

CONTAINER PORTS IN DEVELOPING COUNTRIES
BARRIERS TO PARTICIPATION IN THE GLOBAL ECONOMY

By William Tricot Laventhal

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and Professor Thomas H. Wakeman III
and approved by

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Dissertation Directors: Richard Langhorne and Thomas H. Wakeman III

ABSTRACT

This dissertation investigates whether organizational and technological changes in the global economy, the port and maritime industry, and infrastructure financing have created port development barriers for developing countries on the global periphery. The restructuring of the international economy and development of global supply chains has altered both the routes and manner in which goods are traded. The port infrastructure that connects economies to the system of global trade has changed significantly in response to containerization of manufactured trade. The financing of port development has also evolved as governments have transferred investment responsibilities to the private sector. This dissertation proposes that changes in the global economy, maritime industry, and port financing models have created barriers to port development for countries on the global periphery. Port development barriers can have a significant impact on these countries' economic development. This research examines potential solutions for overcoming port development barriers, and also discusses some future trends that may shape the port development patterns and the overall global economy in the future.

DISSERTATION COMMITTEE

Richard Langhorne

Professor, Division of Global Affairs

Rutgers University – Newark

Thomas H. Wakeman III

Deputy Director, Center for Maritime Systems

Stevens Institute of Technology

Gabriella Kütting

Associate Professor, Division of Global Affairs

Rutgers University – Newark

Yale Ferguson

Professorial Fellow, Division of Global Affairs

Rutgers University – Newark

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CHAPTER 1: INTRODUCTION

The development of global supply chains has enabled multinational production to dominate the global economy. A hierarchy of production has emerged with supply chains being comprised of high-value and skills goods (producer-driven networks) and low cost and skills goods (buyer-driven networks). Developing countries are most likely to participate in the global economy by producing goods within buyer-driven networks. Because these goods require less skilled workers and compete primarily on price, competition is strong between international production sites. Multinational corporations shape global supply chains by selecting countries that can be competitive suppliers. Countries might only produce one piece of the final good. These intermediate goods are transported to various countries for further processing and eventual finishing. Because of the complexity of these production networks, some of the key attributes for participating are flexibility and reliability. This cannot be achieved, however, at the expense of speed and low costs.

The quality of infrastructure is a major factor in multinational firms' location choice (Wheeler and Mody 1992). Transportation infrastructure is one important component of infrastructure and serves as a link between international production sites. While improvements in the shipping industry have reduced the per unit cost of transporting goods, the increase in length of the typical supply chain has meant that overall transport costs have not necessarily decreased (Pedersen 2001).

Lowering transportation costs has been a focus for policy makers around the globe. The European Union has looked to develop infrastructure in a way that improves economic

efficiency for the entire continent while also bringing opportunities for economic growth in the less wealthy peripheral regions (van Klink and van den Berg 1998). Areas on the margins (both geographically and economically) are especially vulnerable to high transportation costs.

Most of the world's trade travels by sea. One of the most important infrastructural components is the port that serves as an international gateway. Global ports have always been assessed by the cost of their services, but now have to include flexibility and reliability in order to satisfy the demands of global supply chains. Ports that do not function seamlessly with the requirements of international production networks are likely to have an adverse impact on the economic development prospects of the port's hinterland (market area). In the case of small developing countries, this may have strong national implications. The substitutability of goods in buyer-driven networks means that developing countries in the early stages of manufacturing development face severe penalties for poorly functioning ports.

Since the late 1950's, the increased use of containers for international maritime trade has prompted ports to allocate greater resources to container-handling functions. Specialized container terminals at ports have emerged as the most successful model for profitable port development. The scale and cost of these container terminals are significantly higher than previous cargo-handling terminals.

In conjunction with the technological changes brought about by containerization, a reorganization of the port industry took place at an institutional level. Until the 1980's, ports had been owned and operated, with few exceptions, by government entities (port

authorities). During the 1990's, governments throughout the world looked to turn over responsibilities to the private sector, including those related to port infrastructure. At the same time, changes in the logistics industry encouraged private firms to pursue greater control over the supply chain and all of its parts. As government's role receded, the private sector took its place as port operators, developers, and ultimately owners. In some cases, the private sector's arrival brought more financial and managerial resources, but it also changed how the benefits of port infrastructure were measured. Shareholder returns took precedence over the public good, and the time expectation for return on investment was significantly shortened.

The combination of international economic change and technological transformation of the shipping industry has had an impact on port development. Numerous models of port development have been proposed since the 1960's. Some have been generic and applicable to all countries while others have focused on developing countries and regions.

In light of the changes described in the preceding paragraphs, this research asks the following question: Have the changes in the global economy, as well as the maritime and port industry, created barriers for container port development in developing countries on the periphery? It is proposed that poor countries in the southern hemisphere are especially disadvantaged with regards to port development.

This dissertation considers three specific contributors to the barrier. Location has an influence on port development because of the existing dominant trade routes along an East-West axis between Asia, Europe, and North America. Economies of scale in ship and port size are generated by large consumer markets and established manufacturing

sectors. Accumulated public investment from decades or centuries of previous port investment have given existing leading ports an advantage that allows them to achieve lower costs that are unreachable for smaller ports in developing countries.

These barriers to port development can have an impact on port development as fewer large ports are needed. Existing patterns point to fewer ports handling an increased amount of container traffic. To overcome these barriers, developing countries might seek foreign investment in ports, but private involvement can lead to monopolistic behavior in container terminal management. The resulting high port costs may be just as harmful to the country's economy.

To overcome barriers to port development, developing regions could implement policies to encourage the development of regional feeder networks that use a designated hub port to capture economies of scale. Alternatively, regional cooperation and integration can expand market size and facilitate container port development. In addition to providing financial resources, international organizations may play a role in cooperative efforts that disseminate knowledge, best management practices, or assist in developing complementary transportation policies.

There are some current developments that may enable developing countries to participate in containerized trade without requiring large investments or policy attention. One example is the increased containerization of agricultural products. This would spur improvements in container-handling capabilities and help build the needed infrastructure for an eventual development of a multinational manufacturing sector. Speculation about the future, however, needs to be done with an acknowledgement that looming

environmental issues, political and security instability, and an increasingly competitive global logistics industry will continue to reshape the maritime industry.

Chapter 2 is a brief review of relevant existing literature. Chapter 3 discusses the changes in the global economy and logistics industry that have occurred in the past fifty years. International trade flows, trade routes, shipping lines, and the top container ports are described in Chapter 4. In Chapter 5, the introduction of containers and its impact on ports is discussed. Chapter 6 contrasts the aims of public financing of port development with those of private financing and notes the various forms of public and private participation. Port development models and a brief history of the evolution of ports around the world are presented in Chapter 7. Barriers to port development and a framework to analyze them are explained in Chapter 9. Chapter 9 notes some general implications for developing countries and explores the case of Sub-Saharan Africa in greater detail. In Chapter 10, three broad proposals are put forth as a means to overcoming barriers to port development. Chapter 11 includes some general conclusions and recommends a few avenues for future research. The afterword contains some comments on the current global economy and how it will impact the arguments and conclusions contained in this work.

CHAPTER 2: LITERATURE REVIEW

Three main areas of research form the backbone of the planned research. The emergence of global production networks using maritime transportation, changing port development patterns, and the increased role of the private sector in port infrastructure investment are topics that have generated considerable amounts of research. Their intersection in the global economy and their impact on countries on the periphery is the focus of this work.

Global Production Networks

The modern global economy, while experiencing rapid change in the last decades, is the outcome of centuries of evolution. Chase-Dunn, Kawano, and Brewer (2000) trace the specific issue of trade and economic integration since 1795, noting multiple waves of globalization and the reasons for the fluctuations. The 20th century economy is studied more closely by Dicken (2002), who notes the concentration of trade and financial flows between East Asia, Western Europe, and North America.

Feenstra (1998) investigates how trade liberalization has allowed for the emergence of global production networks. The price of inputs and wages shaped and continues to shape the decisions of multinational firms in organizing their production processes. Hummels, Ishii, and Yi (2001) address the issue of vertical specialization involving different countries participating in the supply chain at various steps in the production process. The characteristics of these supply chains, the technological enablers, and the management

structures are detailed in Ernst and Kim (2002). Global production networks are not, however, identical across all types of products. The distinctions between producer-driven networks and buyer-driven networks are emphasized by Dicken (2003) in his work on the global economy in the 21st century.

The lengthening of supply chains and geographic diversity of global production network participants might suggest that distance and peripheral status are less of a hindrance to integration into the world economy. Rietveld and Vickerman (2004) refute this point by noting that although transportation costs have in fact decreased in the past few decades, their importance remains high. Hesse and Rodrigue (2004) emphasize that factors such as time and flexibility play an important role in global production networks as consumer demand constantly reshapes the international economy.

Port Development

With global production networks incorporating an increasing number of countries, the importance of ports as transit facilities for both intermediate and final goods has grown. The changing function of ports – from places through which goods transit to critical elements of a supply chain – is highlighted by Robinson (2002) in his work on “ports as elements in value-driven chain systems.” Limão and Venables (2001) assess the impact of infrastructure on trade flows and find that developing countries are particularly affected by poor infrastructure.

The extensive work by Levinson (2006) on the history of the shipping container provides a detailed look at the transformation of maritime freight handling. The author also chronicles the growth in the size of ships, as well as the fundamental reorganization of terminals – both in their physical assets and their locations. A comprehensive report by the World Bank (2003) – the Port Reform Toolkit – details the changing conditions and trajectories of port development. Looking at successful examples of port development such as those in East Asia (Frémont and Ducruet 2005; Yap, Lam, and Notteboom 2006) provides an assessment of the necessary port infrastructure to successfully compete in the global economy. In contrast, authors such as Hoyle (1999) and Sánchez and Wilmsmeier (2005) examine port development from a developing country perspective in the cases of Kenya and Central America, noting the lack of sufficient transportation infrastructure.

Port development does not occur in isolation from the national or regional transportation system. Notteboom and Rodrigue (2005) write that the space within which a port competes has changed as freight distribution patterns evolve and hinterland connectivity take on greater importance. The issue of freight volume is also relevant, and authors such as Bärthel and Woxenius (2004) address the how intermodal transport depends on large flows for greatest efficiency. In their work on the port system in the western Mediterranean, Gouvernal, Debie, and Slack (2005) place considerable emphasis on geographic location as a determinant of port development. McCalla, Slack, and Comtois (2005) perform a similar exercise in their research on the Caribbean basin.

Port Financing

At the same time as the multinational production and containerized trade has transformed the global economy, the role of the public sector in port infrastructure receded. Early work by Slack (1993) or more recent scholarship such as Notteboom and Winkelmanns (2001) document the erosion of the public monopoly as transportation and logistics evolved in the 1990's. Cullinane and Song (2002) analyze port privatization measures, concluding that they constitute only a "partial cure" for improving port operations. Broader analysis of private participation in infrastructure has also been undertaken, including Ramamurti and Doh (2004) who look at foreign investment in infrastructure in developing countries.

From a port terminal operator perspective, Slack and Frémont (2005) look at industry trends and conclude that participation of shipping lines in terminal operations has altered the maritime transportation industry. Notteboom (2002) addresses these issues as well when evaluating the potential monopolistic behavior in the container-handling industry. Building on these ideas further, De Langen and Pallis (2007) directly address the issue of entry barriers in seaports and provide a helpful framework for this dissertation's discussion of impediments to participating in the global economy.

CHAPTER 3: GLOBAL ECONOMY

The aim of this chapter is to emphasize how changes in the global economy have created opportunities for developing countries to participate in world trade, provided they have the necessary tools and conditions. World trade has grown tremendously in recent decades but not all countries and regions have benefitted. Fundamental economic principles suggest that development can be based on manufacturing. In a globalized world, manufacturing is directly linked to international production and trade. Supply chains connect consumers and producers and seek out the most competitive environments. Flexible, efficient, and reliable transportation is essential for participating in global supply chains. Therefore, to assess the development prospects of countries on the margins of the global economy, one must properly understand the conditions under which manufacturing can take place. Although there are many determinants of economic development, the subsequent chapters of this dissertation focus on the maritime transportation elements required to take part in the global economy.

This chapter begins with an overview of the evolution of global trade and provides an explanation of why it would be beneficial for developing countries to increase their exports. It examines the reorganization of the global economy into a system of multinational production linked by international supply chains. It concludes with an analysis of the key characteristics required for companies and countries to participate competitively as parts of the supply chain.

The Rise of Global Trade

In recent decades, the importance of traded manufactured goods in the world economy has grown dramatically. Manufacturing production and trade has been an important driver of the global economy in the past 50 years (Dicken 2003). The trade of merchandise as a percentage of global GDP has grown from 18% in 1960 to 50% in 2006 (World Bank 2008). The trend has accelerated since 1994, when merchandise trade represented only 32% of global GDP.

The increase in trade that has been associated with the recent wave of globalization in the 1990's is unlike increases of the past. In some instances, trade patterns were shaped by historical interaction. Countries with colonial relationships engaged in trade that resulted in a core-periphery organization of their economies. Industrialized countries in the core acquired natural resources and foodstuffs while exporting manufactured products to the periphery. In other cases, countries without colonial ties traded with other countries that could provide finished goods at the lowest cost. Early trade between the US and Asia resulted from countries' abilities to serve the American market more cheaply than US producers. These same links held for other parts of the world, with the sourcing of finished products coming from a variety of countries with low-cost manufacturing sectors.

The growth of trade relative to global GDP in the 1990's took place in a decade in which the prevalence of capitalism was reinforced (Chase-Dunn, Kawano, and Brewer 2000).

Without competing economic models, trade policies were heavily influenced by free market approaches. The result was a series of bilateral, regional, and multilateral free trade agreements that opened markets and lowered trade barriers. Trade liberalization stimulated trade growth and contributed to a more interconnected global economy (Sachs and Warner 1995).

Participation in the global economy has been uneven. A substantial amount of manufacturing has been concentrated in a relatively small number of countries (Dicken 2003). North America, Europe, and Japan dominated the 1980's. China's rise in the 1990's did little to alter the North America-EU-Asia triad. While many Asian countries (including India) developed their economies, others were left out. This was especially the case in Sub-Saharan Africa and parts of Latin America. The countries on the margins did not enjoy the benefits of global economic growth. They remain on the periphery, both economically and geographically.

Table 1 – Exports of Goods and Services – Developing Economies – Millions of US \$

	1995	2000	2005
Africa	145,469	197,229	353,021
America	287,922	437,173	671,233
Asia	1,286,589	1,803,797	3,368,939
Oceania	5,630	4,521	6,640

Source – UNCTAD 2008

The value of exports from developing countries is presented in Table 1. There was growth in all regions between 1995 and 2005. Asia's higher level of participation is evidenced by the fact that the value of its exports exceeds those of Africa, America, and Oceania combined. Growth in Africa and Latin America was significant during this period, but their level of exports remains small compared to developing Asian countries.

