Chapter 18. Ports

Group of Experts: Alan Simcock (Lead member)

1. Introduction

Ports are the nodes of the world's maritime transport system. Every voyage of a ship must begin and end at a port. Their size and distribution will therefore both reflect and contribute to the pattern of maritime transport described in Chapter 17 (Shipping). Since the maritime transport system is part of a much larger global transport system, including road, rail, river and canal transport and the interchanges between all the modes, the factors that determine the location and growth (and decline) of ports are manifold, and go well beyond an assessment of the marine environment. These non-marine factors (such as land and river transport connections, location of population and industry and size of domestic markets) will determine, to a large extent, the development of ports and, therefore, the way in which they affect the marine environment. Nodes, however, can become

Dry bulk traffic covers the five major bulk trades (

example, between 2008, when grain trading was deregulated in Australia, and 2013, the country's containerized wheat export shipments increased tenfold (UNCTAD, 2013).

The world's busiest container port is Shanghai in China, with 33.62 million TEU movements in 2013. Table 1 sets out the numbers of container movements for each of the further five container ports with the heaviest traffic. Outside these areas, there are of course other very large and busy ports – for example (with millions of TEU movements in 2013): Los Angeles, California, USA (7.87), Long Beach, California, USA (6.73) and New York/New Jersey, USA (5.47). In total, the world's 50 busiest container ports in 2013 were spread as follows:

(a) Twenty-four in the west Pacific (ten in China; three in Japan; two each in Indonesia and Malaysia; and one each in Hong Kong, China, the Philippines, the Republic of Korea, Singapore, Taiwan Province of China, Thailand and Viet Nam);

(b) Four in the eastern Pacific (two in the United States of America and one each in [illegible]

PORT	COUNTRY	TEU MOVEMENTS 2013 (MILLIONS)
Hampton Roads (Newport News, Norfolk, Virginia Beach)*	United States	2.22

groupings of ports around the world. Some of these groupings have sprung from a successful operator of a specific port: the Port of Singapore Authority is the leading example of this type of development, with interests in 25 terminals around the world. Others have sprung from major shipping lines: APM Terminals is controlled by the major Danish maritime shipping enterprise A P Møller Mærsk, and has interests in 71 ports around the world. Another starting point for assembling a chain of ports has been sovereign wealth funds: for example, Dubai Ports World has interests in more than 65 terminals around the world. The final major type of port grouping is represented by Hutchison Port Holdings, part of the Hutchison Whampoa group, which developed from a dock-operating company in Hong Kong; it has interests in 52 ports. These four groups alone therefore have major interests in over 200 ports worldwide. There are a number of smaller similar chains, largely with a regional focus: these include SSA Marine in North America and Eurogate in Europe (privately-owned companies), Hanjin and Evergreen (linked to ocean carriers) and Ports America (owned by financial holding companies) (Rodrigue, 2010). In many countries, however, ports remain under the control of government agencies or chambers of commerce, or are independent public agencies;

(c) The larger sizes of ships have intensified the pressures to handle them in port in the shortest possible time. Ship owners want their capital to be earning money on voyages as much as possible, and therefore dislike the ships being tied up in port – or, even more, waiting at sea until they can get into a port berth. This, coupled with the more stringent requirements arising from growing trade volumes, global value chains, increasingly time-sensitive trade and lean supply chains, has led to increased competition between ports, intensified the pressure on ports to service ships and handle their cargo the shortest possible time and produced an intense focus on the efficiency of ports.

One important aspect of the economics of port operation is security against theft and disruption. In 2002, the International Maritime Organization adopted a new chapter in the International Convention on the Safety of Life at Sea (SOLAS) and promulgated the International Ship and Port Facility Security (ISPS) Code to improve ship and port security. This is supported by the joint IMO/International Labour Organization code of practice on security in ports. These instruments provide a consistent baseline worldwide, by clarifying the desirable division of responsibilities for issues such as access control, cargo and ship stores control, and facility monitoring to prevent unauthorized persons and materials from gaining access to the port. The ISPS Code came into force in 2004. Gaps still remain in some areas to implement these arrangements (IMO, 2015).

