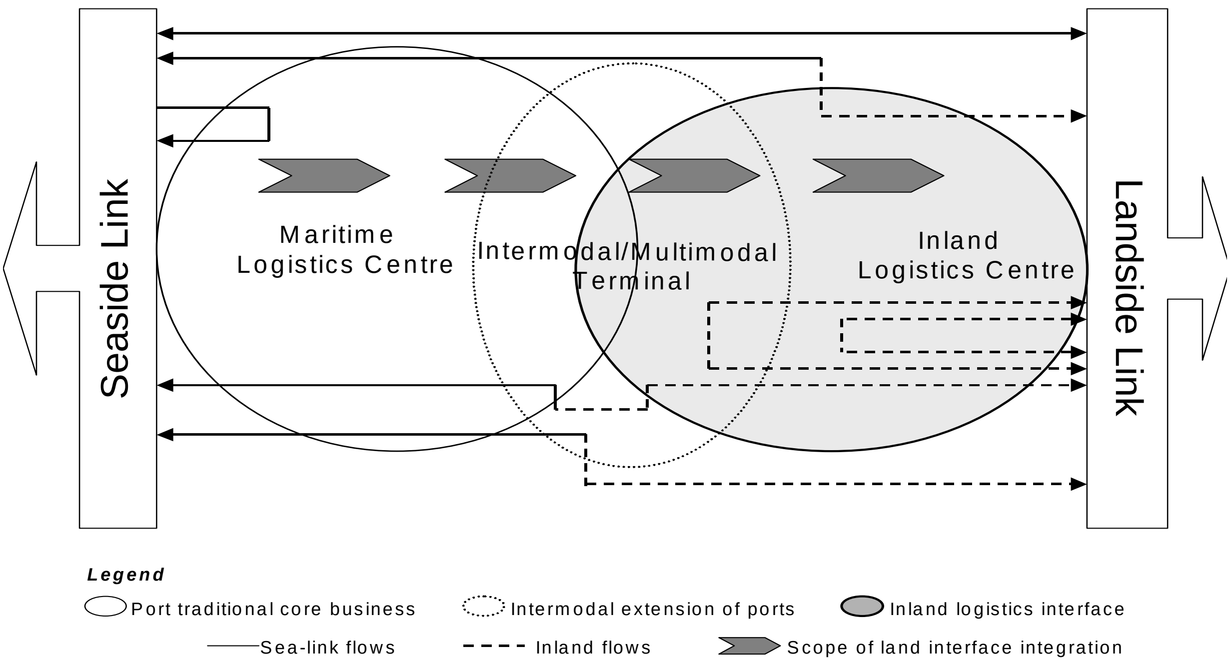
Figure 4: Example of a node-link system



From an operational perspective, a distinction must be made between facilities operating as logistics centres, and those only providing cargo handling or intermodal services. For instance, a warehouse or a container freight station (CFS) may be located almost anywhere, and thus the determinant of a logistics centre is more a variable of functional attributes than institutional or spatial features.

Figure 5 shows the interaction between the sea, land, and intermodal systems and the scope for ports to integrate all such three interfaces. At the seashore interface, maritime logistics centres operate and provide VAL services for sea-bound goods at both origin and destination. Cargo flow can take different routes including through intermodal interchange and/or inland warehousing and logistics facilities. Not all ports are maritime logistics centres, and only few can even offer intermodal services. The inland logistics interface is primarily concerned with managing physical flows for inland cargo (e.g. ICDs and dry ports), but can also process sea-bound or intermodal cargo without being physically linked to the sea. The intermodal system intersects the inland and maritime interfaces as well as the different modal flows of inland cargo (e.g. road with rail). Its main role is to act as an interchange point rather than a logistics centre.

Figure 5: Scope and potential for ports to develop beyond a maritime logistics centre.



Port development and strategic orientation traditionally aimed at logistics integration at the maritime interface and, to a lesser extent, at the intermodal/multimodal sea interface. Strategies of inland integration whereby seaports seek to either pull outside cargo-operations into the port base, or geographically expand beyond traditional spatial bases, are rarely considered in the port industry. Legal, spatial, institutional, and even functional constraints usually prevent ports from adopting such strategies, as three main questions need to be addressed before any attempt to develop such strategies:

1. What is the geographical limit of port inland expansion?
2. What is the extent of port's roles, functions, and missions? and,
3. What types of institutional, organizational, and operational port models can accommodate such strategic orientation and/or spatial expansion?

Nevertheless, in a highly competitive environment marked by various mobility and accessibility options, such strategies may become imperative if ports want to retain or increase their market share in the total transport and logistics chain. The next section introduces a number of operational and management tools for port land interface, and attempts to integrate them within the wider port logistics system. Particular attention will be drawn to strategy and policy issues of port land interface integration, namely with regard to spatial, functional, and institutional dimensions.

Competition in the port sector is complex and has multiple facets depending on the nature, scope and scale of the port activity. Based on a detailed analysis o a port's internal and external environment, a competitive strategy can be designed and effectively implemented. This must be linked with a good marketing and promotion strategy. The task of port marketing starts with data collection, information analysis, and market research; and ends with strategy formulation and implementation.

5.2 Port Competition and Marketing under an integrative land strategy

A. Port market structure and competitive models

The economic theory of competition is based on the general assumption that all companies in the market seek to maximize their profits. This is not always the case for a port operator or a port authority as it may be restricted by a status of common service or public interest provider. The interaction between price, product/service, and suppliers/producers creates various market patterns, under which competition can take different forms as shown in table 8.

Table 8: Different market forms. Compiled from different sources

		Suppliers and degree of product differentiation	Influence of firms over prices	Marketing tools
Perfect Competition		Many suppliers Identical products / services	None	Commodity exchanges or auctions
Imperfect Competition	*Oligopoly*	Few suppliers Product differentiation	Considerable	Advertising, quality, etc. Rivalry administered prices
	Duopoly	Two suppliers Product differentiation	Considerably	Advertising & public relations
	Monopoly	Single producer No close substitutes	Considerable	Promotional & public relations advertising

Markets under perfect or pure competition must satisfy four main conditions:

- ✓ Large small sized number of buyers and suppliers preventing a single actor from affecting the market,
- ✓ Homogeneous and standardized products/services that can not differentiate the industry,
- ✓ Customers and suppliers well informed about product and quality offered or required, and
- ✓ No market entry or exit restrictions for both customers and suppliers.