Understanding why certain countries and regions have not prospered is complicated because the path to economic development is not always straightforward. On one hand, countries such as Ireland and India have seen growth fueled by their participation in the trade of services. This approach involves skilled labor – something that is in shortage in many African and Latin American countries. The more traditional approach, however, involves an evolution of a country's economy through different stages of development – each leveraging its comparative advantage. Starting with the exports of primary goods that require limited amounts of skilled labor, countries can use earnings to invest in worker training and generate capital investment to build factories. This manufacturing of low cost export goods will bring additional resources to invest in the economy, allowing the country to produce more technologically complex goods. Along the way, domestic consumption should increase as the country gains from trade. Eventually, the country's advantage is not its natural resources or cheap labor, but its skills and technology.

In the past decade, developing countries have had varying levels of success in boosting their manufacturing sectors (Table 2). The growth in manufacturing in Africa and Latin America was much more modest than growth in Asia. The level of GDP attributable to

manufacturing more than doubled in Asia between 1995 and 2005. Asian countries were able to achieve economic growth through a variety of sectors during this time, and manufacturing certainly played an important role. The production of higher value goods such as electronics was increasingly shifted to low wage countries such as China, which in turn developed the skills to manufacture technologically advanced goods. Although the benefits of economic development have not reached the entire population in China, hundreds of millions of people were able to escape poverty as the economy was transformed.

Table 2 – GDP Related to Manufacturing – Developing Economies - Millions of US \$

	1995	2000	2005
Africa	75,482	75,747	108,642
America	327,624	361,540	442,705
Asia	836,426	1,049,303	1,780,652
Oceania	1,160	1,207	1,656

Source – UNCTAD 2008

The increase in manufacturing and exports from Asia has contributed to the high economic growth rates during the last decade. The average annual growth rate of GDP in Asia was 5.5% - higher than any other developing economy region (Table 3).

Table 3 –Average Annual GDP Growth Rates - Developing Economies

	1995-2005
Africa	3.9
America	2.4
Asia	5.5
Oceania	2.3

Source – UNCTAD 2008

There are a variety of determinants of economic development. Political instability and security problems act as a deterrent to both domestic and foreign investment. Rule of law and an ability to withdraw the investment are also necessary conditions. The presence of natural resources has not necessarily been advantageous for developing countries. The resource curse has plagued many African and Latin American countries, to say little of those in the Middle East. Few countries with substantial natural resources have progressed into the manufacturing stage of development.

On a global level, protectionist pressures may also curb the growth of trade that stems from trade liberalization policies. Facing public opposition to the perceived job losses from free trade agreements, policy makers may avoid further liberalization and may revisit existing agreements. Similarly, public pressure relating to environmental concerns may create barriers to investment and economic activity.

More generally, there are influences on a global scale that may disrupt the organization of

the global economy. Climate change, oil shocks, exchange rates, and fluctuating commodity prices can, individually as well as collectively, substantially influence the world economy. The global economy's volatility cannot be ignored either. Dips in growth rates in the 1980's and 1990's show that world economic growth is never uninterrupted (Dicken 2003). The ongoing global economic upheaval, as well as dramatic swings in the price of oil, reinforces this point.

One then must assess how countries on the periphery of the global economy develop their trade manufacturing abilities. If one assumes that trade is an engine of growth that allows countries to move through the stages of development, the disparities in trade participation are of great interest to policy makers. Given the trade liberalization policies implemented around the globe, it appears that the potential for participating in trade has never been stronger. For developing countries, the benefits for participating in trade are numerous. Export manufacturing can generate investment, relieve unemployment, and stimulate economic growth. A developing country's role in global trade is likely to be limited to a particular area of competitive advantage. Focusing on these advantages allows the country to participate in the global economy despite not having the same level of development as wealthy countries in North America, Europe, and East Asia.

Reorganization of the Global Economy

Prior to trade liberalization, companies recreated production processes in different countries in order to avoid tariffs or satisfy ownership requirements. According to Dicken (2003):

“Foreign direct investment is when a firm from one country buys a controlling investment in a firm in another country or where a firm sets up a branch or subsidiary in another country.”

This type of foreign direct investment (FDI) is often termed horizontal FDI (Shatz and Venables 2000). International trade was actually reduced as domestic production – owned fully or in part by a foreign company – replaced imports or competed with locally owned production.

With decreased tariffs, trade liberalization gave incentives for moving additional production overseas, resulting in vertical FDI (Shatz and Venables 2000). International production sites could be used to supply consumers domestically and internationally. Companies searched for countries with low cost and productive labor (Krugman and Venables 1995). From these new sites, multinational companies relocated production sites to the most profitable locations without losing access to consumers around the globe.

Given the lower tariffs and increased opportunities for FDI and international production, investing companies and their host countries pressed for fewer impediments to capital movements. Vertical FDI was encouraged by a loosening of restrictions on the global movement of capital (Ernst and Kim 2002). Coupled with trade liberalization, the increase in FDI to create production sites for global consumer markets helped fuel the growth in international trade. Goods produced in one country or region now were exported to consumers located around the world.

In addition to trade and capital movement liberalization, cheaper communication and transportation costs have acted as enablers to the development of multinational production (Feenstra 1998). Communication technology has allowed companies to better monitor product quality and design at international locations. The decreased cost of transmitting information due to faxes, satellites, and the Internet has allowed management to oversee production from a headquarters location. Transportation costs have also decreased. Larger ships, the use of containers to move freight, and longer range aircraft are all innovations that facilitate the transfer of products in the global economy. A more detailed discussion of containerization and the changes in transportation can be found in Chapter 4.

Combined with the technological developments, the freedom to trade and move capital has contributed to the higher mobility of factors of production, and global manufacturing patterns have evolved into multinational production processes. Production can be split amongst countries with competitive advantages in one or more areas, such as low cost

labor. This has been called the “disintegration of the production process, in which manufacturing ... activities done abroad are combined with those performed at home.” (Feenstra 1998).

Vertical specialization, as defined by Hummels, Ishii, and Yi (2001) involves the use of imported inputs for the production exports. It is common for the entire production process to be conducted overseas while the corporate headquarters is solely responsible for research and development (R&D) and marketing (Ernst and Kim 2002). Lower-tier suppliers, having a competitive cost advantage, export goods to lead suppliers that bring together inputs and produce a finished or nearly finished product. These lead suppliers coordinate many of the steps in the production process but do not have the overall decision-making capabilities of headquarters.

There are two general types of global production networks, each for different products and with different characteristics. According to Dicken (2003), producer-driven production networks tend to occur where multinational corporations control the production system, as in the case of automobiles, computers, aircraft, and electrical machinery. Buyer-driven networks involve a decentralized production process in a variety of exporting countries. They produce items such as garments, footwear, toys, and housewares (Dicken 2003). Countries on the periphery have the best chance of fitting into the buyer-driven networks. The level of skills and technological expertise is lower in buyer-driven networks than in producer-driven networks.

As companies identify locations that are competitive in very specific areas of production, they have broken up the manufacturing process into an increasing number of steps. The lengthening of supply chains in number of steps (and of course in geographical distance) has meant that the trade of intermediate goods has been an important driver in the growth of trade (Hummels, Ishii, and Yi 2001). The global supply chains that feed multinational production processes consist mainly of movements of intermediate goods that are created in one country and sent on to others for additional manufacturing.

Participating in Global Supply Chains

Coordinating global supply chains has become an important concern for multinational companies. In many cases, they coordinate frequent shipments from a variety of locations with limited room for disruptions in the chain. Transportation needs to be reliable and timely. Demand is now shaping supply chains, as opposed to supply (Hesse and Rodrigue 2004). The competitive position of locations depends on their ability to fit into supply chains that are increasingly responsive to consumer markets. Lower tariff barriers means that consumers, as well as producers using imported inputs, have greater choices and can find alternative suppliers more easily.

Competitive pressures are rising as countries across the globe make the necessary changes to become part of the global supply chains. Countries are chosen as production sites when they can offer high levels of reliability and efficiency, as well as low costs and short freight transit times (McCann and Shefer 2004). Multinational firms have sought

more reliable manufacturing centers as supply chains have grown. Managing the complicated production process across countries and continents leaves little room for uncertainty.

Global supply chains are more profitable with efficient manufacturing locations that minimize the number of steps and resources needed to perform their roles in the production process. With the streamlining of the chain (e.g. elimination of warehouses), however, the transportation costs are becoming relatively more significant (Hesse and Rodrigue 2004). McCann and Shefer also agree that logistics costs have not declined in recent years (2004).

The dispersal of production around the globe gave many developing countries the opportunity to take part in the world economy. The disparities between regions and countries in the trade of manufactured goods suggest that globalization's benefits have been unevenly distributed. One of the ways to close the gap in economic development is by increasing the ability of developing countries to increase their export manufacturing. It is important to take into account the changes that have resulted in sophisticated networks of international production. Supply chains are increasingly lengthy and compete not only on costs of production, but also on reliability, flexibility, and lower transportation costs.

CHAPTER 4: GEOGRAPHY OF PRODUCTION AND TRADE

Despite the dispersal of production and the development of global supply chains, economic activity has not been evenly distributed around the world. Developing countries have taken on a greater role in the global economy, but much of the increase in export manufacturing has occurred in Asia. As a result, trade flows between Asia, Europe, and North America dwarf those to and from Latin America and Africa. Containerized cargo is carried between locations by ocean carriers with business operations in all areas of the globe. The major container ports through which trade passes are concentrated along heavily used trade lanes linking global production and consumption centers. Not surprisingly, countries that are far from these centers of economic activity have smaller ports and lack the transportation infrastructure to participate in the global economy.

This chapter examines world trade patterns and the maritime industry (ocean carriers, terminal operators, ports) in order to better understand which global regions can be considered to be on the periphery. The first section presents data on trade and manufacturing exports, highlighting Asia's rise and the relative stagnation in Latin America and Africa. The next section reviews global trade flows and maritime shipping routes. The final section examines the world's top container ports and compares them to ports in Latin America and Africa.

World Trade

Developing, transitioning, and developed economies have all experienced a considerable growth in exports between 1995 and 2005 (UNCTAD 2008). Table 4 shows the value of all exports (food, ores, manufactures, etc.) for 1995, 2000, and 2005. While developed economies exported twice as much as developing economies in 1995 and 2000, the 2005 figures indicate a converging trend in exports between developed and less developed countries. The value of exports from developed economies in 2005 was less than twice that of developing economies, a much diminished ratio in comparison to 1995. These figures, however, do not indicate what type of exports were the drivers in the growth of developing economy exports.

Table 4 – Value of Exports - Millions of US Dollars

	1995	2000	2005
World	5,171,624	6,455,988	10,474,871
Developing economies	1,428,658	2,056,407	3,775,908
Economies in transition	121,897	154,507	359,164
Developed economies	3,621,068	4,245,074	6,339,799

Source - UNCTAD 2008

As mentioned in Chapter 3, growth in manufacturing exports is most likely to lead to sustained economic growth. Table 5 presents the value of manufacturing exports for the period of 1995-2005. World manufacturing exports nearly doubled during this time.

Developed countries grew their manufacturing exports between 1995 and 2005, but not at

the same pace as the developing and transition economies. Developing countries more than doubled their manufacturing exports, as did transition economies. In 1995, the value of developing economies' manufacturing exports was much less than half that of developed economies. Between 2000 and 2005, developing countries increased their level of manufacturing exports to half that of developed economies.

Table 5 – Exports of Manufactured Goods - Millions of US Dollars

	1995	2000	2005
World	3,734,947	4,663,564	7,299,878
Developing	929,960	1,354,966	2,409,480
Transition	42,1634	48,171	94,515
Developed	2,762,824	3,260,426	4,795,884

Source – UNCTAD 2008

Table 6 shows the export values of manufactured goods for 2005. Developed countries have a greater level of exports in each of the categories presented. In the UNCTAD database, *chemical products*, *machinery and transport equipment*, and *other manufactured goods* are the three subsets of *manufactured goods*. The value of manufacturing exports from developed countries is nearly twice that of developing countries. *Chemical product* exports from developed countries are nearly three times the value of exports from developing countries. For technologically- and capital-intensive exports such as *machinery and transport equipment*, developed countries enjoy a substantial advantage over developing countries.

Table 6 – Value of Manufactured Goods Exports - 2005 – Millions of US Dollars

	Manufactured goods	Chemical products	Machinery and transport equipment	Other manufactured goods
Developing economies	2,409,480	219,780	1,305,260	884,440
Economies in transition	94,515	17,597	22,151	54,767
Developed economies	4,795,884	851,444	2,574,469	1,369,971

Source - UNCTAD 2008

For *other manufactured goods*, the gap between developing and developed country exports is narrower. This category contains numerous products that are produced in buyer-driven production networks. As defined in the previous chapter, these networks are the most flexible, contain the lowest labor costs, and are focused on the price of the product rather than quality or technological content. Appendix A provides a list of products in this category.

Developing countries currently on the margins of the global economy are most likely to take part in global production networks for lower value goods. Table 7 presents data from 1995-2005. In 1995, developed countries exported twice the value that developing countries exported. By 2005, developing economies were exporting two-thirds of the value of developed economies.

Table 7 – Other Manufactured Goods - Millions of US Dollars

	1995	2000	2005
World	1,312,541	1,475,670	2,309,177
Developing economies	431,286	536,060	884,440
Economies in transition	22,445	26,544	54,767
Developed economies	858,810	913,066	1,369,971

Source - UNCTAD 2008

Developing economies in Asia have emerged as a major export manufacturing center for these buyer-driven networks (Table 8). Companies have located factories in Asia as these locations provide large pools of cheap labor and stable political conditions. These governments have directed their economies towards global production networks and encouraged private firms to participate in the global economy.

Table 8 – Buyer-Driven Production Networks - Developing Economies –
Millions of US Dollars

	1995	2000	2005
Africa	14,419	17,706	27,901
America	42,199	62,153	92,072
Asia	373,911	455,259	763,527
Oceania	756	942	939

Source – UNCTAD 2008

Developing economies in Africa and Latin America are relatively small participants in buyer-driven production networks. The level of production in both regions more than

doubled between 1995 and 2005, but they represent less than 20% of the total of all developing economies.

Global Trade Flows

The rise of Asia as an export manufacturing region – both for buyer and producer-driven goods – has contributed to large Asia-Europe and Asia-North America trade flows (WTO 2008). Table 9 shows that these two flows are the 3rd and 5th largest, respectively. Trade is also high within Asia as intermediate goods are exported within the region for final assembly and consumption, either in developed countries or rapidly growing economies such as China. Exports from North America and Europe to Asia remain high due to the competitive advantages that developed countries retain in the manufacturing of technologically- and capital-intensive exports.

Intra-European exports of manufactured goods continue to comprise the largest trade flows. Liberalized trade policy and distance between markets continue to shape the geography of trade. Eastern European countries with low wages are attractive locations of multinational production. Much of these trade flows, however, are of high value goods with significant technological content. The level of exports between North America and Europe further demonstrates that exports of manufactured goods between developed countries remains high.