3.1 Efficiency

In 2012, the Organization for Economic Cooperation and Development (OECD) published a study on port efficiency that it had commissioned (Merk and Dang, 2012). This study sought to compare the efficiency of ports around the world, in the different fields of containers, grain, iron ore and oil, looking at proxies for the inputs of each type of port to the handling of cargoes and the throughput achieved, measured in terms of the dead-weight tonnage (dwt) passing through the port. For container ports, the study concluded that, with the exception of Rotterdam in the Netherlands, the most efficient ports were mostly located in Asia. The most efficient container ports were not necessarily the largest ports. Among most efficient ports are some of the largest global container ports (for example, Hong Kong, China; Singapore; and Shenzhen and Shanghai in China) (handling from 20 to 60 million dwt per port per month), but also medium to small size ports. For bulk oil ports, it concluded that, with the exception of Galveston, Texas, in the United States and (again) Rotterdam in the Netherlands, the most efficient oil ports are mostly located in the ROPME/RECOFI area[1], but not all ports in that region are operating efficiently. In this case, size does matter: the most efficient terminals are largely those with the largest throughput. In the case of bulk coal ports, the study concluded that a group of coal ports in Australia and China were clearly more efficient than nearly all the rest of the sample, although Velsen/IJmuiden in the Netherlands, Banjamarsin in India and Puerto Bolivar in Colombia were equally good. In the case of iron-ore and grain ports, the study concluded that, in both cases, larger ports were more efficient. It also concluded that, for grain ports, the least efficient terminals tend to be found in developed OECD countries. It should be noted, however, that the methodology of the study inevitably tends to rate a port as less efficient if, for historical reasons, its past investment has provided more facilities than is required for current levels of traffic.

It is instructive to compare the results of this study with the ranking published by the World Bank of the quality of the infrastructure of ports in different countries. This is based on a questionnaire to members of the World Economic Forum, which has been running for some 30 years. Recent rounds of the survey have included around 13,000 respondents from around 130

A parallel situation arises in the seaward direction, where there is often a need for dredging to maintain the access channels. In some countries, port operators have pressed governments to fund all or part of the costs of deepening and widening navigation channels, since they find themselves faced with competition from neighbouring ports which have natural deep-water harbours.

3.3 Landlocked countries

Because of the large proportion of international trade that is transported by sea (see Chapter 17 – Shipping), landlocked countries have particular difficulties from their lack of seaports. The 31 landlocked developing countries (LLDCs), 16 of which are among the least-developed countries (LDCs), face serious challenges to their growth and development, derived in substantial part from their problems in accessing maritime transport. In general, LLDCs face a 45 per cent higher ratio of freight charges to total value of exports and imports than the average of the developing countries through which their exports and imports must transit (LLDCs, 2011). This is a further aspect of

For this reason, the regional memorandums of understanding on port-state control have an important role in managing the impact of ports on the marine environment. Other effects, such as the turbidity caused by ships' propellers disturbing sediments, are more site-specific, and can to some extent be controlled by port navigation rules. Nevertheless, such turbidity (and the subsequent re-settlement of sediment) can have adverse impacts on sensitive habitats, such as corals and sea-grass beds (Jones, 2011).

In all these cases, port authorities and port operators have some important roles to play in managing the impacts of ships. Adequate waste-reception (and especially for cruise ships) sewage-reception facilities are important for preventing marine debris and eutrophication problems. Likewise, adequate land-based electricity supplies ("cold ironing") for ships that need to run equipment while in port (especially refrigerator ships) are essential to reduce air pollution, since otherwise they must run the ships' generators while they are in port.

The IMO has set up a system whereby ships' operators can report inadequacies in port reception facilities. This can be found at https://gisis.imo.org/Public/PRF/ReportedCases.aspx. It enables ships to report the problems that they have encountered and port authorities to offer (if they wish) explanations for such shortcomings and information on steps that are being taken to resolve them. Since the beginning of 2005, 279 inadequacies have been reported. States have responded in only 76 cases (although there are several where the port State had not been notified).

4.2 Coastal space

The demand for coastal space in ports is tied up with the growth in container traffic. Space is needed next to the berths for the containers to be off-loaded. In step with the development of container traffic, there has therefore been a substantial growth in the land needed for container ports. Rodrigue (2010, in figure 3) shows the current scale of coastal space occupied by container ports. These are particularly demanding of coastal space because they have to have level space to hold the containers until they can be forwarded into the hinterland: bulk cargoes are normally transferred directly to less space-demanding storage.