In practice, most markets are to a large extent imperfect. Imperfect competition may range from duopoly and oligopoly, to pure monopoly where there is no competition at all. The main sources of imperfect competition are cost conditions and barriers of competition. Such sources arise in many situations, e.g. when there is small number of suppliers or significant economies of large-scale production, a product/service that has a patent protection, or in situations where the nature of regulatory barriers precludes competition. For instance, monopolistic situations can still be found with many countries with one railway operator, while oligopoly can be noticeable in both liner shipping (e.g. through conferences, alliances and mergers) and international container port operations (HPH, P&O Ports, Maersk terminals, etc.). Some near-forms of perfect competition seem to govern the tramp shipping market, as well as large segments of the inland transport and logistics market.

A general statement classifying the competitive market structure of the entire port sector cannot be made because it is necessary to review structures in particular market areas. Even within a single port entity there exists a variety of different services, involving a complex combination of commodities, vehicles, customers, and operators under various regulatory, social, and economic conditions. To undertake a competitive, marketing or pricing port strategy, one must describe the situation at any one point, and even then the situation may differ between customers and users. This is particularly the case of landside port activities where multi-institutional and cross-functional dimensions are a common denominator between the port system as a marketer and service providers on the one hand, and the inland transport and logistics system as a customer and service user on the other hand. The picture becomes ever more complicated when the two systems compete against each other, or that there is an intra-competition situation within each system, e.g. between rail transport and road transport, or between the landlord port owner and the private port operator. Nevertheless, the complexity of the situation does not eliminate the validity of the competitive models described above. It only means that in order to make use of these models, we must have knowledge of the situation that exists in a particular port setting. A useful way of doing this is to look at port competition from two different levels:

1) If we consider the port organization as a unified and aggregate economic activity then the competition will occur at two levels:

- ✓ *Horizontal or inter-port competition*: In the form of a *direct competition* with ports situated within a given inland spatial range. The concepts of hinterland and foreland usually relate to a ship's cargo destination and origin, but could equally be applied to the captive cargo (or inland transport) being serviced at port inland facilities. Particular attention should be given to the developments of new inland infrastructure and distribution and network transport systems.
- ✓ *Vertical and cross competition*: Also called intermodal port competition. This is initiated by the competition between different modes of transport and does not originate necessarily from competing ports. This is an *indirect* form of competition involving actors outside the port sector such as intermodal terminals, inland logistics centres, and even shipping lines. A port may lose its inland market share when its waterway or maritime traffic is being replaced by air, rail, or road transport. Conversely, it will gain more traffic if it invests in facilities that can connect different components of the transport system.

2) If we consider the port organization as a platform gathering several activities and actors, then the competition will be centred within the port itself. Two forms of competition can be identified at this level:

- ✓ *The segmented form*, which corresponds to the intra-competition between different components of the port organization. This can either be horizontal by involving actors within the same core of activity (e.g. private warehousing companies competing between each others), or be vertical involving different types of port operators (e.g. a stevedoring company competing with a logistics provider).
- ✓ *The aggregate form* that drives every component of the *port community* into an indirect *inter* or *cross* port competition. The competitiveness of the port as a whole depends on the efficiency of all actors within the port community. A failure from any port member to efficiently perform its own activities will jeopardise the competitiveness and performance of the entire port community. Superior port management is the aggregation of performances of all port community members, who should work in a collaborative spirit so as to compete

against other port and transport systems. This aspect will be developed further when analysing port efficiency and performance measurement.

Once a firm (e.g. a port operator) or an aggregation of firms (e.g. port community) have analysed the structure of their industry, the number and type of existing and potential competitors, then they need to choose between one or a combination of the three major competitive strategies:

- *Overall cost leadership*. This strategy requires aggressive construction of efficient-scale facilities, vigorous pursuit of cost reduction, tight cost and overhead control, and cost minimization in non-core areas such as in research and development, sales force and advertising. Management control and low cost compared with other competitors are key factors to achieving overall cost leadership. The main advantage of this strategy is that reduced costs protect companies against the bargaining power of customers (e.g. inland transport operators, freight forwarders, logistics providers) and the threat of substitution (e.g. to another port or inland terminal). However, the strategy has many drawbacks such as the incapacity to invest in new equipment, marketing, research and development. Many ports in the world enjoy natural cost leadership through for instance low salaries, tax exemptions, proximity to customers and suppliers, etc. Examples of cost leadership in port landside management include proximity to inland cargo sources and destinations, proximity to inland, multimodal and intermodal transport routes, integration with other transport modes (door-to-door pricing rates), economies of scale (derived from both port capacity and throughput), and low tariffs and customs duties (free port).

- *Differentiation*. The basis of this strategy is to create something unique that will establish a clear distinction from other competitors' products and services. This can be achieved through customer service, technology, prestige, quality and other factors. Differentiation allows a great positioning in the market through customer loyalty and lower sensitivity to price, but can also be risky when customers sacrifice loyalty by low cost or in situations where other competitors follow the same strategy. For ports of developing countries, land interface integration can by itself embody a differentiation strategy, e.g. in terms of dedicated warehouse and inland terminals, services to special cargo and land transport vehicles, value-added logistics activities and other non-standard services, etc.

- *Focus*. This is a relatively new strategy in the port sector. It can be achieved when a port tries to create niches or serve a specific customer or port user. Through specialization, the level of improvement and know-how in a particular traffic or operation becomes higher, hence reducing operating costs and even attracting more customers. However, this strategy may yield to opposite results if loyalty is not assured, in situations of seasonal fluctuations, or when competitors successfully specialize in the same niche of the market.