Table 9 – Manufactured Export Flows Between Regions - US Dollars - 2006

Exporter	Importer	Value
Europe	Europe	2,814,603,000,000
Asia	Asia	1,226,953,000,000
Asia	North America	654,952,000,000
North America	North America	648,079,000,000
Asia	Europe	534,069,000,000
Europe	North America	354,275,000,000
Europe	Asia	319,208,000,000
North America	Asia	231,765,000,000
North America	Europe	216,724,000,000
Europe	Middle East	110,153,000,000
Europe	Africa	95,819,000,000
Asia	Middle East	90,301,000,000
North America	South and Central America	79,953,000,000
Asia	South and Central America	59,133,000,000
Europe	South and Central America	58,299,000,000
Asia	Africa	54,552,000,000
South and Central America	South and Central America	51,800,000,000
Middle East	Middle East	49,048,000,000
South and Central America	North America	48,817,000,000
North America	Middle East	35,068,000,000
Africa	Europe	35,066,000,000
Middle East	Asia	26,533,000,000
Middle East	Europe	23,273,000,000
Middle East	North America	22,100,000,000
South and Central America	Europe	18,288,000,000
North America	Africa	15,020,000,000
Africa	Africa	13,114,000,000
Africa	Asia	9,206,000,000
South and Central America	Asia	9,010,000,000
Africa	North America	8,024,000,000
Middle East	Africa	7,107,000,000
South and Central America	Africa	3,491,000,000
Africa	Middle East	2,976,000,000
South and Central America	Middle East	1,774,000,000
Middle East	South and Central America	1,360,000,000
Africa	South and Central America	947,000,000

Source - WTO 2008

Manufactured exports from Latin America, the Middle East, and Africa are relatively limited in comparison to those from Asia, North America, and Europe. The largest flow of manufactured exports from Latin America is the 18th biggest overall (intra-Latin America). The Middle East's largest flow is intra-Middle Eastern and ranks 19th out of the 37 possible regional combinations. Africa's largest flow of manufactured exports (Africa-Europe) is the 22nd largest global flow.

Trade Routes

The three major interregional trade flows are between Asia and North America; Asia and Europe; and North America and Europe. Manufactured goods traded between East Asia and North America are transported across the Pacific Ocean. While West Coast ports are the primary entry points for Asian imports to the United States, some ships transit the Panama Canal to serve the East Coast directly. Trade between South Asia and North America often flows through the Suez Canal, as transit times are shorter than Trans-Pacific routes. The two canals can cause bottlenecks in maritime trade, with the Panama Canal having the greater limitation due to its restrictive dimensions relative to modern ships sizes.

East and Southeast Asian exports to Europe move first through the Malacca Strait between Malaysia and Indonesia. The Malacca Strait has been plagued by piracy in recent decades, impacting not only trade in manufactured goods but also raw materials

and, most importantly, oil supplies from the Middle East to Asia. Exports to Europe then pass through the Suez Canal and into the Mediterranean. Container ships from Asia most often bypass Mediterranean ports and continue to Northwestern Europe where they can access the large consumer markets and still serve Continental Europe efficiently by road, rail, and barge.

Trade between North America and Europe generally flows through a number of U.S. East Coast ports. In Europe, the primary ports handling this trade are located in the Netherlands, Belgium, Germany, and France.

Shipping Lines and Networks

There are many shipping lines in the maritime trade industry. Ocean carriers own or charter (lease) container ships that vary in size depending on the trade route. Typical container ships in a major carrier's fleet have a capacity of 6500 TEU¹, although the largest ships in operation can carry nearly 14000 TEU. The most common shipping networks are organized into direct port-to-port services, but some ocean carriers also operate a hub and spoke network (Frémont 2007).

Maersk Sealand, MSC, CMA-CGM, and P&O Nedlloyd are some of the few carriers that operate globally (Notteboom 2004). They are competitive in Europe, Asia, and North America, and also are present on routes to South America and Africa. Other carriers, such as APL, Hanjin, and NYK are regionally based, remaining strong competitors in the

¹ TEU = twenty-foot equivalent unit, a container with a length of 20' (Notteboom 2004)

Asia-Europe/North America trades. Many ocean carriers have entered into operating agreements to achieve the necessary economies of scale and expand their ability to serve destinations around the globe. These can take various forms, the most notable of which are alliances.²

Container Ports

Table 10 presents the top 20 container ports by volume handled in 2005. Six of the top ten are in Asia, reflecting the important position of Asian exporters. The presence of Rotterdam, Hamburg, and Los Angeles in the top ten demonstrates the high volume of imports in North America and Europe.

The ports listed in Table 10 do not all serve the same general function in the global economy. The functions of ports vary depending on factors such as the country's economy, geographic location, and proximity to rival ports. Ports can generally be classified into three categories: gateways, transshipment hubs, and feeder ports.

Gateway ports serve as export or import platforms for large manufacturing and consumption centers. They are connectors to the global economy and are the junction between countries and maritime transportation. Gateway ports' primary function is to

² The major alliances are Grand Alliance, Cosco/K-Line/Yangming Alliance, New World Alliance, and United Alliance (Notteboom 2004)

handle large volumes of goods (containers) and transfer them between land infrastructure (primarily road and rail) and the sea.

Table 10 – Container Ports - 2005

World Ranking	Port Name	Trade Region	Total TEU
1	Singapore	South East Asia	23,192,200
2	Hong Kong	East Asia	22,601,630
3	Shanghai	East Asia	18,084,000
4	Shenzhen	East Asia	16,197,173
5	Busan	North East Asia	11,843,151
6	Kaohsiung	East Asia	9,471,056
7	Rotterdam	Northern Europe	9,250,985
8	Hamburg	Northern Europe	8,087,545
9	Dubai	Mid-East	7,619,219
10	Los Angeles	North America West Coast	7,484,624
11	Long Beach	North America West Coast	6,709,818
12	Antwerp	Northern Europe	6,482,061
13	Qingdao	East Asia	6,307,000
14	Port Klang	South East Asia	5,715,855
15	Ningbo	East Asia	5,208,000
16	Tianjin	East Asia	4,801,000
17	New York/New Jersey	North America East Coast	4,792,922
18	Guangzhou	East Asia	4,685,000
19	Tanjung Pelepas	South East Asia	4,177,121
20	Tokyo	North East Asia	3,819,294
21	Laem Chabang	South East Asia	3,765,967
22	Bremen/Bremerhaven	Northern Europe	3,735,574
23	Xiamen	East Asia	3,342,300
24	Tanjung Priok	South East Asia	3,281,580
25	Algeciras	West Mediterranean	3,179,300

Source – Containerisation International

The ports of the United States, Europe, and China are all primarily gateways for exports and imports. The world's largest gateway ports are often part of regional groupings – port clusters – that serve large consumer and producer markets. For example, the US East

Coast ports, from Boston to Savannah, may compete for business to serve the interior of the country. Within the East Coast clusters, there can be smaller clusters such as the Mid-Atlantic ports of Norfolk, Charleston, and Savannah. Similarly, a cluster of ports from Le Havre, France, to Hamburg, Germany contain all of the major gateway ports serving European markets.

Transshipment hubs are ports that are located along trade lanes and can serve as consolidators of container shipments to gateway ports. They also serve as distributors of goods back to these smaller ports that generate lower cargo demand levels. Arriving ships may discharge containers for various destinations and load containers for the destinations that they serve. Transshipment hubs have minimal connections with the country's infrastructure. Containers are transferred from ship to the yard, only to be loaded onto another ship. While Dubai, the 7th largest container port, generates considerable imports and exports, it can be classified as a transshipment hub for the Middle East. Other busy container ports, including the competing ports of Singapore and Tanjung Pelepas, are primarily transshipment ports. Because this work's focus is on national integration into the global economy, the case of transshipment ports along the east-west routes will not be considered because of their limited direct contributions to their countries' development of manufacturing industry.

Feeder ports have lower volumes and handle smaller ships than gateway ports and transshipment hubs. They send containers to other ports where the loading of large

containerships occurs. Many of the smaller ports in China are feeder ports, as are numerous ports in the Caribbean.

Ports on the Periphery

In Table 10, there are no ports in Latin America and Sub-Saharan Africa. Ports in these regions are relatively small and handle limited numbers of containers. Table 11 lists the volumes handled at container ports in Sub-Saharan Africa in 2005. The ports of Las Palmas de la Gran Canaria and Santa Cruz de Tenerife have been excluded because they are part of Spain. Durban, South Africa is by far the largest container port as it serves the wealthiest consumer markets on the continent. Its world ranking, however, is only 48th. Abidjan, Cote d'Ivoire and Tema, Ghana are the busiest ports in West Africa, but are small in comparison to the total volume handled by South African ports. Similarly, the ports of Mombasa and Dar es Salaam are the largest in East Africa but have volumes that are a fraction of Durban's.

Table 11 – Sub-Saharan African Container Ports – 2005

World Ranking	Port Name	Trade Region	Total TEU
48	Durban	Southern Africa	1,955,803
104	Cape Town	Southern Africa	736,943
126	Abidjan	West Africa	571,674
144	Mombasa	East Africa	436,671
155	Tema	West Africa	392,761
162	Port Elizabeth	Southern Africa	370,849
181	Luanda	West Africa	316,396
184	Dakar	West Africa	309,000
185	Dar es Salaam	East Africa	305,866
225	Lome	West Africa	203,372
233	Djibouti	East Africa	193,600
234	Douala	West Africa	190,859

260	Cotonou	West Africa	158,201
303	Funchal	West Africa	95,919
304	Ponta Delgada	West Africa	90,951
334	Walvis Bay	Southern Africa	71,456
360	Maputo	Southern Africa	54,088
367	Takoradi	West Africa	49,321
368	Puerto del Rosario	West Africa	49,237
382	East London	Southern Africa	42,545
460	Tanga	East Africa	13,682
498	Luderitz	West Africa	6,154
506	Richards Bay	Southern Africa	4,981

Source – Containerisation International

Table 12 lists the volumes handled at container ports on the East and West Coast of South America in 2005. Ports in Brazil (Santos) and Argentina (Buenos Aires) are the largest on account of their more developed economies. Container ports on the West Coast are far smaller and rank no higher than 88th in terms of world volumes.

Table 12 – East and West Coast South American Container Ports – 2005

World Ranking	Port Name	Trade Region	Total TEU
38	Santos	East Coast	2,267,921
66	Buenos Aires	East Coast	1,370,015
88	Callao	West Coast	887,035
101	San Antonio	West Coast	773,048
110	Rio Grande	East Coast	675,111
116	Itajai	East Coast	647,796
127	Guayaquil	West Coast	567,608
132	Buenaventura	West Coast	531,795
143	Montevideo	East Coast	454,531
149	Paranagua	East Coast	420,318
158	Valparaiso	West Coast	377,275
173	Rio de Janeiro	East Coast	326,177
190	Sao Francisco do Sul	East Coast	290,440
215	Vitoria	East Coast	219,800
220	Iquique	West Coast	208,303
221	Salvador	East Coast	208,090
230	Sepetiba	East Coast	200,199
242	Suape	East Coast	179,473
245	Lirquen	West Coast	171,791

270	San Vicente	West Coast	147,968
309	Paita	West Coast	87,569
344	Fortaleza	East Coast	62,844
372	Belem	East Coast	47,300
391	Arica	West Coast	39,745
392	Manta	West Coast	39,233
395	Antofagasta	West Coast	38,299
409	Vila do Conde	East Coast	30,765
410	Ushuaia	East Coast	30,631
433	Puerto Bolivar	West Coast	22,546
436	Puerto Madryn	East Coast	21,778
438	Mejillones	West Coast	20,469
454	Imbituba	East Coast	16,866
458	Puerto Deseado	East Coast	16,183
481	Chacabuco	West Coast	9498
484	Salaverry	West Coast	9381
492	Maceio	East Coast	7700
496	Punta Arenas	West Coast	7007
497	Chimbote	West Coast	6168
505	San Antonio Este	East Coast	5000
508	Rosario	East Coast	4936
510	Coronel	West Coast	4809
512	Natal	East Coast	4612
515	Esmeraldas	West Coast	3335
516	Coquimbo	West Coast	3190
520	Talcahuano	West Coast	2785
530	Ilo	West Coast	1321
533	Campana	East Coast	965
553	Puerto Montt	West Coast	49
554	Santarem	East Coast	28
557	Ilheus	East Coast	0

It is not surprising that the ports in South America and Sub-Saharan Africa handle much lower volumes than ports in Asia, North America, and Europe. Multinational production has been primarily centered in Asia and goods have been shipped along an East-West axis around the world. Southern Hemisphere countries are on the periphery of the global economy in terms of manufacturing locations, global trade lanes, and port activities.

Chapter 9 will discuss the implications of the remote location of South America and Sub-Saharan Africa.

The reason why relatively so few South American and African ports handle large numbers of containers is simple: these countries have limited exports, and their markets either do not require or cannot afford a high volume of imports. There is no need for massive container ports when there is no appropriate economic activity. This research recognizes that port development can come as a result of economic development. The current organization of the global economy, however, may increase the role of ports as determinants of economic growth. Globalized production, part of which is boosted by reliable, efficient, and low cost transportation, has increased competition between countries. Workers in Latin America and Africa generally do not have such low wages that the cost of production in these regions can offset poor transportation infrastructure. Global supply chains will search out locations, countries, and regions with an existing minimum level of infrastructure (in this case, ports).

CHAPTER 5: PORT INFRASTRUCTURE

This chapter compares how modern container ports differ from their breakbulk-handling predecessors. It attempts to identify the characteristics of competitive port infrastructure in order to better understand what is required to participate in multinational production and global supply chains. Arguably the most important technological change in the maritime industry in the 20th century was the introduction of the shipping container. While already almost universally adopted as a way to transport manufactured goods across the oceans, ports are still in the process of adapting in order to maximize the benefits of containers. Leading ports around the globe were able to take advantage of technological improvements in container-handling tools, provided that cargo volumes increased sufficiently. The sets of skills required for port labor, managers, and planners changed as containerization took hold. The old business practices still employed by many developing countries are no longer competitive in the modern maritime industry.

This chapter begins by summarizing the typical operations of a port terminal prior to containerization. It notes the tools used, labor requirements, and spatial layout of these terminals. The following section details the evolution of ports due to the introduction of shipping containers. Ships and waterways have grown significantly, as have the cranes and yard equipment that handle containers. Labor-intensive processes have given way to capital-intensive operations using sophisticated computer software. Terminals have become specialized as economies of scale encourage the separation of container and non-container activities. Finally, the use of containers encouraged greater use of intermodal

shipping methods, allowing cargo to move more seamlessly between ships, trains, and trucks. Ports have adapted by improving the ease with which containers move between these modes.

Breakbulk Cargo

Prior to containerization, ships carrying manufactured goods had large cargo holds that were filled with many types of merchandise. The goods were positioned individually within the hold and secured with small pieces of wood and rope (Stopford 1997). This type of loose freight was termed “breakbulk”. Ships were often self-sustaining, carrying cranes and other equipment that was necessary to unload the cargo (Talley 2000). When the ship was in port, cargo was loaded or unloaded in baskets, bags, drums, or pallets. Cargo was staged on the quay – the area at the edge of the water.

This was a labor-intensive process and ships could remain in port for days before the discharging was complete. Technological advances such as the use of pallets and higher capacity shore-based cranes reduced the need for labor to a certain extent, but the use of breakbulk vessels continued to require a minimum number of workers. Longshoremen were an important part of the port industry and commanded some of the highest wages for non-college educated workers. Dockworker unions fought for shorter shifts, increased pay, and substantial overtime benefits.