Further growth in port throughput will inevitably result in further demand for container storage space at ports. This demand is rarely going to be able to be met from land that is not part of the coast, because around most ports this land is already committed to other forms of development (such as housing or industry) which are also essential for the growth of the port. As discussed in Chapter 26 (Land/sea physical interaction), this demand has therefore often been met by land reclamation – often from mangroves or salt marshes (for the pressures on which see Chapters 48 (Mangroves) and 49 (Salt marshes). These pressures are likely to continue. There is therefore a need for further investigation on how ports can handle increasing numbers of containers without increasing their demands for coastal space.

4.3 Deep water

The third pressure generated by ports is for deep water access channels. This normally means that dredging is used to deepen and widen the channels through sedimentary deposits, although in some cases it can involve blasting a channel thouDredging(d-09.9(60(40wet92d)-40(g)2i ge-.1rvee-.1(s)12( )]TJ0.005 Tc 01439 Tw 0.870 -1.22 0.yd(m)4(a)4(y)8(

6. Information and capacity-building gaps

6.1 Knowledge gaps

Since ports constitute a significant economic sector, much information is available about them and their operations. What seems to be lacking is systematic information bringing together worldwide the operational aspects of ports and their impacts on the local marine environment, and their contribution to economic activity.

6.2 Capacity-building

Since the operation of a port can significantly affect both the successful operation of ships and the economic performance of the countries it serves, some ports need capacity-building in the operational skills needed for successful port operation. This is particularly important for ports that are serving as transit ports for landlocked countries, since the landlocked countries rely on the quality of port management in the transit country or countries, and are not in a position to insist on improvements.

It is important to develop (and then maintain) the capacities of port States both to

References

Baosteel (2008). Baosteel Bought Shares of Zhanjiang Port Group, http://www.baosteel.com/group_en/contents/2863/38876.html (accessed 16 June 2014).

Brodie, J. (2014). Dredging the Great Barrier Reef: Use and misuse of science. Estuarine, Coastal and Shelf Science 142.

DfT (United Kingdom Department for Transport) (2014). UK Port Freight Statistics 2013. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/347745/port-freight-statistics-2013.pdf (accessed 20 October 2014).

Donaldson of Lymington, Lord (1994). Cleaner Seas, Safer Ships: Report of Lord Donaldson's Inquiry into the Prevention of Pollution from Merchant Shipping, Her Majesty's Stationery Office, London (ISBN 978-0101256025).

Erftemeijer, P.L.A., Lewis III, R.R.R. (2006). Environmental impacts of dredging on seagrasses: A review. Marine Pollution Bulletin 52.

EU (European Union) (2000). Directive on port reception facilities (Directive 2000/59/EC).

Haralambides, H.E. (2002). Competition, Excess Capacity, and the Pricing of Port Infrastructure, International Journal of Maritime Economics, Vol. 4 (4).

ILO (International Labour Organization) (2002). General Survey of the reports concerning the Dock Work Convention (No. 137) and Recommendation (No. 145), 1973. (ISBN 92-2-112420-7).

IMO (International Maritime Organization) (2015). The International Ship and Port Facility Security Code (ISPS Code) (http://www.imo.org/OurWork/Security/Instruments/Pages/ISPSCode.aspx accessed 20 April 2015).

Jones, R.J. (2011). Environmental Effects of the Cruise Tourism Boom: Sediment Resuspension from Cruise Ships and the Possible Effects of Increased Turbidity and Sediment Deposition on Corals (Bermuda). Bulletin of Marine Science, Volume 87, Number 3, 2011.

LLDCs (Group of Landlocked developing Countries) (2011). Position Paper on the draft outcome document for UNCTAD XIII, Geneva (UNCTAD Document TD/450).

Merk, O., Dang, T.T. (2012). Efficiency of World Ports in Container and Bulk Cargo

Notteboom, T., Parola, F. and Satta, G. (2014). Progress Report on EU Research Project: Synthesis of the information regarding the container transshipment volumes (http://www.portopia.eu/wp-content/uploads/2015/01/Transshipment.pdf accessed on 20 April 2015).

Pattiaratchi, C.B., Harris, P.T. (2002). Hydrodynamic and sand transport controls on en echelon sandbank formation: an example from Moreton Bay, eastern Australia. Journal of Marine Research 53.

Rodrigue, J. (2010). Maritime Transportation: Drivers for the Shipping and Port Industries, in In