B. Port land interface promotion and marketing

The identification of port competitors and the development of competitive strategies require at first a detailed analysis of the port's market and competitive environment, including:

✓ The structure and dynamics of the port market in relation with the trade, transport (inland and intermodal), and logistics system,

✓ The interaction between port management in its different organizational forms (landlord, tool, service, public, private, etc.) with the various port users (shippers, shipowners, land-based transport operators, intermediaries, intermodal and logistics providers, etc.), and

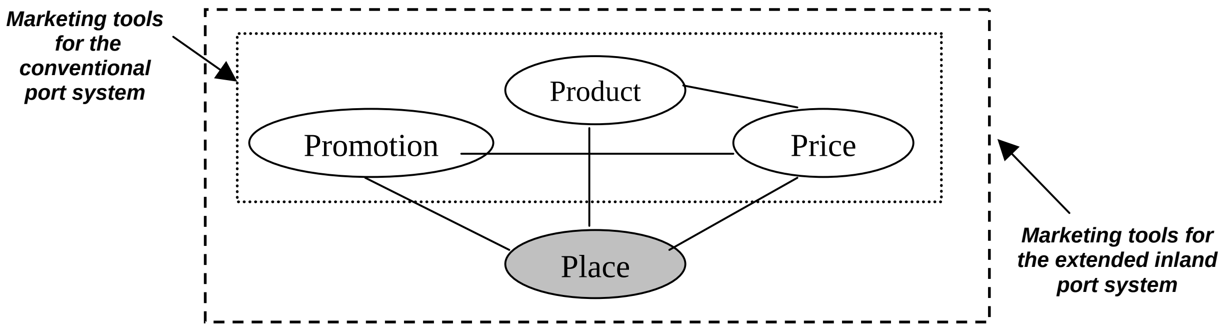
✓ The regulatory framework that governs ports at both national and international levels.

Marketing in ports, as well as in other economic sectors, is composed of a number of activities principally related to market research, promotion tools, marketing strategy and implementation. To design marketing strategies for port land interface integration, port managers need to seek out, gather and analyse relevant and reliable information and data, including for current customers and potential inland-facility users, variations in cargo volume, origins and destinations, developments in competing ports, distribution and transport networks, institutional and regulatory changes affecting port's activity, etc.

Market research is a task that goes beyond information gathering and data collection. It not only involves the analysis of the information gathered, but also and mainly the projection of future trends. A useful way to do market research is to undertake *market segmentation*. The port inland market can be segmented by type of facility (terminals, warehousing and logistics facilities, handling equipment), traffic or commodity (bulk, break bulk, container, general-cargo), equipment or vehicles (handling equipment, types of trucks, etc.), customers or users (shippers, logistics providers, transport providers, etc.).

Marketing tools are those elements that influence the ‘sales’ of a product or a service. In port literature, marketing tools are usually identified as the 3P’s namely: product (service), promotion, and price. The integration of land interface activities requires the integration of place, or the fourth P element, in the marketing mix since the issue of place and spatial expansion of ports becomes more relevant in the port inland marketing strategy.

Figure 6: Marketing tools for the inland port system



Product in the port business refers to the range of port operations, services and facilities. Usually, and apart from price, an inland or logistics user chooses a port based on one or a combination of different elements including geographical position, hinterland connections, land and storage capacity, range and quality of port services, labour force and social climate, management and technical know-how, and financial or fiscal environment.
Pricing in ports is very difficult given the wide range of port services, but also cost structure complexities (as described above) and the fluctuations in international trade, logistics and transport system. The pricing of port land services is established at different levels, the most common of which are land leases, handling costs, warehousing, value added logistics services, and auxiliary and extra services (bunkering and supply, etc.).

Promotion can be defined as a marketing means of communication between the port and various target groups in order to inform them and influence their market attitudes. Among a firm’s marketing tools and functions, promotion is probably the most important, visible, and culture-oriented. Therefore, any port promotion strategy has to consider the three principal components: means of communication, type of audience (targeted customers), and the nature and characteristics of goods (or services) to be promoted. At the inland interface of ports, this implies a new product (e.g. warehousing, logistics and terminal services) for a different audience (e.g. inland transport and logistics operators), and thus a different means of communication and advertising.

6. Measurements and Monitoring of Port's Land Interface Efficiency

Performance indicators are control tools or instruments that allow managers and decision makers to monitor and evaluate the performance of their firms and companies, and take corrective decisions to improve it when and where be needed. Performance measurements are also useful for investment decision strategies, as well as for port planning and forecasting.

6.1 Overview and Shortcomings of conventional Port Performance Indicators

The literature on port efficiency is almost totally quantitative and is known to be vast in scope and nature, but can be broken down into two broad categories of indicators: macro-performance indicators quantifying aggregate port impacts on the economic activity, and micro-performance indicators evaluating input/output ratio measurements of port operations and productivity.

Port impact studies have emerged as an area of applied research that can bridge trade with the wider regional and national policy, through assessing aggregate port impacts on their traditional or extended spatial bases, or analyzing a port's efficiency as a determinant of the total transport and trade costs. Ports are therefore ranked according to their size and scope of influence, generally identified as being trade-related: sea-borne versus non sea-borne trade; space-related: hinterland versus foreland, national versus international, feeder versus hub; or sector-related: direct/indirect versus induced, maritime clusters versus industrial clusters. Nevertheless, the study of port aggregate impacts has proven to be a controversial subject often with many conflicting standpoints (economists, city-planners, environmentalists, etc.), and different methods of assessment, e.g. added-value, input-output, statistical compilation, etc. It has also been criticized because of the selection of limited industrial categories not reflecting the true functional profile of ports, and because aggregate impacts seem to focus on the competitiveness of ports as regions rather than ports as firms.

Micro-performance indicators are closely related to operational efficiency, but with different approaches of analysis. There are several methods for measuring port productivity ranging from econometric methods, accounting methods, to data envelopment analysis (DEA) and other engineering approaches. Micro-performance indicators mostly use empirical research, and can be grouped into three major categories: throughput measurements, productive efficiency, and financial reporting. Both productive efficiency and the throughput measurement approach in equating port operations to the production function, with the difference that productive efficiency compares actual performance to optimum output rather than to past performances. Financial reporting draws on accounting ratios (pay-back, ROI, gearing-ratio, etc.) to assess port performance using indicators such as operating expenses/ surplus per cargo-unit or per ship-type.

Nonetheless, many inadequacies arise when using one or a combination of these measurements. First, they focus almost totally on sea access rather than landside port interface, although much of cargo movement and operations takes place within the port land area. Such measurements also ignore many of the activities undertaken at port's land interface including warehousing and storage, and value added logistics services. Another major drawback relates to the application of average global ratios, and the discrepancy on standard units to use as a measure of performance, for instance in counting movements and cargo handling of empty containers versus those of full or less-than-full container loads (FCL/LCL). In similar vein, the use of financial metrics is as much criticized in the port sector as it is in other businesses. Probably the main bias refers back to the difficulty of applying a universal accounting system to different markets, products, and industries, particularly in the typical multi-functional and cross-sectoral port system. Others criticize financial techniques in that they show the results of past actions instead of indicating future performances. Moreover, they are generally designed to meet external evaluators' needs and rarely direct the aspects of internal performance. The latter drawback is best explained by the incapacity of conventional financial metrics to assess the contribution of intangible activities such as innovation and development programmes.