Activity at breakbulk port terminals was frequently interrupted. Inclement weather halted work due to the risk of damage to the goods and dangers for the longshoremen. Unions in Europe and the US held considerable influence at ports and demonstrated their strength in numerous strikes throughout the 20th century. Illegal activity also plagued the port industry, ranging from simple theft to organized crime (Monaco and Olsson 2005).

Breakbulk terminal assets were usually not used exclusively by one company. Ship berths were available to the various ocean carriers calling at the port. The port authority would allocate the berths and labor assigned to a particular ship. Prior to loading or after unloading, goods were often stored in warehouses at or near the port. Warehousing was often available immediately adjacent to the pier. As with the transfer of breakbulk to and from the ship, the stacking of goods in warehouses was a labor-intensive process. Goods were subject to damage and theft.

In addition to warehouses, port terminals frequently had a variety of activity that did not involve manufactured goods. The same berths and quays could be used to unload wood, drums of chemicals, and other products. With these competing uses, transportation modes varied and remained labor-intensive. Trucks and rail boxcars could be loaded in a similar fashion to breakbulk ships. Local trucking firms and railroads had limited coordination with the ocean carriers and therefore could not synchronize shipments. Cargo arrived far earlier than ship departures, or waited extended periods of time after being discharged.

Containerization

The shipping industry was radically transformed by the introduction of the shipping container. The first significant use of containers occurred in 1956 when the *Ideal X* – a modified general cargo ship - sailed from Newark, NJ to Houston, TX with 57 truck vans on its deck (Levinson 2006). The most important advantage of containers is that they allow for the easy transfer of cargo between truck and ship without the need to handle the product itself. Ships can be loaded and unloaded quickly and with minimal labor.

Containers also provide a secure method of transporting manufactured goods, reducing the risk of damage and theft. The economic advantages of the modern shipping container have transformed how freight moves around the world. Containers have permitted more efficient and timely intermodal movement of goods.

The introduction of shipping containers coincided with the specialization of ships in the 20th century. In the 1950's and 1960's, containers were often secured on the deck of breakbulk cargo ships. Containers had to be removed in order to unload the loose cargo stored in the ship's hold. As containers became prevalent, specialized container ships were developed. Modern container ships are no longer self-sustaining and rely on port cranes rather than ship cranes for transferring containers. Many of the goods produced by global supply chains are transported on massive container ships that dwarf their recent predecessors of the early 1990's. Considerable cost savings are generated by the economies of scale in building larger ships (Stopford 1997). The largest container ships now exceed 14,000 TEU. Their lengths and widths often exceed the dimensions of the

Suez and Panama canals (Cudahy 2006). Ocean carriers acquiring ships with dimensions larger than the Panama Canal have had to balance the advantages from the economies of scale with the route and port limitations.

Port infrastructure has changed to meet these requirements. As ships have grown, ports and harbors have been improved to accommodate them. The depths of these ships require the dredging of channels in order to provide access to the port. The largest ships cannot call at some major ports, including the Port of New York where channel depths and bridge clearances currently restrict ship size.

Because global supply chains compete heavily on the timely delivery of products, there is considerable pressure on port terminals to load and unload container ships quickly.

Cranes have not only gotten bigger but also more productive. The heights and reaches of cranes are far larger than those of the past. While early container cranes moved one box at a time, new cranes move multiple 40 ft. containers simultaneously. This results in cranes loading and unloading containers at a much faster pace than was previously accomplished.

Containers spend little time on the quay and are transferred quickly to an area called the container yard. Depending on the volume of containers handled and the space available, containers are transported to and from the quay by a variety of methods. At low volume terminals, these may be forklifts and top-loaders. At higher volume terminals, sophisticated machinery such as *straddle carriers*, *rubber tired gantries*, and *rail*

mounted gantries may be used to achieve greater efficiencies. In most cases, loaded containers are stacked two or three high, whereas empty containers can be stacked seven or eight high. Container yard management has benefited from technological improvements. Computerized allocation of yard assets, optical scanners for container numbers, and electronic dispatch orders for workers all improve the ability to track and manage containers.

With the use of containers and the shift to a capital-intensive terminal operation (cranes, straddle carriers, optical scanners, etc.), labor needs at ports have declined. Ports no longer need tens of thousands of longshoremen as they did in the 1950's (Monaco and Olsson 2005). Port workers are becoming more skilled as technology becomes an integral part of the port industry. Labor shortages, which once had adverse impacts on port performance, have now become a negligible concern in most countries.

More broadly, the organization of activities within the port has changed. The tools for handling bulk, breakbulk, and containers differ, as do the assets of the port including warehouses, silos, and yards. Container operations stack containers in the areas where warehouses had been previously located. The efficient movement of containers at ports is impeded by breakbulk activity involving trucks for small shipments or boxcars needing long times to load and unload. Profitable container operations hinge on high volume flows requiring large cranes and specialized container yard equipment. Specialized container terminals have emerged where the activities are confined to container handling.

Because breakbulk cargo is declining in importance, it is being relegated to a separate and often smaller area of the port.

Containers and specialized terminals have allowed for a more integrated management of goods movements. Because containers can be transferred between ships, trains, and trucks, port activity has been reorganized to improve intermodal opportunities. Container terminals now include dedicated tracks where containers can be transferred immediately to trains for onward delivery, or vice versa. Local roads and highways play a vital role in bringing goods to and from the port. Because of how quickly containers can be transferred to and from trucks, drivers may make multiple visits to the port each day. This increased reliance on connections to the hinterland means that the operation of ports, terminals, and their infrastructure can no longer be separated from the domestic transportation infrastructure.

The transformation of ports that has been brought on by containerization has made port operations far more capital intensive. Cheap port labor – previously a competitive advantage – was less valuable as competitiveness was increasingly determined by levels of investment to keep up with the rapidly changing industry. Port managers were challenged by the maritime and port industry's transformation, as were policy makers and planners. The scope of operations and competitive environment expanded beyond the boundaries of the port and began to include domestic infrastructure connections. With such a dynamic situation, the competencies of many government officials were surpassed and ports found it difficult to adjust quickly and appropriately. The following chapter will

discuss in greater detail the impact of these changes on the financing and operation of ports in recent years. The changes in the maritime and port industry opened the door for much greater private participation – in effect relieving overwhelmed port authorities of many of their responsibilities.

CHAPTER 6: FINANCING PORT INFRASTRUCTURE

The objective of this chapter is to show how port financing has changed in light of containerization and the development of global supply chains. Government financing of port infrastructure has given way to a system of private financing by maritime industry firms. Global terminal operators and shipping lines have scrambled to acquire control over port terminals and have channeled considerable investments into these facilities. Private financing of port development, however, has required higher cargo volumes in order to properly exploit economies of scale. Firms have also had a lower tolerance for economic risk as compared to government investments in port infrastructure. For developing countries with low trade volumes and relatively higher levels of economic and political risk, the changes in port financing suggest that port development will continue to be challenging and may limit their abilities to plug into the global economy.

The first section examines how government is no longer the monopolistic provider of port infrastructure in many countries. Public spending at ports was reduced by a combination of limited funds, ideological changes, and the increased availability of private financing. The next section discusses how changes in the global maritime and logistics industry have encouraged private participation in the ports sector, albeit with different conditions and incentives than those of governments. Finally, the chapter looks at which private actors have become directly involved in port development.

Public Spending

Throughout much of history, port infrastructure development was primarily undertaken by public entities. Because the benefits of ports extend beyond the immediate users, and the costs of infrastructure development were considered too high to be shouldered by those same users, governments used public funds to invest in port facilities. If the market would not generate the necessary infrastructure, government could become the supplier. The expectation was that government could provide infrastructure without requiring short-term returns on investment. Satisfying immediate port infrastructure needs was important, but not necessarily paramount. The infrastructure could be an investment in the long-term economic performance.

Governments have been able to use port policy as a means to generate support and achieve political objectives. Beyond contributing to national economic performance, ports allowed governments to create direct employment. Providing port labor could serve as a political tool to garner support from constituents. Also, the government could use port spending as an economic stimulus, allowing it to inject large amounts money into the economy. Ports are a politically sensitive area because of the immediate impact that disruptions in service can have on the lives of citizens. Farmers and factory workers can be adversely affected by a slow down in the export process. Virtually all citizens can be impacted by the rise in cost of imported food and other products. For this reason, government has traditionally paid close attention to the port industry.

Government ownership in port infrastructure has traditionally taken on two forms. Ports can be owned and operated by a port authority, as in the case of ports in Houston, Norfolk, and Durban, South Africa. In other instances, port authorities can act as landlords, with port planning and terminal development being heavily shaped by government entities. The landlord port authorities then lease their assets to private companies while still retaining some influence and ability to directly generate broader economic benefits from the port. Examples of landlord ports include New York/New Jersey, Oakland, and Rotterdam.

Privatization of Ports

In the past decades, the role of government has been reevaluated. Government intervention in all aspects of the economy receded as an ideological shift deemphasized the need for public provision of infrastructure. It was argued that market efficiencies, propelled by profit motives, would allow the private sector to outperform governments in the provision of certain public goods. This change was experienced in both the developed and developing world. The US and European Union looked to private entities to take on a greater role where the market would allow. With respect to infrastructure, private firms became involved in a variety of projects, including roads, power grids, and eventually ports.

Since the 1970's and 1980's, state-owned enterprises in many developing countries have been unable to meet the growth in demand for all types of infrastructure (Ramamurti and

Doh 2004). In the 1990's, the World Bank and International Monetary Fund (IMF) pressured governments to privatize services and increase their reliance on private actors. They also pushed for deregulation in many sectors, including the transportation industry.

Many of the same policy (capital movement liberalization) and technological changes (communications) that enabled multinational production to evolve also facilitated private participation in infrastructure. The resources required for infrastructure projects were considerable, but with anticipated profits, private firms could attract capital from abroad and take on large responsibilities in the economy. In developed countries, extensive periods of stability allowed firms to project profits long enough into the future to recoup their investment. In certain developing countries, expectations of rapid economic growth meant that despite higher risk, infrastructure investment could be profitable in an accelerated time frame.

The use of "project financing" as a way to finance infrastructure projects contributed to the increase in infrastructure FDI (Ramamurti and Doh 2004). This financial technique allowed foreign investors to borrow money based on the value of the assets (ports, roads, telecommunications, etc.) without exposing the company itself to potential losses. In turn, participating banks formed syndicates to minimize each bank's individual exposure in the project. Finally, the loans could then be sold to a larger number of investors through securitization, further reducing the risk to any one particular investor.

Logistics Industry Transformation

The reduced role of government in providing port infrastructure has coincided with the rise of global supply chains and the transformation of logistics. As supply chains lengthened and became more complex, seamless connections between sea, rail, and road transportation grew in importance. Because standardized shipping containers permitted greater intermodality, port infrastructure is no longer viewed in isolation. A port's competitiveness is now far more influenced by how it fits in with the overall supply chain requirements (Robinson 2002).

In addition to providing intermodal connections, container terminal management helps determine a port's competitiveness. Port congestion, delays, and mismanagement are greater hindrances than before, given the improvements in ship speed, modal transfer, and visibility of containers within the supply chain. The supply chain may consist of a variety of actors. Government-run ports do not necessarily have the same goals as private firms.

Investment and planning needs vary based on the type of port function (bulk, container, etc.), placing additional pressure on port management to stay informed of numerous industry trends. In many ways, these conditions were overwhelming for government agencies. Employees could not keep up with the dynamic conditions, nor were they necessarily compensated for their efforts. Governments and policy makers therefore looked to transfer port responsibilities to the private sector.

The retreat by government from the ports sector in no way suggests a diminished importance of port infrastructure. The importance of reliable, timely, and low cost movement of goods for global supply chains means that shippers have stringent requirements of ports through which their goods move. While transportation costs have decreased significantly in the past half-century, the dependence of supply chains on transportation logistics has increased. Fluctuations in schedules and volumes of goods movements are important factors in determining where multinational companies locate production sites. It was in large part the recognition of the increase in importance of port infrastructure that led to governments' willingness to relinquish much of their control.

Private Spending

Private investment in port infrastructure is in part determined by a set of preconditions similar to those for foreign direct investment in manufacturing. Factors such as rule of law and political stability are especially important since the assets are fixed and cannot be repatriated without difficulty. The capital-intensive aspects of the modern port industry meant that the stakes for foreign investors were higher. Therefore, private actors scrutinized the host countries very closely and carefully monitored any trends suggesting that governments would prove less cooperative in the future. There is considerable risk that a host government might alter the conditions of the original agreement or fail to provide certain promised conditions. In his analysis of mining investments by overseas companies, Vernon (1971) calls this an "obsolescing bargain". Although recent examples of outright expropriation are rare, host countries can create an "administrative

expropriation” by constantly changing the terms or suspending agreements (Ramamurti and Doh 2004). In general terms, governments in developing countries became far more receptive to FDI in the 1990’s (Dunning 1998). Private companies perceived the risk of expropriation to be minimal when compared to the 1970’s and 1980’s.

The emergence of private actors in port infrastructure development has made profitability a top priority. Unlike government investment in ports that could be driven by a combination of short and long-term economic growth, as well as immediate benefits in the form of jobs and opportunities for corruption, private investment in ports requires limited economic risk. To maximize returns on investment, there is pressure to achieve economies of scale through bigger and more efficient container terminals. Companies are more likely to invest in ports where the costs of container terminals are offset by revenue from existing trade flows.

A key difference between government and private firms, therefore, is the time frame used in evaluating port infrastructure investments. For instance, if a port authority issues bonds to fund port development, they often enjoy a repayment period of 15 to 30 years. This allows a longer amount of time for the economy to generate enough demand, as well as allows the port itself to stimulate some of that demand. From a private investment perspective, profitability tends to be measured in a 3- to 5-year timeframe, leaving little room for an economic downturn or growth that fails to materialize.

The impact of the shortened time frame for private firms to turn a profit is compounded by the soaring cost of modern container terminal infrastructure. A port's redevelopment or transformation to specialize in container handling comes at a great cost. Cranes, yard tractors, and computer technology may be worth tens or hundreds of millions. Dredging may become even more complicated and expensive as ports push the limits of the natural environment that at one time made them attractive locations (Burroughs 2005).

Forms of Private Participation

Ramamurti and Doh (2004) categorize private participation in infrastructure into three groups: privatization of state-owned enterprises; allowing private actors to develop greenfield port sites; and incremental private investment in existing infrastructure. Where existing or expected port revenues can provide a return on investment in the required time frame, private firms have been willing to undertake large scale investments worth hundreds of million of dollars.

The privatization of state-owned enterprises has occurred in many industries around the globe, including the port industry. In this case, the government sells a portion or the entire organization to a private firm or group of investors. For a variety of reasons, the government may retain some regulatory influence over the firms' operations. Of particular interest to government regulators is the privatization of a monopolistic state-owned enterprise. In the case of the port industry, this could occur in a port where terminal operations are concentrated in the hands of one or a few private enterprises. An

unregulated private firm would be able to abuse its monopolistic position at the expense of the port's customers and ultimately the national economy.

Greenfield investment in port development is less common than privatization. It occurs when governments deregulate the port industry or enact other changes that enable the private sector to act as a provider and developer of port infrastructure. The investments are not greenfield in the sense of developing previously unused land. Greenfield ports are developed in locations that were previously not ports. A recent example of greenfield port development by private investors is in the Norfolk, Virginia area where a large ocean carrier and its affiliated terminal operator have constructed a container terminal without government involvement. One of the reasons for doing so is that the private sector is unencumbered by many of the environmental and social reviews, as well as public comment periods and strict rules concerning contractors and financing. The success of the few existing privately constructed and operated container terminals will surely influence port development patterns in the future. For the moment, the use of this model for financing and constructing ports remains limited.

Finally, there are incremental investments in existing infrastructure that is leased or managed by a private firm. Governments may lease or jointly operate port facilities with private firms that have financial resources and managerial expertise in the port industry. These arrangements allow government to maintain influence in the port sector while benefitting from the private sector's strengths. Firms may be granted favorable leases, access, or services in exchange for specified levels of investments in terminals. The

involvement of government may interfere with the firm's desired practices, but the tradeoff is often desirable. Although the private firms have to abide by rules that may conflict with profit maximization, the government's stake in the project can demonstrate a commitment to the port's long-term development. Port infrastructure in developing countries during the 1990's generally allowed for this type of private participation.

Private Firms

In many ports, private companies have taken over entire terminals. Some container terminal operators control assets in only one port, while others expand globally to form international terminal networks. Companies such as Hutchison (Hong Kong), PSA (Singapore), and DPW (Dubai) have expanded globally and each control over 25 container terminals. They benefit from their specialization in terminal management to provide competitive services to shippers and revenues for their owners and shareholders. These companies are able to achieve economies of scale in equipment purchases, rate negotiations, and management training.

A different type of specialization is occurring in the ocean carriers. As opposed to integrating horizontally by acquiring rivals (although in many cases, this is also occurring), shipping lines are becoming for more vertically integrated. The growing complexity and lengthening of the supply chain means that providing all-in-one logistic services can be a competitive advantage. Carriers have sometimes invested in rail and trucking operations, as well as container terminals. Controlling the full range of

intermodal assets allows ocean carriers to provide “door-to-door” service. This can simplify the logistics activities of shippers and also lower their costs by reducing the number of transactions. An early mover towards vertical integration was American President Lines (APL), as the company expanded into rail services from the US West Coast. Similarly, Maersk’s subsidiary APM Terminals manages over 35 container terminals, allowing it to better manage its shipping operations while providing customers with more reliable service and faster transit times. All of these improvements translate into reduced overall costs and potentially higher profits.

A more recent development has been the emergence of large financial institutions and pension funds as investors in container terminals. Companies such as AIG and Deutsche Bank, and funds such as the Ontario Teachers Pension Plan, have acquired terminals at multiple ports in the past four years. Because of the typically stable returns on investment over long periods of time, the purchases help diversify the portfolios of large institutions in what is forecast to be a steady market for decades into the future.

The role of port authorities as the sole providers of infrastructure has receded, but their position as a supplier, financier, competitor, and regulator of infrastructure has remained strong (Ramamurti and Doh 2004). The high cost of port development and the reduced role of government in the economy (both locally and globally) means that developing country governments do not have the funds to invest, and likely could not spend them as easily were they to acquire them. The challenge for developing countries will be to create the necessary conditions to attract foreign investment. The private industry’s accelerated

expectations of profits on port investment clash with the idea of infrastructure as a determinant of economic growth. Private involvement in port infrastructure provides a partial answer to the question of whether ports must precede development, or vice versa. Firms in the port industry are attracted to areas where potential is very strong, or activity is already high enough to justify investment. For developing countries on the margins of the global economy, expectations of private investment in their ports appear to be unlikely.

CHAPTER 7: PORT DEVELOPMENT MODELS

There are a numerous port development models that capture important elements of the evolution of ports around the globe. Models proposed by academic researchers, the United Nations Conference on Trade and Development (UNCTAD), and the European Union have all addressed the changes brought about by the containerization of manufactured goods. This chapter discusses a few of the relevant models.

Port Development Models

UNCTAD has been a leading organization in the field of port development in developing countries. Of particular interest is UNCTAD's Three Generation Port Model. Beresford et al. (2004) provide a summary of the model. It proposes that there are three distinct stages in port development. First generation ports "were considered to operate in isolation where they acted as an interface between land and sea transport." Little integration existed with shippers, shipping lines, and the local community. These ports handled break bulk cargo, and a mix of labor and capital was relied upon for competitive operations. Second-generation ports developed a greater level of services and had facilities housing commercial activity related to imports and exports. These second-generation ports offered more than a simple transit point between land and sea as port authorities and operators became more responsive to business needs. Third generation ports reflected changes in the global economy, including containerization and international production networks. Integration between transport modes took on greater importance and

technology became a significant competitive factor. UNCTAD's model of port development was based on an assumption that ports progress through each stage in order to reach third generation status. The Three Generation Model also suggested a timeframe that captured the typical development patterns. First generation ports were prevalent before the 1960's, followed by second-generation ports until the 1980's, and eventually third generation ports that continued to fit observed port patterns in the 1990's when the model was developed by UNCTAD.

The WORKPORT model, which was developed by researchers funded by the European Commission, was created in response to perceived shortcomings in UNCTAD's Three Generation model (Beresford et al. 2004). Researchers believed that the sequential order in port development did not necessarily reflect reality, nor did the suggested time frame. WORKPORT researchers also noted that individual terminals within ports evolve independently and often retain old technologies or practices. Critics also asserted that the link proposed by UNCTAD regarding a port's use of technology and its stage of development was questionable, given examples of instances where volume and other port characteristics dictated what assets are needed.

Notteboom and Rodrigue (2005) present their own port development model within a spatial development framework. They argue that port regionalization, due to the demand for ports to play an integrated role in supply chains, has expanded the geographic scope necessary for evaluating port development. Intermodal connections, freight distribution centers, and inter-port competition have increased the area within which a port operates

and competes. The model also acknowledges the increasing number of ports that serve as transshipment hubs. The UNCTAD and WORKPORT models focused on the port itself and paid limited attention to the port's place within a regional or global network of freight movement.

Robinson (2002) reviewed the literature on the role of ports and proposed a new analytical framework. Although Robinson's work does not create a new port development model, it is an important contribution for understanding the context within which ports develop. As has been pointed out earlier in this work, it is essential to take into account the ways in which supply chains and distribution networks have changed and continue to do so. Robinson examines the evolution of academic research on ports, noting how studies began by viewing ports as locations for the exchange of cargo. He notes how subsequent research valued the operational and economic efficiency of a port, and later on incorporated notions of port administration and government policy. Robinson cites the importance of these ideas but, as Notteboom and Rodrigue (2005) did more recently, suggests that the competitive position of a port can be won or lost outside of the port itself. Access to hinterlands is important, but Robinson stresses the importance of the port's position as only a piece of the total supply chain. Supply chains compete against other chains. A port's competitiveness is heavily dependent on the value that the entire chain brings to shippers. Ports may be operationally efficient and offer an advantage to the firms with which they directly interact, but this might be of little value to the exporter or importer that is managing a complex global supply chain. This does not mean,

however, that ports are not important. Unreliable, high cost, and congested ports will still be avoided and well-run ports are most likely to retain and expand their business.

Historical Evolution of Global Ports

Throughout history, ports have evolved in an incremental fashion. To meet maritime trade demands, ports could add on extra feet of dock and rail to accommodate larger ship size. Ports could also add one berth at a time if necessary. Cranes could be upgraded slowly to keep pace with linear growth in the size of ships. Terminal facilities also grew incrementally, with warehouse and yard space expanding gradually.

Although activities at the port competed for space, ports allocated resources in a fashion that allowed for mixed uses. Automobiles, bulk, breakbulk, and containers were given space according to their profitability, but no particular activity was successful in pushing out rival cargo activities entirely. Shifts in allocations of port resources occurred little by little. This process was acceptable prior to the rise of multinational production. Many countries had only one port and were able to grow slowly within a port development paradigm that had evolved over centuries.

Since ports are forced to invest in specialized and costly container-handling equipment and terminal infrastructure to stay competitive in the global economy, the incremental port development of the past has given way to a system of major investments to keep pace with global commercial trade demands. It no longer suffices to add one extra foot of

depth to channels, or construct an additional 10 feet of pier to accommodate new ships.

Assets such as channel depth, berth size, and yard acreage need to increase at a pace that requires significant planning, reorganization, and a rethinking of both the port and its relationship to its surrounding environment.

CHAPTER 8: BARRIERS TO CONTAINER PORT DEVELOPMENT

The objective of this chapter is to demonstrate that there are barriers to using port development as a mechanism for increasing developing countries' level of world trade. It appears that it has never been easier for countries to tap into the global economy by becoming producers in international production networks. Success stories in Asia highlight the possibilities. In addition to China, countries such as Thailand, Vietnam, and Malaysia have benefited from their ability to export goods as part of global supply chains. Similarly, Eastern European countries increased their manufacturing exports during the 1990's and became important suppliers to global markets. The basic preconditions for economic growth still apply, including political stability, rule of law, and economic policies that welcomed foreign investment. Countries also need the appropriate infrastructure connections to the global economy. Ports are critical components of the elaborate maritime system that has evolved to serve global supply chains. With competitive port infrastructure, developing countries can plug into the global economy and use trade to fuel economic growth.

Unfortunately, as this chapter will discuss, there are limits to the ease with which developing countries can develop the necessary container-handling ports. Globalization has made the world smaller in many respects, but location still matters in the global economy. Distance from existing centers of economic production influences port development and overall economic growth. Location also plays a role with respect to distance from trade lanes, as shipping networks and private firms in the port industry

have an interest in remaining close to the most heavily used routes. Along with location, economies of scale are also important determinants of container port development.

Technological changes in port equipment brought about by containerization have enabled a surge in world trade, but their profitability is directly linked with the generating of economies of scale through high volumes of cargo. Finally, because of changes in how port development is financed, the advantages of government investments made in existing ports are difficult to recreate in developing countries, as public financing has been supplanted by a system of privately financed port infrastructure.

This chapter begins with a generic discussion of barriers to entry before presenting three barriers to port development: location, economies of scale, and accumulated public investment. It notes how the conditions needed for container port development present a threshold that ports, locations, or countries must reach before they can attract investment, develop their maritime linkages, and decrease the costs of participating in the global economy.

Barriers to Entry

The maritime industry has become a highly competitive activity in large part because containers have standardized the services provided and the product being handled (van Klink and van den Berg 1998). This means that the services of one ocean carrier are able to be substituted for those of another without a loss of quality in the delivered product – in this case, transportation.

Although the standardization of products or services in a market typically expands the number of producers or suppliers, this has not been the case in the container shipping industry. The substantial changes in the global economy, the shipping industry, and port investment patterns have actually created impediments for port development and maritime trade. These entry barriers limit the number of participants and have consolidated market power in the control of fewer and fewer firms, ports, and countries.

The presence of entry barriers in a particular market suggests that actors will face start-up costs that deter them from participation. While economic theory assumes perfect markets in which there are no entry barriers, the global economy rarely behaves in this fashion. In a competitive market, an actor is free to participate with any level of economic activity. Entry barriers prohibit this possibility, instead requiring the actor to generate enough activity to recoup the costs of entry.

There are many instances where entry barriers limit the potential for countries to develop particular industries. In natural resource extraction – an activity that many developing countries can participate in – the cost of mining equipment as well as the skills requirement can deter investment. Specialized port terminals are required to handle bulk commodities, and dedicated rail infrastructure is often necessary to ensure profitability. The costs of entry can limit participants. Within this framework, it is possible to view multinational production as one general market with port infrastructure requirements serving as a barrier to entry.

Ports and Barriers to Entry

Entry barriers have emerged at multiple levels. Work done by De Langen and Pallis (2007) discusses entry barriers for firms in the context of liberalization of port services. The authors present three types of barriers to entry: economic, regulatory and institutional, and locational. The economic entry barriers are divided into two sections: *absolute cost advantage* and *the magnitude of switching costs*. Within the *absolute cost advantage*, there are three specific barriers considered: a better location in the port; a larger scale of operation with associated scale economies; and incumbents benefiting from accumulated public investments.

This research proposes that the framework De Langen and Pallis employ for absolute cost advantages to identify entry barriers at the firm level in the port industry can be applied at the port level in the maritime industry. Countries have a need to develop their ports, but they face barriers as a result of a variety of changes in the global economy and maritime industry. The following sections attempt to show how these changes have contributed to this entry barrier. The first section addresses how an unfavorable location can impede port development. The second section discusses scale economies in the maritime industry and includes an analysis of past trends in ship size, port characteristics, and volume and market size requirements. The third section presents a case for how changes in port financing, combined with a growing gap between the top global ports and their competitors, are increasing the barrier to entry.

Location

There are many instances throughout history where ambitious efforts have been made to improve access and reduce distance in the global economy. The Suez Canal shortened the time to transport goods between Asia and Europe by eliminating the need to circle the entire African continent. In similar fashion, the construction of the Panama Canal allowed for ships to cross between the Atlantic and Pacific Oceans without having to sail around the South American continent. The role of railroads in opening up new territories and markets has been well documented. An important recent example was the construction of the Channel Tunnel between France and England, which has brought the markets of Continental Europe and the United Kingdom much closer together.

Advances in maritime transportation decreased the importance of distance in the 20th century. The reduction of transportation costs due to the use of containers and containerships offset the increased distance between production centers and consumer markets. Improvements in communication technology allowed for the relocations of production. Relatively low oil prices ensured that while distance in supply chains was growing, the per-unit costs of transportation remained low.

Distance may have declined in importance as a determinant of export production, but it continues to play a role in shaping the location of activity in the global economy. Because supply chains have grown complex and the trade of intermediate goods has ballooned, proximity to suppliers and final assemblers is critical. This importance of location is

highlighted by the concentration of multinational production in Asia; per-unit transportation costs may be low, but the relative importance of overall transportation cost is still significant. For low value products, global production networks could not function if intermediate products needed to be shipped from all corners of the globe. Instead, supply chains benefit from production concentrated in a particular region where intermediate products move quickly and cheaply through the production process.

The advantages of regionally centered production networks include more than just fuel costs. The maritime industry is more efficient and ships travel faster than before, but goods in buyer-driven networks must meet stringent market demands. The value of goods is in part dependent on whether it arrives in a timely manner to consumers. Because intermediate goods move more quickly between locations, multinational production can more easily satisfy supply chain requirements if the distance between manufactures is minimized. Remote locations, even with lower labor costs, may not be able to meet the requirements for timely delivery of orders. In the modern global economy, the pressure to meet market demand as quickly as possible is high.

Another factor that makes location a barrier to port development is the relationship between proximity to heavily used trade lanes and the quantity, quality, and price of maritime transportation services. Because a vast amount of shipping activity flows along an East-West axis, ports along this global maritime highway have an advantage due to the greater number shipping options between production centers and consumer markets. With these options comes an increase in the quality of service, including the availability of

direct maritime connections. The competition between ocean carriers for customers along the East-West trade routes lowers the cost of maritime transportation, allowing for more competitive participation in global supply chains. Countries that are far from these routes have less choice and pay more for comparable services.