6.2 Physical Indicators Relevant to Land Interface Port Activity

Port landside integration can be undertaken through different strategies, including as intermodal terminals, warehousing sites, logistics centres, or a combination of one or all these functions. Table 9 summarizes major indicators used for inland terminals and *public* warehousing in a port management context. Obviously, such indicators do not apply in the case of private warehouses situated in the port's estate, as the port's service in this case is limited to space/facility rental, lease or concession.

Table 9: Example of indicators used to measure the performance of both inland terminals and warehouses.

Performance category		Example of indicators
Inland and Intermodal Terminals	Accessibility and connectivity to ports	infrastructure (railway tracks, large distance roads, bridge weight/height restrictions, pavement, speed limit, existence of railroad electrification), drayage distance, fluctuations in traffic volumes, number of accessing gates and facilities, traffic volume on access road/rail tracks, travel delay, prioritization of track/road access usage, adequacy of infrastructure connection by mode, connectivity between modes, activity centre by mode, number of intermodal facilities,
	Availability of port facilities	Facility service area, storage capacity and restrictions, number of intermodal facilities, volume to capacity ratios, average dwell time, gate facilities, superstructure / equipment availability (downtime), access time, system condition, working time, types of modes/commodities handled, track capacity, expansion capability
	Productivity and economic efficiency	operational standards and productivity, queuing of vehicles, turning radius into facility, average transfer time, cost/revenue per unit operated (ton, TEU, commodity, mode, etc.), maintenance cost, hours of access lost, port charges and other user fees, market share by mode, number of users per transfer point, cargo handling and equipment speed, equipment maintenance
	Safety and security	Number of accidents per movement/year, loss and pilferage ratio, grade crossing safety improvement, number of accidents involving dangerous cargo, degree of compliance with relevant regulations,
	Time	customs/administrative processing time, congestion level, average travel time between facility and major origins/destinations, freight transfer time between modes, gates transfer time, in-transit time at terminal facility, border delays due to inspection services, mobility index (tons per mile / vehicle miles), mobility index by direct / indirect routes, immobilization time,
	Reliability and quality of services	Real-time cargo information, air quality congestion reduction, level of service, work value, level of co-ordination, adaptation of services to clients,
Warehousing	Throughput / output	warehouse service area, storage capacity and restrictions, stacking factor, holding capacity, warehouse occupancy, volume to capacity ratios, throughput / output levels, working hours, expansion capability
	Operational efficiency	Work efficiency, space utilization (both storage area and aisles), order structure (average order size, percentage of orders in different sizes, etc.), order cycle time, ease and flexibility of order placement, percentage of orders filled, equipment speed, equipment utilization,
	Safety and security	Number of accidents per year, loss and pilferage ratio, safety systems
	Service level	Accuracy, perfect order rate, Frequency, flexibility, working hours, reliability

6.3 Traditional Versus Logistics Approaches to Costing

Cost structures in transport services and ports are generally perceived in terms of fixed and variables costs; capital and operating costs; direct and indirect costs, etc. For instance, ship costs are generally divided into fixed and variable costs, and sometimes to voyage and port costs. The same subdivision may be applicable to other transport modes, but with varying degrees between the proportion of fixed and variable in each mode. In ports, costs are usually broken-down into four elements: land costs, capital/infrastructure costs, equipment/ superstructure costs, and labour and running costs.

Such classification mostly derives from accounting computation systems that focus on cash flow and profitability indices without a clear allocation of different costs among the various products and services of the port. For instance, there is no clear allocation of social costs associated with port and transport activities, e.g. waste, pollution, noise, etc. Another shortcoming of the accounting cost system is its nature of measuring past costs, which oppose it to the futuristic economic cost system stemming from the concept of opportunity cost or the cost of resources at their best alternative uses. The economic costing system is particularly relevant to port and transport projects, because once the investment has been made one should not be concerned with recovering what is sometimes referred to as *sunk costs*. *Cost-Benefit Analysis* (CBA) is the standard method used at this level, and consists in identifying the optimum benefit-cost ratio, usually by contrasting loss earnings against the benefits of the project. Nevertheless, in the typically fragmented port industry, the CBA model raises the problem of the allocation of costs or benefits. In other words, who will bear the cost or gain the benefits of a port expansion or investment project? In this context, the *stakeholder analysis* (SHA) was introduced in the early 1980s as an alternative method to correct CBA deficiencies particularly with regard to cost sharing and distribution.

Under the traditional approach to costing, every department/activity in ports will be considered as a cost centre (e.g. transport, maintenance, warehouse, cargo handing, administration, etc.). There is no way, under this system, for the costs of the different departments to be integrated. Without knowing all the costs associated with the flows of goods, capital and information, it is difficult to achieve an *overall optimal solution*. One way to overcome this is to adopt methods which look at costs in terms of flows of goods through the firm, and in the context of ports, across a network of firms within the port community.

In recent years, new techniques for allocating costs directly to activity centres (or business units) have been implemented in both transport and logistics communities, yet with few applications in ports. *Total Cost Analysis* (TCA) is an approach, which looks for the optimal solution within a logistics system. It does so by examining the overall impact when individual costs are varied. TCA proposes a trade-off analysis among different internal functions to minimize the total cost without compromising customer satisfaction. TCA can be extended to external logistics performance by integrating various flows and processes in the supply chain. *Activity-Based Costing* (ABC) identifies costs specifically generated by performing a service or producing a product. It proposes an evaluation of the costs of a firm's activities based on the actual resources and time consumed to perform them, and allows the causal relationships between expenses to be observed. ABC does not allocate direct or indirect costs based on volume alone, but determines which activities are responsible for these costs and burdens these activities with their respective portion of overhead costs. From a logistics perspective, both overall cost reduction and customer satisfaction should be achieved, and thus these cost methods have been coupled with other value performance indicators as shown in table 10.

There are number of other logistics metrics, but the techniques mentioned above are probably the most suitable for costing and managing cross-functional activities within a typical port setting.