Direct shipping services to consumer markets is a particular advantage for exporters. The handling of containers in ports is one of the more significant costs in maritime transportation. Transshipment from one vessel to another adds to the total transportation cost. Because of the highly competitive offerings between Asia, North America, and Europe, containers can be loaded at a port in the country of origin and offloaded at the destination port. Transporting a container from Vietnam to Europe on a direct route is likely to be cheaper than shipping an equivalent container from Sierra Leone to Europe via Algeciras, Spain, despite the closer proximity of West Africa. For this reason, the barriers due to location cannot simply be measured in distance from consumer markets. Rather, it can be the distance from a trade lane with competitive services and rates.

For the reasons listed above, distance remains an important determinant in economic development and acts as a barrier to port development. The maritime industry has transformed itself to serve global supply chains, but the very changes that shrank the distance between some locations (e.g. China and Europe) have in some respects made other locations relatively more remote.

Economies of Scale

Perhaps the most important barrier to port development for many countries is the economies of scale that have emerged in the port and maritime industry. Economies of scale at ports occur when there are cost savings associated with handling larger volumes. The per unit cost of moving containers decreases as new tools, technologies, and configurations are introduced to accommodate increases in cargo. Economies of scale give a competitive advantage to ports with high volumes and are disadvantageous to ports serving small markets. Because port activities are no longer as labor intensive, developing countries cannot leverage their low wages for port labor as had been previously done.

Economies of scale are one of the primary reasons why containers were introduced. Moving goods in container-loads rather than piece by piece or on pallets reduces costs and increases the efficiency of port operations. Shippers are encouraged to move full container loads, thus minimizing the number of times that goods are handled. Less-than-container loads (LCLs) are ultimately consolidated into one container at a warehouse either on- or off-port.

There are many areas of the port industry where economies of scale are present. Three of them are identified below. Containerization brought greater economies of scale to the shipping industry as specialized and increasingly large containerships were developed. Ports adapted to these changes by acquiring larger cranes and yard equipment. Port

access channels have also been deepened to accommodate the new dimensions of containerships. To handle the containers, ports built connections to rail lines, improved links to distribution networks, and created off-port locations. Leading ports capitalized on the economies of scale, making competitiveness in the port industry directly linked to handling an ever-increasing number of containers.

Changes in the design of ships have enabled economies of scale in the shipping industry. Ships were first converted to carry containers exclusively. The next step was to eliminate on-board cranes in order to expand the number of containers being transported. Specialized container ships are able to employ fewer workers and achieve significant labor cost savings.

The more recent trend has been the dramatic growth in ship dimensions. Cullinane and Khanna (2000) offer 5 generations of containerships based on design and size. The earliest ships had maximum capacities of 1000 TEU, while late 1960's and early 1970's ships were constructed with 1500 TEU capacity. During the 1970's and early 1980's, containerships were generally no greater than 3000 TEU, but changes in 1984 introduced 4500 TEU ships. The dimensions of these 3000-4500 TEU ships reached the limit of what the Panama Canal could accommodate (Cullinane and Khanna 2000). Beginning in 1995, in what the authors call the 5th generation, containerships of over 6000 TEU were being delivered to ocean carriers. These new ships use much less fuel per container than those of previous generations.

What made the 5th generation ships so unique was the much higher rate of adoption by ocean carriers. The earlier generation of ships were adopted slowly and trickled down from early adopters and market leaders to ordinary shipping lines. During the late 1990's, most ships on order were well over 3500 TEU, signaling the beginning of an arms race in the shipping industry (Cullinane and Khanna 2000).

Ships have since continued to grow and the latest deliveries to Maersk are nearing 14000 TEU. One of the ways to finance these massive, expensive ships was through the formation of alliances among ocean carriers. In addition to being able to offer enhanced global networks, alliances have allowed ocean carriers to boost cargo volumes and justify megaships. (Cullinane and Khanna 2000). This type of cooperation - Vessel Sharing Agreements – had not been common prior to the 1990's (Trace 2002) and is considered to have contributed greatly to the rapid growth in use of container ships over the past two decades.

The world's top container ports are increasingly large. Having done away with non-container operations, the focus has turned to acquiring larger berths, cranes, yards, and gates. These container terminals often operate around the clock, with some even open on weekends. These ports handle the largest ships and prioritize business relationships that generate high volumes of containers.

To accommodate the increased traffic, these ports have completed significant dredging projects at an accelerated pace. The economic advantages of large ships become

disadvantages if they have to wait for unloading or loading in port. For this reason, the number and size of berths at the quay has grown tremendously. Cranes have grown in size and improved their productivity. Containers at leading ports are stacked higher, and investment in container-handling equipment has led to faster and more reliable tools, as well as expanded the total number operating at a terminal.

Economies of scale within the boundaries of the port are essential, but the port must also be able to distribute and receive containers from its hinterland. Supply chains take advantage of intermodal infrastructure to move containers quickly and efficiently to off-port sites for distribution. Important economies of scale are gained when trucks, trains, and barges connect with large distribution centers and warehouses. Leading ports around the globe often have on-dock rail facilities to move containers quickly between ships and trains. Rail can be an affordable transportation mode for goods that are either low value, not time sensitive, or both. Profitable rail, however, is dependent on having sufficient and regular demand. Ports with enough volume can justify investing in assets that help move goods to and from their hinterlands and reinforce their competitive position.

Some economies of scale in ports are actually derived at off-port locations. Inland terminals handling full and empty containers relieve congestion at port terminals.

Imported goods are more quickly moved out of the terminals, providing space to operate, as well as contributing to lower costs by improved efficiency. An especially beneficial aspect of inland terminals is their ability to store empty containers (Notteboom and Rodrigue 2005). Because empty containers may be less time sensitive, they can be stored

for extensive periods of time outside of the port and summoned whenever it is convenient for the terminal operator or ocean carrier. The movement of empties is an extra cost within the intermodal network, and inland terminals serve as a lower cost storage solution.

An important determinant is the size of the market that the port serves. The market can be located in the immediate vicinity of the port, or in the interior of the country or region. The size of the market can be measured by a variety of indicators, including GDP, import volume, or population size. This will have a tremendous impact on the port's future profitability, and determine the financing possibilities for the container terminal development.

A large segment of a port's market is the manufacturing sector that uses the port for imports or exports. Since much of global production involves the movement of intermediate goods from one link in the supply chain to the next, manufacturers must have access to inputs arriving by container ship. Manufacturers, of course, must also have the ability to export their products, whether as intermediate goods or finished products. Taken in combination with market size, a balanced combination of imports and exports – whether in volume by weight or measured in value – can make a port and the market it serves more attractive to shipping lines and port infrastructure investors.

Leading global ports are growing in countries where either the consumer market or the export industry has attained a certain size. Because of the traffic that these imports and

exports generate, ports can afford to invest in increasingly large assets based on the high likelihood that projected cargo flows will continue. The high capital costs require considerable economic activity to justify investment.

In a port without significant transshipment, the market size of the hinterland will determine the level activity of the port. The market size requirement for a port's hinterland is applicable for transshipment port development as well. A "local cargo base" limits the consequences of losing transshipment business due to regional competition (Gouvernal, Debie, and Slack 2005).

Accumulated Public Investment

Many of the largest ports have been able to sustain the leading positions in part because of previous investments in port infrastructure. These ports built up their assets over time. Dredging projects were continuously completed to accommodate the growth of ships. Terminals were expanded to match both the growth of the domestic economy and the rise of global trade. These ports are able to reap the benefits of the investments by capturing economies of scale.

Leading ports may also benefit from decades of domestic infrastructure investment. Because the shipping container has allowed for intermodal movements from ship to truck or train, infrastructure to facilitate these flows provides an advantage to the host country. Ports are now more than just points for loading and unloading ships, but serve as

connectors between modes within global supply chains. As Notteboom and Rodrigue (2005) emphasize, inland transportation costs represent an average of 18% of logistics costs, but are in many cases much higher. The connection with land transportation infrastructure at the port represents a significant portion of these costs, which it can contribute directly through congestion and delays. Government revenues from previous economic growth have been used to finance domestic infrastructure, providing a further cost advantage to the country for participating in global trade, whether through imports or exports.

As the role of government in port development recedes, new ports do not benefit from some of the important characteristics of public infrastructure investment. In the past, governments that were concerned with long-term economic growth often financed port infrastructure. The governments did not necessarily recoup the costs of the investments because their aim was to provide infrastructure resources for their economy (De Langen and Pallis 2007). In recent times, governments in wealthy countries are unable to invest as much due to self-imposed constraints, and governments in poor countries are unable to make similar investments due to a lack of financing and constraints imposed by donor and lending agencies.

The increased role of the private sector in financing port development contributes to the barriers to port development. Private companies are motivated by profit and seek to benefit from economies of scale in the port industry. Public investment in many of the world's leading ports was undertaken as a tool for economic development. Paradoxically,

developing countries have difficulty attracting investment in ports because they have low volumes of trade, but their trade will remain low without adequate port investment. The gap between developing country ports and leading ports around the globe is difficult to close under these conditions.

This research has not focused directly on the skills and knowledge requirements for competitive port development. Because the port industry is becoming more knowledge-based, there is an entry barrier that can be called *inaccessibility of knowledge and networks* (De Langen and Pallis 2007). Supply chains have grown more complex, and ports and shipping increasingly favor skilled over unskilled labor. Established leading ports gain from accumulated experience and technological know-how. Experienced port authorities and terminal operators can maintain an advantage over newer locations as a result.

In conclusion, it is important to note that there is a paradox when it comes to the link between container port development and economic development. Port development is most easily achieved in locations where there are already high levels of economic activity. Economies of scale can be taken advantage of provided that there are substantial trade flows that can pass through the port. The deficit in port infrastructure faced by developing countries, relative to developed countries, can be overcome by having enough trade to attract private investment. If this is the case, then port development is less and less likely to be a determinant of a country's participation in world trade.

The implications of these barriers are examined in the following chapter. Many developing countries are geographically removed from existing locations of international production and are far from the East-West trade lanes. Their ports do not handle large enough volumes to generate the economies of scale that many of the world's leading ports enjoy. Finally, their port infrastructure has not benefitted and will not benefit from the same levels of investment that many national governments devoted to improving their connections with the global economy.

CHAPTER 9: IMPLICATIONS FOR DEVELOPING COUNTRIES

The barriers to port development may have a strong impact on developing countries. As a result of trends in the port and maritime industry, there will be fewer port locations suitable for modern and globally competitive container terminals. Economies of scale are leading to port concentration as a hierarchy of ports develops, with certain ones handling increasing container volumes while others stagnate. The location and the size of a port's hinterland are the primary determinants. This existing level of infrastructure at a port also contributes to its potential for development. Without these attributes, it may be difficult to justify or attract investment from outside of the country. As developing countries turn to private firms to lead port development efforts, they will have to ensure that appropriate policies and safeguards are put in place to prevent a terminal operator from abusing its monopolistic position in the market. Similarly, as ocean carriers become more vertically integrated and expand into terminal management, they too will acquire higher levels of market power that make ports even more vulnerable to industry and economic volatility.

In Sub-Saharan Africa, the implications of the trends in the port industry are particularly important. The continent as a whole lacks the levels of economic activity that are needed to attract private firms and port investors. Governments in Africa have a poor track record of managing not only their port infrastructure, but also their countries' national economies. Economic development on the continent has been mixed at best and in many cases awful. Sub-Saharan Africa is on the periphery of the global economy in terms of world trade and the routes by which goods move around the globe. The low level of

container traffic being handled at ports across the continent is, unsurprisingly, matched with insufficient or non-existent modern port infrastructure.

This chapter begins by exploring three general implications of barriers to port development. First, trends towards port concentration are reducing the opportunities for all ports to compete successfully in their region. Second, greater private involvement in container port operations may bring the necessary financial resources to fund port development, but the privileged market position that some firms can enjoy may be detrimental to the country's economy. Third, as some ocean carriers take control over container terminals and the maritime industry becomes more consolidated, developing countries may become especially vulnerable to market swings and operational changes of private firms.

The second half of the chapter provides a detailed look at the ports of Sub-Saharan Africa. The range of ports on the Atlantic Ocean - from Senegal to Angola - are presented in the first section. Next, the ports of Kenya, Tanzania, and Djibouti are discussed. The third section identifies the major ports of South Africa, Namibia, and Mozambique. To complement statistics compiled on African ports, information about hinterlands, location, and domestic infrastructure is offered in order to stress the opportunities and limitations facing Sub-Saharan Africa for container port development.

General Implications

As economies of scale continue to reshape in the port industry, the development of ports that serve as gateways to world trade and economic integration is becoming more difficult. A pattern of port concentration is emerging as a select group of ports are making the most out of economies of scale and are out-competing rivals in their port range. Some ports are growing increasingly large, while others are expanding at more modest rates, stagnating, or declining.

There are certain fixed costs associated with calling at ports that are incurred regardless of the volume of cargo being loaded or offloaded. These come in the form of the cost of tugs and pilotage, as well as fees for the use of channels and taxes paid to port authorities, as well as local and national governments. By reducing the number of port visits and increasing the volume handled at each stop, the ship is likely to make more revenue than through a system of scattered, low-volume port calls. Obviously, ocean carriers have always preferred to stop at ports offering the most business potential, but economies of scale created by large ships and an improved ability to load and unload have meant that the incentive for high volume port calls is even greater than before.

Consolidating the movement of containers at a few locations can improve the balance of imports and exports. This improves port productivity as each movement to unload or load a ship or move containers to or from the quay can be followed by a productive move rather than one that simply repositions equipment. Similarly, ships can generate more

revenue for each port call by increasing the total volume associated with its visit. Well-balanced import and export flows also act as a hedge against economic fluctuations. For example, if a country's currency fluctuates and imports become less competitive, the remaining flow of exports can offset the loss of revenue. The reverse is also possible.

The concentration of trade into a select number of ports also allows for the economies of scale necessary to develop intermodal infrastructure. Global supply chains seek out ports where they have the flexibility of being able to choose between modes by which cargo travels. Rail can compete with road transportation over long distances, as well as when fuel prices are high, or the cargo is high weight and/or low value. Inland water transportation and short sea shipping are similar to rail, and all are very dependent on economies of scale for profitability. Large ports are typically better able to offer intermodal services, given that they handle greater numbers of containers on a more predictable basis.

Because of the pressure to consolidate port activity into fewer locations, ocean carriers, terminal operators, and investors are attracted to locations with considerable economic activity. These can be centers of global production, as is the case in much of East and Southeast Asia. Alternatively, developed or emerging consumer markets offer economies of scale to the port industry. The easiest way to generate economies of scale is by serving developed economies and large exporting or importing countries. Another approach is to seek out transshipment volumes along trade routes with heavy traffic. Ports closer to trade lanes have an advantage as their locations can be leveraged to capture economies of

scale. This comes at the expense of developing countries looking to generate port investment. In particular, those on the global periphery are constrained by their geographical distance, which only increases the barriers to port development.