Table 10: Comparative advantages and disadvantages of various value metrics

Value metric	*Advantages*	*Disadvantages*
Customer Satisfaction	Has a direct impact on the bottom line through revenues and total logistics costs Improves market share Enables alignment of services with customer needs Relatively easy to obtain Customer does the work by filling out the survey	Relies on the customer to determine if the level of satisfaction justifies paying a premium price or purchasing more from the supplier Relies on management outside of logistics to identify the impact on revenues which typically does not happen
Customer Value-Added	Based on the notion that value beyond price leads to higher sales figures, higher profit margins and higher shareholder value Relatively easy to obtain Customer does the work (survey)	Relies on the customer to determine if the level of customer value-added justifies paying a premium price or purchasing more from the supplier Fails to measure the financial impact of providing higher levels of customer value-added
Total Cost Analysis	Price and related costs are considered Managers can improve profits by reducing total cost of logistics	Does not consider revenue implications of logistics related services More time consuming Requires access to cost information Perpetuates the myth that logistics is simply a cost to be reduced
Segment Profitability Analysis	Revenue and out-of-pocket costs are considered	Does not measure the cost of assets employed with the exception of inventory and accounts receivable Need revenue and costs data by supplier. Customer may not have these data or willing to share supplier data Requires sophisticated accounting system
Strategic Profit Model	Measures net profit, ROA, return on net worth Assists managers in the evaluation of cash flows and asset utilization decisions	Fails to consider the timing of cash flows Subject to manipulation in the short run In addition to revenues and costs, assets dedicated to the relationship must be known
Shareholder Value	Recognises the time value of money and the risk of an investment Focus on cash flow overcomes the inadequacies of traditional financial measures	Implementation related concerns in the areas of discount rates, planning period, and projected cash flows (missing linkage between the business strategy and shareholder value) Most data intensive method Most time consuming and expensive to implement

Source: Adapted from Lambert & Burduroglu, 2000, Measuring and Selling the Value of Logistics, *IJLM,* 11 (1)

6.4 Integrative Framework for both Sea and Land Interface Port Efficiency

A. Mapping and design of port operations

In today's highly competitive market place, port authorities and port management teams are required to redefine their core businesses, competencies, and strategies so as to accommodate different pattern arrangements of the complex and dynamic trading and logistics systems. As discussed earlier, the integration of land interface networks could constitute an additional core mission for ports, but this requires an appropriate strategy directed towards inland transport and logistics providers. Undertaken in isolation, such strategy could be as beneficial as detrimental to ports given the risk of splitting port management and marketing between shipping services and land transport networks. The optimum solution is to integrate ports in the wider logistics and supply chain system, with equal emphasis on landside networks as on seaside links. In this way, ports could be approached as integrated logistics centres for both maritime and inland transport services. However, despite their logistics and extended supply chain potentials, a valid curriculum for port logistics and channel management is yet to be developed and successfully applied.

Figure 7 presents port managers with a framework of process mapping and relationships to accommodate all operational and management flows within and around ports. The design of the supply chain focuses on the location of decision spots and the objectives of the chain. In our case, this is done at two levels of port management. The first level corresponds to *internal logistics integration*, whereby the interactions of port functions and institutions are translated into physical and non-physical flows. Physical flows combine ship/vehicle and cargo movements across various port assets and facilities, whereas non-physical flows encompass the derived capital, payment and information flows. Ships and vehicles include all types of vehicles used in the port system such as commercial ships, tugs, cargo-handling equipment, and inland transport vehicles (trucks and lorries, trains, etc.). The second level refers to *external supply chain integration* whereby the port system is linked to the activities of supply chain partners at both seaside and landside directions. Using flow-type configurations provided in figure 7 as guidance, it is possible to design, trace, and scrutinise various functional and institutional interactions within each port and terminal, as well as across their extended supply chain networks.

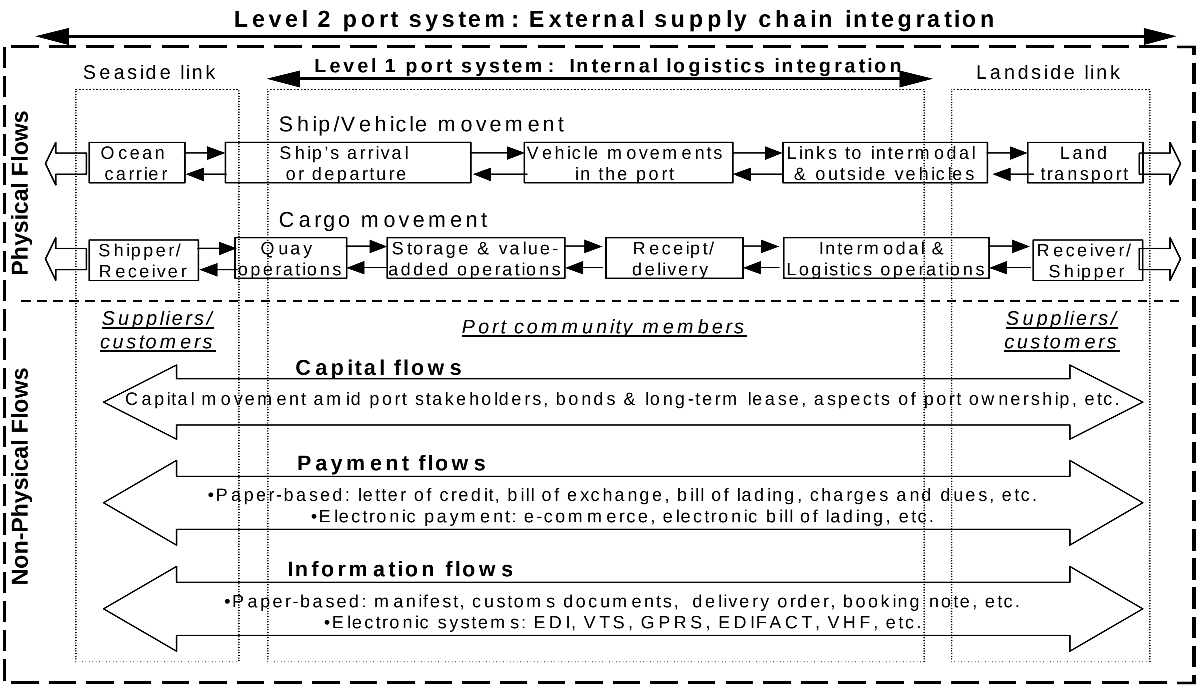


Figure 7. Process mapping and design of port internal and external systems

B. *Towards an integrated port performance analysis*

The application of ABC in ports can improve the management and control of overhead by determining the factors that actually result in the requirement for overhead resources. ABC works on a two-stage assignment procedure for assigning cost to a cost object. The first stage focuses on determining the costs of activities within the port community, or the port internal system, as designed in figure 7. The second stage traces activity costs to port products/ services consuming the work performed.