The penalties for ports and countries that lose out to rival locations are significant. Exporters may need to first ship cargo to one of the larger ports before it is transported to its destination. In this case, fuel costs can be higher and more than one ocean carrier might be needed. Transshipment adds the additional cost of loading and unloading, and may lead to a longer total transit time. Finally, each move within the train can increase the potential for disruptions at port or at sea. These penalties are at odds with the demands of global supply chains.

Developing countries are especially vulnerable to the trend of port concentration. They generally have lower levels of exports and their consumer markets are small. Many do not have an even balance of trade because while containerized imports are few, containerized exports may be even fewer. Developing country ports, however, are not the only victims of port concentration. An example of this is in the Baltic where Scandinavian ports have seen their level of connection to main trade routes decrease (Cullinane and Khanna 2000). Hamburg and Rotterdam's dominance has increased as the number of top tier ports in Europe declines in favor of concentrated flows of containers through strategic load centers.

The competitive position of ports can be self-reinforcing. Once ports gain cargo at the expense of their rivals, they profit from the economies of scale. This generates profits, and expectations of future profits, which attract greater levels of investment. New container-handling equipment, better intermodal infrastructure, or channel deepening becomes more easily financed, leading to an improvement in the port's competitiveness. This virtuous cycle is certainly desirable for the successful port, but may prove insurmountable for its competitors.

Not only are there fewer opportunities for developing global gateway ports, but the path to capitalizing on the remaining opportunities presents growing challenges. In many cases, developing countries are unable to publicly finance port development. Container terminals are extremely costly and many countries simply do not have the funds. In cases where they might, the trend is still to rely on the private sector for investment and leadership. Developing countries therefore have looked to private terminal operators to either participate, or in many cases, take most of the responsibility for port development.

In the privatization of port assets, terminal operators typically seek to acquire control over an entire terminal. They often eliminate non-container activities, reconfigure the terminal layout, invest in container-handling equipment, and optimize the terminal operations. The expectation is that private firms have greater incentives to maximize productivity, efficiency, and profitability than do public entities. In theory, the improvements at the terminal should benefit the users of the port and ultimately the country's overall economy. What can happen, however, is that terminal operators abuse

their newfound monopolistic position. There are few port terminals competing for business in many developing countries, and in many cases, there is only one container terminal. Without competitors, terminal operators have less pressure to provide competitive services, lower prices, and respond to local and national demands. This runs contrary to the notion that the private sector is a viable substitute where government has failed.

Port authorities and governments must take into account the dangers of granting a private firm a monopoly (or partial one) during the privatization process. Unfortunately, as is the case with many complex economic matters, developing countries have a poor track record of anticipating and mitigating problems. One possible solution is to privatize port assets in pieces, such as granting exclusive use of certain piers to terminal operators. While this would allow private actors and port authorities to evaluate the benefits of privatization with less risk than wholesale privatization, the economies of scale and resulting profits may be too limited to attract investors. Terminal operators are interested in acquiring total control over their operations, and the sharing of assets is a strong deterrent. Privatization at the terminal level allows for private firms to create the reliability in their operations that is essential in global supply chains. Piecemeal privatization leaves more actors (e.g. port authority, rival terminal operators) in the port, which can adversely impact the terminal operators' activities.

Van Niekerk (2005) and De Langen and Pallis (2007) stress the need for balancing port reform and concessions with ensuring that private terminal operators do not gain

monopolistic power. The authors, however, make the assumption that private monopolies will inflict greater harm than government monopolies due to the governments' responsiveness to social concerns. It is worth considering whether monopolistic behavior by the private sector in the port industry is necessarily worse than the impact of government-run port operations. In numerous cases, port authorities and governments see their port assets as revenue generating and use the fees collected for other projects in the country. As discussed earlier, ports have also been used as a source of employment, and politicians have been able to capitalize on their ability to distribute jobs to constituents. In terms of port operations and competitiveness, port authorities have struggled to implement appropriate pricing of their services and do not always adapt to market demands as quickly as possible. Considering these factors, it is important to assess the tradeoff between private terminal operators behaving monopolistically and the inefficiencies of government operated terminals and ports.

Preventing monopolistic behavior is not the only difficult issue for developing countries wishing to rely on private firms for the financing of port development. In negotiating agreements, governments often specify the levels of local labor that must be used, or introduce other requirements specifying that local firms must be part of the bid for the assets to be privatized. These conditions can cause inefficiencies and limit private interest in the project. In a more direct way, corruption by port authorities and governments add costs to terminal operators wishing to acquire assets and invest in developing country ports. More broadly, developing countries are often at a disadvantage in terms of their understanding of the global economy. Negotiators may fail to recognize opportunities,

undervalue their assets, or unduly reject offers and bids from firms. Resources such as information and staff that are available to global terminal operators and port industry actors may far exceed those available to governments and port authorities. As is the case in many industries, the knowledge-gap can penalize developing countries in their interaction with the rest of the globe.

Regardless of whether port development is undertaken by the private or public sector, the need for specialized container terminals is problematic in some instances. Many countries only have a few ports and quite a few only have one. Terminals in developing country ports can still be multiuse, with activities including the handling of containers, vehicles, bagged commodities, heavy lift items, and construction materials. Because of the low level of manufactured goods trade at many ports, container handling may not be the primary activity. The diverse range of activities can actually limit risk for firms operating at the port, provided they serve customers in a range of industries. Modern container terminals, however, are based on specialized configurations and tools. Non-container activities have been pushed to other areas of the port.

Terminal specialization in North America and Europe was successful in large part due to the ability to shift non-container activities not only within but also outside of the port. Other locations could perform the services that were eliminated at the specialized terminals. For developing countries with one or few ports, the relocation of non-container activities is not as simple. Small ports have fewer existing quays and terminals capable of accommodating the remaining breakbulk, vehicles, and other goods no longer accepted at

container terminals. Building additional terminals within the port is an expensive alternative. The option of switching to another port (if it exists) may be even more costly due to the poor domestic transportation infrastructure in many developing countries. Specialization, while needed for profitable container terminal operations, puts additional pressure on the port industry to find ways of absorbing the relocated non-container activities. This is yet another hurdle for countries looking to use port development as a mechanism for increasing manufactured trade.

The threat of monopolistic behavior by firms in the port industry is not limited to the case of private terminal operators. The concentration of market power among ocean carriers and their alliances is emerging as a destabilizing force in the port industry. In seeking to capitalize on economies of scale, ocean carriers have acquired rival firms. Alternatively, they have formed alliances with competitors in order to boost capacity on certain trade routes. This has allowed ocean carriers to take advantage of larger ships, thereby decreasing their costs. Economies of scale are reflected in the decrease in shipping rates on many of the world's high traffic routes. The top ocean carriers have also been able to offer more frequent sailings, as well as networks that span a wider geographical range. The competitive advantage of higher frequencies, reduced costs, and improved networks in turn generates greater demand for an ocean carrier's services, further enabling it to take advantage of economies of scale.

Ocean carriers that cannot keep up with the changes in the industry have trouble competing in the new global environment. Small- and medium-size shipping lines have

traditionally had success serving developing countries, especially in Africa and Latin America. These carriers do not necessarily offer lower costs, but have been more flexible in accommodating shippers' desire for flexible payments and delivery of cargo (McCalla, Slack, and Comtois 2005). They frequently use ships that can carry both containerized goods and other cargo, including vehicles and oversized items. The diverse range of customers allows them a reduced risk as market fluctuations in a specific sector do not overly influence these carrier's profitability. The ships tend to be older and may have been sold by leading shipping lines that have acquired more modern equipment. They may not be as efficient and maintenance costs can be significant, but their low purchase price decreases the capital costs of serving developing countries.

Because these ships are now technologically obsolete for many leading ports around the world, they are finding fewer opportunities to carry goods between developing and developed countries. They take longer to load and unload and can generate more pollution than newer ships. Most importantly, they carry less cargo, meaning that each stop in a port is not only less profitable for the shipping line but for the terminal operator as well. This means that while the level of demand for the goods may not have declined, the level of demand *for goods carried by these ships* is lower. The demise of small- and medium-size ocean carriers has the potential to harm developing countries' ability to trade, unless they are replaced by services from the larger ocean carriers that are looking to expand their networks.

If the world's top ocean carriers do in fact supplant the small and medium ocean carriers in serving developing country ports, this will add to their already significant market power. Global shipping lines and the alliances among them represent access to the world economy. The volume of cargo that they carry is tremendous and ocean carriers will use this market power to push for lower costs of doing business at the ports at which they call (Cullinane and Khanna 2000). Terminal operators and port authorities must consider this new environment as they assess the potential for recouping investments in terminals and other port infrastructure. Actors with either monopolistic or competitive positions in the port need to recognize that their ability to set the price of port services is directly challenged by the consolidation of market power in the shipping industry. Because of the considerable importance of each ocean carrier or alliance, the penalty of conflict and lost business is severe. Private investors will certainly consider the diversity of shipping lines calling at a port in making their decisions.

The situation can become even more precarious for port authorities or governments if the firm that operates a container terminal is also an ocean carrier. Vertically integrated firms in the maritime industry have emerged to better serve global supply chains. Shipping lines have expanded their activities to include container terminal operations and land-based transportation. Allowing shipping lines to operate a dedicated terminal at a port may be of interest as the firm now has a strong interest in maintaining cargo flows at the port. The company's presence at the port can be beneficial to importers or exporters who obtain an improvement in the maritime transportation component of their business. A

combined shipping line/terminal operator is also likely to bring financial resources that can be used to finance port improvements and expansion.

There are, however, potential pitfalls to allowing one firm to control such a large piece of a country's containerized trade. Ocean carriers may use container terminals in a manner that suits their business the best but does not maximize the value of the asset for the economy as a whole. Although the combined carriers and operators handle substantial amounts of cargo, the control over both the port and shipping activities may enable them to behave monopolistically. There is also a long-term risk of the company abandoning the terminal by breaking the contract or leaving at the end of the lease. Firms are responsive to their shareholders and have little concern for the economic development of the country. The departure of a terminal operator may be unplanned for by port authorities, possibly leaving few substitutes and resulting in a setback for the port and its customers.

Implications for Sub-Saharan Africa

Developing countries in Sub-Saharan Africa are especially likely to experience barriers for port development. Africa's manufacturing exports are minimal, its consumer markets are underdeveloped, and the existing level of containers being handled in its ports suggests that infrastructure is relatively limited. Making matters more difficult is Sub-Saharan Africa's remote location in comparison to the heavily used global trade lanes. In this section, the ports of three general regions of Sub-Saharan Africa are analyzed in greater detail.

West and Central Africa

Table 13 presents the TEU volumes for ports in West and Central Africa for 2005. This year is chosen due to the higher number of African ports that reported their volumes to *Containerisation International*, a leading container industry publisher and news organization. It ranked 555 ports around the globe in its 2005 collection of port statistics. It is important to note there are no Nigerian ports listed in the table, and that Cameroon and Angola are the only Central African countries represented. Angola is classified as Central African due to Luanda's proximity to the Democratic Republic of Congo (DRC). A few of the following sections will discuss ports and countries without the benefit of recent data.

Table 13 – West and Central African Container Ports – Volumes – 2005

World Ranking	Port	Country	TEU
126	Abidjan	Côte d'Ivoire	571,674
155	Tema	Ghana	392,761
181	Luanda	Angola	316,396
184	Dakar	Senegal	309,000
225	Lomé	Togo	203,372
234	Douala	Cameroon	190,859
260	Cotonou	Benin	158,201
367	Takoradi	Ghana	49,321

Source – Containerisation International

The Port of Abidjan in Côte d'Ivoire is West and Central Africa's largest port. Despite its leading regional position, it is only ranked 126th in the ranking of top container ports by volume. At 571,674 TEU in 2005, its total container traffic is a fraction of some of the world's busiest terminals. Until 1999, Côte d'Ivoire was one of the relative success stories in West Africa before being destabilized by a coup that eventually brought on a civil war. The country was divided between the north and south for a number of years before recently returning to a more peaceful status. Compared to its neighbors, Côte d'Ivoire remains relatively more developed. Its exports are primarily from natural resources, but basic processing of some commodities could lead to higher rates of containerization. This might raise container throughput enough to attract firms and generate investment in the port. Combined with its close proximity to Ghana and a more peaceful set of neighbors (e.g. Liberia, Guinea), Abidjan has some potential for transshipment hub activities.

Though not presented in Table 13, the Port of Lagos in Nigeria may be the second-busiest container port in West and Central Africa. According to *Containerisation International*, Lagos reported a throughput of 443,507 TEU in 2004. The port serves the immediate hinterland in and around Lagos, as well as the interior cities of Abuja and Kano. Considering that Nigeria has a population of nearly 150 million (CIA World Factbook 2009), the number of containers passing through the port is quite small. Nigeria remains a poor country and its consumer markets cannot afford many imports. The Nigerian economy has been focused on the country's vast oil reserves at the expense of other industries. Should Nigeria's economy begin to transform itself and generate wealth for

the population, there is potential for tremendous economies of scale as a result of its population. Private investors, however, have been deterred by rampant corruption and increasing lawlessness and violence in the Niger River Delta. For terminal operators and shipping lines, the risks of doing business in Nigeria complicate the environment in which they operate. With a substantial improvement in the political and economic climate, Lagos would be a logical place to serve the large Nigerian hinterland while also acting as a hub for its many neighbors.

The Port of Tema in Ghana is the third largest in West and Central Africa. Ghana has been one of the few bright spots in the region since becoming, in 1957, the first Sub-Saharan African colony to gain independence. The country is stable and has had democratic transitions in the past decade. Its exports are primarily commodities and that is reflected in the modest (392,761 TEU) container traffic. Tema acts as a gateway for Accra and the immediate hinterland but is poorly connected to the northern half of the country (Fair and Jones 1991). To the west of Tema is the port of Takoradi. It handles some containers but serves primarily as a gateway for Ghana's natural resource trade. The separation of port functions into two locations may be an advantage for future port development as Ghana seeks to expand its container terminals. The remaining non-container functions at Tema could be relocated to Takoradi should there be space constraints. Ghana's track record as a country with a stable political environment can help attract private investors. For this reason, shipping lines and terminal operators looking to expand in West Africa may choose Ghana over neighboring locations.

One of the ports most suitably located to become a transshipment hub is the Port of Dakar, Senegal. Although it handles little more than 300,000 TEU (184th world ranking), it is the first stop along many of Africa's trade routes. It is the largest port by far when compared to its neighbors and is the closest port listed in Table 13 to Europe and North America. Senegal, by West African standards, is stable and the breakaway region of Casamance has been generally peaceful. There is a rail line that links Dakar to the landlocked country of Mali, although the infrastructure has deteriorated significantly in recent decades (Fair and Jones 1991). Although this is a modest hinterland to compete for, Mali and its capital city of Bamako have few choices of ports in the region. Senegal's other neighbors do not offer much in the way of hinterlands and economies of scale. Guinea and Guinea-Bissau's level of existing development is abysmal, and security in the region is tentative. For this reason, while Dakar's location is attractive, terminal operators would be forced to rely on transshipment traffic rather than gateway traffic. While potentially profitable, there is more risk for port developers without a domestic or regional hinterland. From Senegal's perspective, a transshipment hub could generate revenue through fees, leases, and privatization. A transshipment hub, however, might not extend the same level of benefits to importers and exporters, as would a true gateway port.