Figure 8 illustrates a typical application of ABC in a port setting. Consider, for instance, the costing of a public port warehouse working under the traditional approach of allocating costs based on total dollars or total output shipped to each customer. Port warehouse's customers (shipping lines, land transport carriers, freight forwarders, etc.) and products (container boxes, break bulk consignments, etc.) do not however consume warehouse resources (labour, machine time, fuel and electricity, etc.) proportionally to their dollar or weight volume. An

ABC view of costs at this facility would allow not only a better allocation of costs, but also a clearer identification of performance deficiencies and ways to improve them.

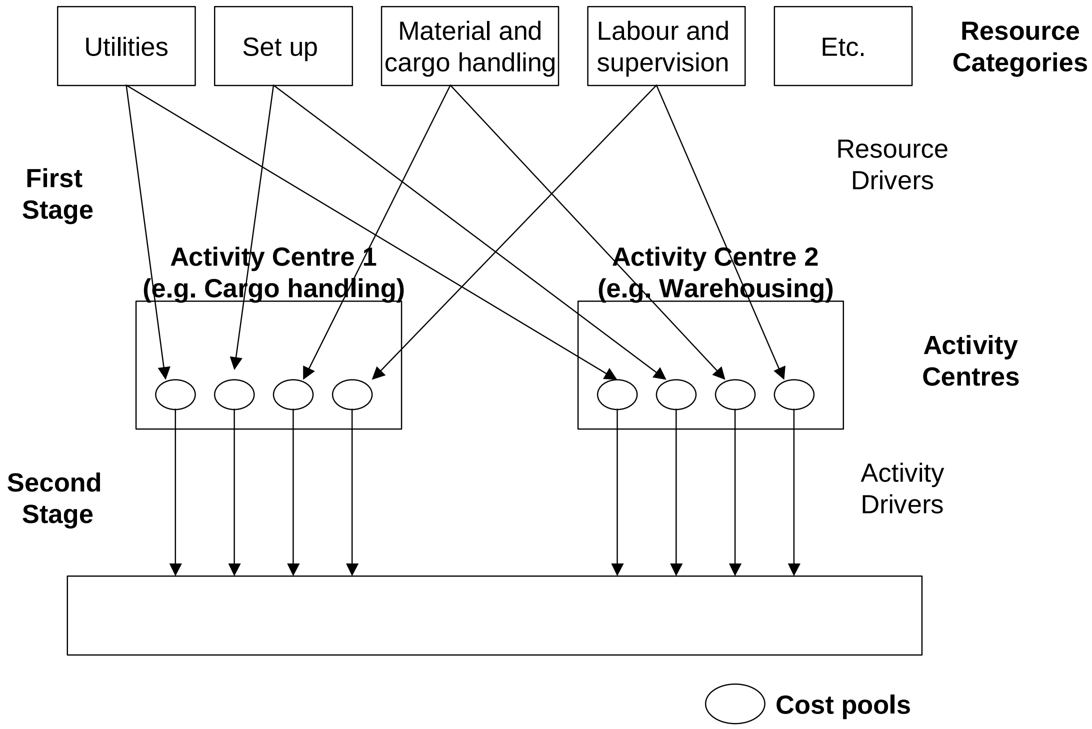


Figure 8. A simplified example of a two-stage ABC cost allocation in a port setting

Performance measures appear as a logical consequence of an ABC system. Activities' descriptions include financial information (cost, profit, etc.) and non-financial information (time, quality, etc.), where the port management can develop a set of performance indicators based on ABC results. The linkage between the activity and the performance measures provides a good indicator for computing the cost of poor or improved performance. Finally ABC supports continuous improvement by identifying where incremental improvements at the activity level can improve the overall port performance.

ABC analysis appears relevant for internal port activity operations as much as for external port channel processes, including the wide range of port customers and users. ABC can be extended across the port supply chain external system with a view to identifying opportunities to eliminate existing redundant (waste) activities within the supply chain, such as port members with excessive resource consumption patterns, or to signalling out attractive alternatives to the present channel structure.

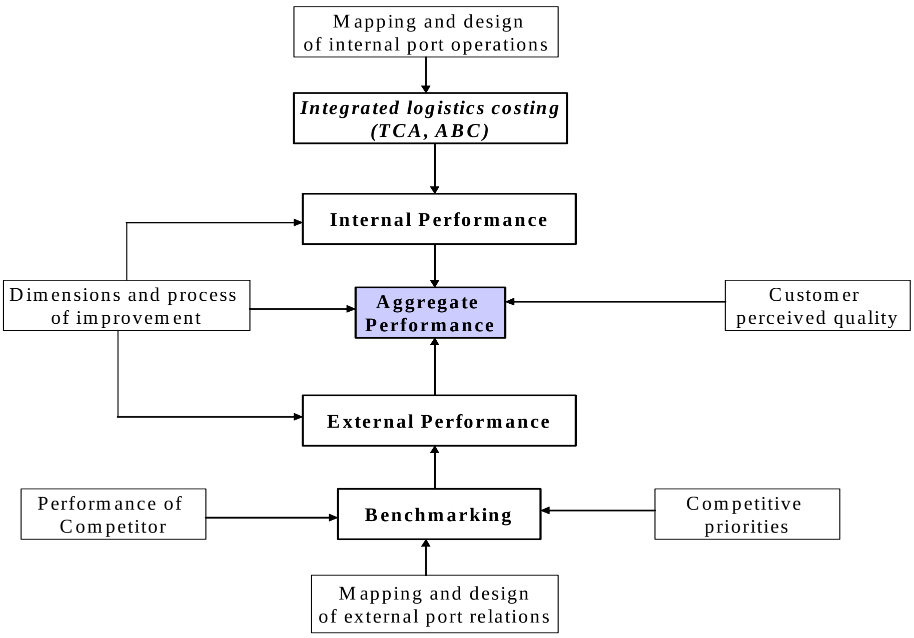
Another major weakness in conventional port management is that it hardly ever approaches its subject matter (ports) from outside sea-related arenas, so as to benefit from concepts and practices developed by other disciplines or in other areas with similar features such as airports and regional distribution centres (RDCs), which can provide an appropriate conceptual framework applicable to seaports. Benchmarking analysis is a good performance method particularly relevant to port management. The main focus in benchmarking is on practical knowledge for practitioners; either by learning from others' outstanding performances, or through creating them with others. Classifications of benchmarking found in the literature are mainly based on the type pf partner:

- ✓ *Internal benchmarking*. Comparison of performance of units or departments within one organization (e.g. between two warehouses or two container terminals within the port),
- ✓ *Competitive benchmarking*. By comparison of performance with direct product competitor, e.g. with another port, or another competing warehouse or logistics centre,
- ✓ *Process benchmarking*. Used to compare operations, work and business processes with best practice in the industry (e.g. looking at the best performance among world ports, inland terminals, and logistics centres), and
- ✓ *Generic benchmarking*. Search for the best practice irrespective of industry, e.g. ports against airports, or other similar industries.

Applying benchmarking to an integrated port system consists in (1) selecting competitive priorities in terms of value added services to port customers and users, e.g. what type of inland facility/service the port is considering to perform as a value added logistics activity, (2) selecting firms for comparison preferably both those within the port sector (competitive benchmarking with other ports, port warehouses, port intermodal facilities, etc.) and those outside the port industry, (3) collecting and gathering data and information the performances of selected firms, (4) analysing, cross-examining, and evaluating the differences in data and the causes of differences, and (5) establishing an action plan for performance improvement.

Based on a channel design and integration of port operations (as illustrated in figure 7), figure 9 provides a framework that combines logistics cost methods, such as TCA and ABC, with benchmarking analysis. The combination between internal and external performances would allow an integrated and comprehensive analysis of port efficiency across the multi-institutional and cross-functional components of the port system or community, including activity extensions at the inland interface spatial level.

Figure 9: Integrated model for port performance measurement



Source: Bichou, K.; Gray, R.: "A logistics and supply chain management approach to port performance measurement" Maritime Policy and Management (31) 2004, Issue 1, pages 47-67.

It is needless to point out the importance of integrating port performance management into overall port planning and strategy. In traditional port planning, performance indicators are pushed to the end of the process and represent only a minor step of the planning process, and thus the evaluation programme is often undertaken as an afterthought. Performance measures are derived from the port goals and objectives, and equally influence the overall planning and implementation process. Thus, port performance measures must evolve from a relatively long list of various indicators to a sophisticated performance measurement system (as illustrated in figure 9) fully integrated into the overall planning of port operations and management.

7. Strategy and Policy Issues

In today's highly competitive market place, port authorities and port management teams are required to redefine their core businesses, competencies, and strategies so as to accommodate different pattern arrangements of modern trading and logistics systems. As discussed earlier, the integration of inland networks could constitute an additional core mission for ports, but this requires an appropriate strategy directed towards inland transport and logistics providers. Undertaken in isolation, such strategy could be detrimental to ports given the risk of splitting port operation and management systems. The optimal solution is to integrate ports in the wider logistics and supply chain network, with equal emphasis on landside networks and seaside links. In this way, ports could be approached as integrated logistics centres for both maritime and inland transport services.

Regulatory and policy issues are at the cornerstone of port management, strategic and long-term planning. As far as port land interface integration is concerned, four main questions need to be answered: what are the functional boundaries of port activity? What is the spatial limit of port expansion? How can logistics requirements become integrated in long-term planning objectives?, and what types of institutional and management models are appropriate for extended port functional and spatial systems?

7.1 Overview of functional, spatial, and organizational attributes of ports

Port functions can be limited to simple berthing facilities, ship/shore or intermodal interfaces, or extended to trade, logistics and production centres. Operational and management features also vary with the type of cargo or ship operated and the extent of services offered. In a typical port setting, there is an extensive portfolio of operations extending across production, trade and service industries, which renders particularly difficult any attempt to consolidate port roles and functions under the same operational, business or market category.

Institutional dissimilarity also hinders a comprehensive approach to ports, as there are several institutional and ownership models applicable to world ports, even between those performing similar roles and functions. A port can provide the function of a stevedoring company, a terminal operator, a logistics provider, or just a cluster of different actors and operators. Historically, ports were both owned and managed by public entities, mainly through port authorities, which performed most functions including navigation, infrastructure/ superstructure development, ship and cargo operations and management. Today the organization of most world ports lies somewhere between purely private ports and totally public ports. Typically, one or a variation of private/public combinations would be obtained starting from totally private form of organization to the purely public administrative form, e.g. private company, semi-public company, municipal or regional authority, port national office, public administration, etc.

A more elaborated approach analyses port ownership through combining the aspects of port facilities and services with the status (i.e. private, public or joint/mixed) of the entity owning and/or providing for them. Here the literature provides new generic terms where ports are classified into service, tool/operating and landlord institutions. The main difference between the three models refers back to the aspects of infrastructure/superstructure ownership and management as well as port labour/manpower affiliation. In the service model, the port owns, maintains and develops both infrastructures and superstructures, operates all handling equipment and performs on its own all other commercial port functions. Both the landlord and tool organizations own and develop port infrastructure and generally lease it to the private sector. However, while the superstructure is owned and operated by private operators in the landlord model, the tool institution still owns the superstructure but may lease it for operational purposes to private companies. This distinction is however not always obvious. Some ports may restrict superstructure assets to cargo handling equipment, while others extend such facilities to warehousing and logistics services. The same applies to manpower employment where in many tool models private companies are required to rely on port labour force. The appropriate organization for ports has been one of the most debatable issues in port operations, management and policy. There is no standard model for port ownership and institutional structuring, and one can find many styles of organizational structure throughout the ports of the world. Port organization also varies in time, and what was previously an ideal-typical model of port ownership can later prove to be outdated and inefficient.

Despite the variety of approaches, no authoritative definition of port missions, functions, institutional, organizational, and even spatial management exists. At one end of the scale port functions are identified by spatial dimensions, e.g. from ship/shore interfaces to logistics and production centres. At the other end of the scale, the functions of a port are defined by the extent of its economic and social missions and impacts. Similarly, port ownership and organizational models tend to be a combination of three variants: the extent of public/private involvement, the mode of governance (from centralized to decentralized), and the scope of port facilities, assets and services.

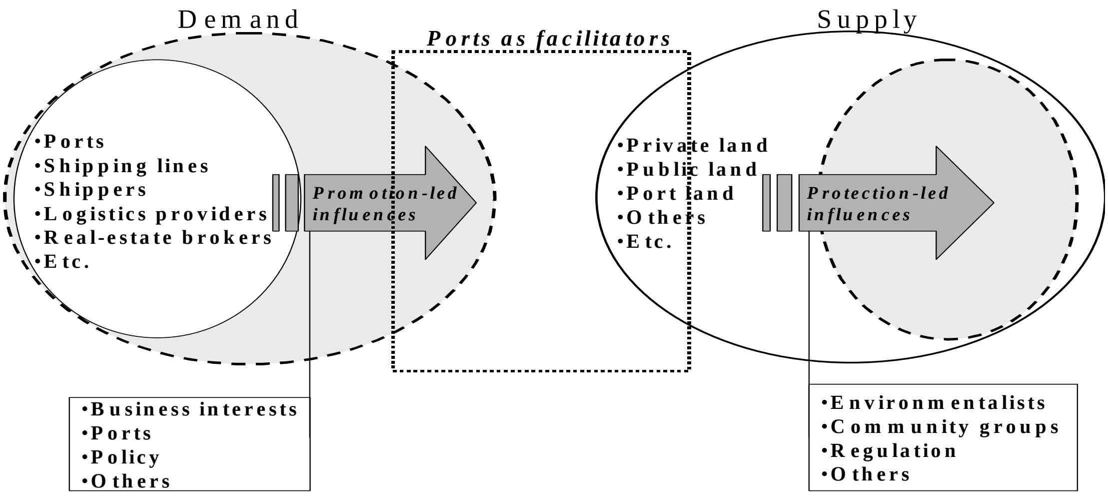
7.2 Policy initiatives for port land interface integration

Although there is no established framework for port spatial or functional expansion, many ports in the world may find their development plans and strategies still restricted by regulatory, spatial or even competitive constraints. Sometimes, ports have sizeable land capacity, but cannot develop it to undertake other non-shipping related activities. On the other hand, if ports are allowed to expand freely beyond their traditional functional or spatial bases, there is no guarantee that they might shift their operations to more lucrative businesses such as real estate property development or leisure/tourism services. Evidences of this can already be found in many ports in the world, particularly those operating in a fully deregulated environment. The aim is to provide a framework that balances between the need of ports to expand, and the requirement upon them to provide facilities and services to the shipping industry. In this context, one can assume that ports might perform non-sea related functions as long as their core business is related to ships and ship-cargo services.

Unlike strategies for sea and nautical developments, port landside development plans are likely to have further implications on land transport systems, urban and spatial planning, land use, and environmental standards, with the likely involvement of politicians along with other economic and community interests including ports and port authorities themselves. Variations between restrictive, protective, and promotion-led port policies will largely shape the nature and dimension of port land interface development and planning. In addition, planned facilities are likely to be managed, operated, and even built and developed by the private sector. In this context, port authorities are better positioned to act as facilitators through creating a platform in which port authorities are working together with various stakeholders to identify and address issues affecting inland expansion, distribution planning and management. Figure 10 portrays various interactions between different market players for dedicated warehousing and distribution land uses in ports, and illustrates the role of ports as facilitators.

Nevertheless, port authorities may need to become more proactive and play an important role as marketers and promoters in the development of inland freight distribution and related-supporting systems such as logistics networks and IT capabilities. This may provide ports and port authorities with an advantage in the design and control of channel flows for inland transport and freight distribution systems. The institutional framework should also follow a channel orientation — as described above — because (1) many of traditional sea-interface users may become potential customers for inland facilities, e.g. shipping lines as logistics providers, and (2) new actors will enter the inland market, e.g. logistics property brokers, with a view to achieve high return on investment instead of providing 'public interest' as traced by the port policy maker. By integrating various stackholders (or channel members), cost benefit and stackholder analyses should provide for a balance between the interest of ports and that of other businesses and communities.[1]

Figure 10: Actors and the port role in the system of inland port expansion



Because of a variety of conflicting standpoints (economists, politicians, urban planners, environmentalists, private companies, etc.), as well as the wide-ranging implications of landside spatial expansion of ports, the port management must carefully plan its land-interface integration at both strategic and operational levels. At strategic levels, ports need to take into consideration the economic, political, legal, and social environments under which they plan and implement these integration strategies. Of paramount importance is the adaptability of exiting regulations and their ability to either promote or refrain land-interface expansion. At operational levels, ports must ensure optimal land utilization; on-time project completion and efficient facility operation in-line with the specific needs of inland transport operators and logistics providers.

1 The failure to identify and integrate various stackholders in a CBA study may lead to unexpected results. See the latest decision on the development of the Dibden terminal at the port of Southampton in the UK.

The time of projects' completion and the nature of market fluctuations also shape the determinants and level of decision-making. At the sea-land interface, the long lead-time for new port construction and equipment installations has always meant that short-term matching of the supply of port facilities to the expected demand is difficult to achieve, especially with the recurrent changes in international trade and logistics systems. At the land-shore interface, port planning and strategy can be undertaken in a different way, given the short lead-time for land projects and the relatively stable and predictable demand at the inland interface.

8. Conclusion

Port land interface operations and management represents a new phase in the development of port systems, which have traditionally focused on the sea access. Strategies of land interface integration can be perceived in two folds: the first is targeting inland transport operators and logistics providers, while the second is aiming at expanding the functional and spatial attributes of ports beyond traditional port land territory.

Throughout this paper, we demonstrated that neither strategy could be undertaken in isolation (1) from each other and (2) from the integrated logistics and supply chain system. An integrated framework for port operations and management, including for the inland interface was proposed and tested against traditional approaches, often fragmented and biased towards the sea-interface. In so doing, ports could develop appropriate strategies and policy initiatives that consolidate their position as central platforms for the interactions of logistics, trading, and supply channels.

Ports from developing countries may have structural disadvantages preventing them from providing world-class services. Nevertheless, the structural changes taking place in international logistics and distribution could benefit these ports, particularly if they act proactively towards integrating and successfully monitoring inland distribution networks and facilities.