The geography of many countries impacts how port development in West Africa will take place in the future. The neighboring ports of Lomé (Togo) and Cotonou (Benin) are small and rank 225th and 260th respectively among world container ports. Togo and Benin have infrastructure that was designed during colonial times to extract resources and link the

interior of the continent to the Atlantic Ocean. The countries are narrow North-South slivers of land with large populations concentrated along the coast. The hinterlands for each container port are very near to one another but not well connected. The improvement of transportation links in an East-West direction would help generate economies of scale in the region. Accra, Ghana and Lagos, Nigeria, are also in close proximity. Cooperation, however, is strained by the desire of each country to maintain their port's gateway status. There is just cause for these policies, as there is a history of instability that could threaten agreements. Politically, it is also advantageous to use ports as a means for generating revenue and creating employment. Because of the concentration of countries in the West African region, there may continue to be an oversupply of ports but a shortage of container-handling capacity.

East Africa

Table 14 – East African Container Ports – Volumes – 2005

World Ranking	Port	Country	TEU
144	Mombasa	Kenya	436,671
185	Dar es Salaam	Tanzania	305,866
233	Djibouti	Djibouti	193,600
460	Tanga	Tanzania	13,682

Source – Containerisation International

On the Indian Ocean side of Africa, there are fewer container ports than in the more densely populated West African region. The container volumes for the four ports that reported statistics to *Containerisation International* in 2005 are shown in Table 14. For this analysis, the ports of Mozambique are categorized as Southern African, although the case can be made that locations in the north of the country are East African as their hinterlands include countries in the Great Lakes region. Somali ports are ignored due to the lack of statistics and dysfunctional national economy. The problem of piracy in Somalia, however, will be covered in the chapter that makes recommendations on future research.

In East Africa, the Port of Mombasa in Kenya is the most active container-handling facility. It ranks 144th in the world in terms of volume and serves as a maritime trade gateway for the entire country, including the large capital city of Nairobi. Kenya has been reasonably stable since independence, although violence in 2007 following presidential elections highlights the difficulties the country has had in becoming a well-functioning democracy. Mombasa also serves the Ugandan market and the country's relative economic success has contributed to some of the volume at the port. The strength of relations between the two countries is critical as Uganda is landlocked and has few alternatives to exporting and importing via Kenya. The Port of Mombasa's captive hinterland in Kenya and Uganda may in fact be detrimental to its competitiveness. Rather than capitalize on economies of scale and leverage its location in order to secure investment and boost productivity, the secure position has allowed for complacency (Hoyle 1999). Privatization may improve the ports responsiveness to market demands,

but there may not be the economies of scale necessary to attract terminal operators and investors. At around 500,000 TEU for the port as a whole, this is the size of many mid-sized terminals in developed countries. The spatial configuration of the port may not permit for a centralized and specialized container terminal. Transshipment is possible in Mombasa as it is the first viable location along the Indian Ocean coast as ships come from Asia, the Middle East, and the Mediterranean Sea. Because there are few other ports in the region and low levels of economic development for East and Southern Africa as a whole, transshipment volumes may still be insufficient.

The only regional rival to the Port of Mombasa is the Port of Dar es Salaam. Its world ranking for container volume is low (185th) and its hinterland is even less economically developed. Dar es Salaam, the capital of Tanzania, is the primary hinterland for the port, although it also handles maritime trade for the small countries of Rwanda and Burundi. These countries are still recovering from turbulent years in the 1990's and cannot be counted on for substantially increasing demand. At times, the Ugandan market has used Dar es Salaam as its access to world trade, but this option involves moving goods along smaller roads (and potentially water transport across Lake Victoria). The Port of Mtwara in southern Tanzania has container-handling abilities but has not reported figures to *Containerisation International* since 2002. It is a small port with a road link to Lake Malawi. Malawi is landlocked and in desperate need of improved access for trade, but its economic development is not a politically motivating factor for Tanzanian policy makers. For this reason, the Port of Dar es Salaam will continue to enjoy a monopoly on much of its existing hinterland. This situation offers payoffs to the current government authorities

and private firms currently operating at the port, but as is the case in Kenya, the resulting complacency negatively impacts port customers. Similarly to Mombasa, the volumes are modest in global terms and unlikely to generate the economies of scale that bring profits comparable to other port locations.

The Port of Djibouti exhibits many of the characteristics that allow governments to attract private investors for port development. Although Djibouti's container throughput was minimal by global standards in 2005, it has major advantages pointing to its future success. First, it is located on the East-West trade lanes, as the port is at the entrance to the Red Sea for ships coming from the Indian Ocean. This makes it an ideal port of transshipment operations, and Dubai Ports World (DP World) acquired the rights to manage the container operations for the entire port in 1985. It recently opened a new terminal in Djibouti with a capacity of 1.2 million TEU. DP World's target transshipment range is globally focused, but also aims to take business from the Ports of Mombasa and Dar es Salaam. It brings competitive management practices and vast financial resources to the East African port industry unmatched by Kenyan and Tanzanian port authorities. Further strengthening its position is the landlocked position of Ethiopia. Since Eritrea's independence, Ethiopia's large market has been cut off from direct access to maritime trade. Economic growth in Ethiopia has helped the Port of Djibouti by generating volume and limiting risk from the volatile and highly competitive market for transshipment. Djibouti and Ethiopia's success is mutually beneficial but has an adverse impact on East African countries as it moves port industry investment farther to the north and makes their location even more remote.

Southern Africa

The two largest ports of Sub-Saharan Africa are found in Southern Africa. Table 15 shows the 2005 container volumes for container ports in the region. The ports of South Africa dominate this range and the country is the only one in Sub-Saharan Africa with more than one gateway container port. Two ports in Mozambique – Beira and Nacala – are omitted from Table 15 because they last reported statistics in 2004 and 2001 respectively.

Table 15 – Southern African Container Ports – Volumes – 2005

World Ranking	Port	Country	TEU
48	Durban	South Africa	1,955,803
104	Cape Town	South Africa	736,943
162	Port Elizabeth	South Africa	370,849
334	Walvis Bay	Namibia	71,456
360	Maputo	Mozambique	54,088
382	East London	South Africa	42,545
498	Lüderitz	Namibia	6,154
506	Richards Bay	South Africa	4,981

Source – Containerisation International

The Port of Durban is the largest in Africa. It ranks as the world's 48th busiest container port and is the gateway to increasingly developed hinterlands in Durban, Johannesburg,

and other parts of the country. From its location on the Indian Ocean coast, it offers the strongest access to much of South Africa through extensive road and rail connections. There is also manufacturing taking place in the eastern half of the country that uses Durban for exports. The nearly 2 million TEU passing through the Port of Durban in 2005 are almost four times the volume of any other Sub-Saharan African port (Abidjan: 571,674 TEU in 2005). On the Atlantic Ocean, the Port of Cape Town had a throughput of 736,943 TEU in 2005. Cape Town is the second-busiest port in Sub-Saharan Africa and has a wealthy hinterland in the immediate area of Cape Town and the Western Cape region. Containerized agricultural products such as fruit are contributing to the growth of Cape Town's port. Because of the distance between Durban and Cape Town, the two ports' natural hinterlands are well protected from each other. In between these two ports are those of Port Elizabeth and East London. They serve the markets in the middle of the country as well as the manufacturing industry in the two cities.

South African ports are the primary gateways for the landlocked countries in Southern Africa. Lesotho, which is completely surrounded by South Africa, is an exporter of textiles and other low-value products is very near to the ports of Durban and Port Elizabeth. The largest market in Botswana is the capital city of Gaborone and is only a short distance to Johannesburg and its road and rail links to Durban. Zimbabwe had made extensive use of the Port of Durban despite the proximity of ports in Mozambique. The civil war there had made trade routes unreliable and the superior infrastructure in South Africa compensated for the increase in distance. Zimbabwe's ongoing economic and

political crisis has reduced trade through South African ports and had the added impact of limiting Zambian trade as well.

The implications of barriers to port development for South Africa appear much less severe than in the rest of Sub-Saharan Africa. Table 15 shows that not only is port infrastructure in Durban, Cape Town, and Port Elizabeth already well-developed but economies of scale are much more substantial than in other countries. The manufacturing industry is far more advanced and the demand for imports from a newly economically and politically empowered population ensures that demand at South African ports will remain high. A large section of the population remains in poverty but South Africa is increasingly grouped with Brazil, China, and India as countries successfully shedding their status as developing economies.

The future of port development in South Africa is likely to focus on appropriate governance models and management practices. The Port of Durban has faced problems in recent years as to how to handle the increasing container volumes and improve its rail connections with the Johannesburg region. There has been pressure on the government as ports are owned and operated by a public port authority. Ideological differences relating to the role of government will shape events in the future and the level of involvement of private terminal operators will be a result of this discussion. Should the private sector be called upon, the ports offer many characteristics that are attractive to firms and investors. Existing infrastructure and economies of scale are already available at most locations to meet the needs of terminal operators looking to acquire globally competitive port assets.

The ports of Walvis Bay, Namibia and Maputo, Mozambique are much smaller than those of South Africa. Walvis Bay's hinterland is the city itself and Windhoek, the Namibian capital roughly 200 miles in the interior of the country. Maputo is the capital of Mozambique and the port's hinterland is limited beyond the immediate region.

Mozambique is one of the poorest countries in the world and the Port of Maputo is only the 360th busiest container port in the world. Walvis Bay's 71,456 TEU handled in 2005 are hardly more globally significant and rank 334th in the world. Both countries have been hurt by decades of instability as civil war and interference by South Africa has inhibited economic development.

Two other ports in Mozambique show the importance of land-based transportation infrastructure and expanded hinterlands for port development. Mozambique can be divided into three general regions. Maputo's port is in the south of the country. In the central region, there is the Port of Beira. It is the closest port to Harare, the capital of Zimbabwe. It reported a throughput of 43,813 TEU in 2004. Instead of being a gateway for Zimbabwe when the country had a flourishing economy during the 1980's and early 1990's, Beira was underutilized as civil war in Mozambique deterred the use of the port. Unfortunately, once the civil war in Mozambique finally ended in the 1990's, Zimbabwe slid into chaos and its economy crashed. The Port of Beira has been unable to expand its domestic hinterland because infrastructure within Mozambique is poor and is based on natural resource extraction activities from the Portuguese colonial period. The Port of Nacala in the northern half of the country faces similar constraints. It is linked to the interior of the country and continent by a poorly maintained rail line (Fair and Jones

1991). Together with Maputo, Beira and Nacala offer the Mozambican economy three potential locations for port development. The potential level of activity at each port, however, is limited by the fact that each section of the economy is isolated from the others. Each on its own is unable to offer economies of scale. The size of the country and distance between populations and markets makes a national strategy of port development very difficult to implement. Each has a defined hinterland that is neither expandable nor sufficient for the demands of the port and maritime industry.

In summary, some of the key characteristics impacting the potential for port development are found in all regions of Sub-Saharan Africa. Distances between consumption centers are often great and transportation connections between them are underdeveloped. Inter-port competition may in theory generate a competitive market for logistics services, but it is possible that potential competitors are too widely scattered throughout the continent. Rail infrastructure has deteriorated significantly and rail lines are unable to handle large loads due to inadequate machinery and poor design and standards of tracks (Pedersen 2001). Ports in Africa have natural hinterlands and relatively few are subject to competition from rival ports. Increasing volumes to generate economies of scale is then entirely dependent on national economic development (Van Niekerk 2005), which is in turn influenced by trade, and trade needs lower logistics costs. Reductions in trade costs are in part achieved by improved port infrastructure, making the situation a vicious cycle that limits economic development.

The implications of port development are relevant outside of Africa as well. The conditions are aggravated by peripheral geographic locations that keep many developing countries at a distance from the world's major trade lanes. Port concentration is occurring as the port and maritime industry seek to capture economies of scale. Not only are there fewer opportunities for the development of competitive locations, but the reliance on privately financed infrastructure development has serious risks. Terminal operators can use their control over a terminal (or all terminals) to charge uncompetitive prices or provide low quality services. Private actors are unconstrained by economic development priorities and their operations might clash with the needs of the national economy. Furthermore, as ocean carriers expand and become terminal operators, this raises concern over the over-dependence of a country's maritime trade needs on the services of a firm responsive primarily to market demands and shareholder votes.

CHAPTER 10: OVERCOMING PORT DEVELOPMENT BARRIERS

This chapter proposes some approaches for overcoming port development barriers. Containerization and other changes in the port and maritime industry as a result of global economic changes have presented another layer of challenges for developing countries. Container port development is a necessity for participating in multinational production. Important determinants of port development are location, economies of scale, and previous levels of port investment. As developing countries seek to attract private investors to finance port development, they are confronted with the fact that they have neither large enough ports nor favorable geographic locations. Their existing port infrastructure is often minimally developed or poorly maintained.

Although a country cannot change its geographic location to boost port competitiveness, a port can expand its customer base and the boundaries of its hinterland. Certain ports have the potential to expand transshipment activities within their region in order to generate economies of scale. This, however, may come at the expense of other ports in the region. Regional cooperation on transportation infrastructure development and overall economic integration would also increase the volumes at some ports. Alternatively, ports can focus on improving their management practices and understanding of the port and maritime industry. This will help port competitiveness and allow policy makers and planners to anticipate and respond to change. International organizations can play a role in facilitating knowledge exchange between governments and the private sector for the benefit of all actors at a port.

Three approaches to overcoming port development barriers are presented in this chapter, but the examples are not an exhaustive list of all options available to developing countries. The chapter continues to focus on Sub-Saharan Africa as the region's location, limited economic development, and inadequate existing port infrastructure contribute to port development barriers. The first section considers potential changes that would capitalize on current global port and shipping industry conditions, including the development of greater maritime linkages and transshipment operations. Second, the chapter discusses the trend of regional cooperation and integration in Europe as a way forward on the African continent. Finally, the third section examines how international organizations can provide training and knowledge dissemination to ports so that governments can implement appropriate port policies that will help improve competitiveness.

Transshipment and Existing Maritime Trade Routes

The development of greater linkages between Africa and the rest of the world, as well as the emergence of a more sophisticated intra-African maritime network, should make trade more affordable and expand opportunities for exporters. Port development is expensive and poor countries are unable to finance the investment themselves. African countries can focus on improving connections to existing transshipment hubs (e.g. Djibouti, Algeciras). A successful transshipment network would allow for incremental investments that let small ports evolve from minor feeder ports to national gateways.

The most developed existing option is to transship goods from Sub-Saharan Africa to ports along the East-West axis. The difficulty with this strategy is that the closest, most productive transshipment hubs are in Djibouti or the Arabian Peninsula for Indian Ocean traffic, and Algeiras on the Atlantic side. These are a considerable distance from potential producers such as Kenya, Tanzania, Ghana, and Nigeria. The smaller, inefficient, and more costly vessels calling at African ports would be used for distances possibly greater than those of network spokes in Asia, contributing to higher logistics costs. Worthy of mention is the rise of piracy near the Horn of Africa that contributes to higher insurance costs, loss of cargo, and either real or perceived unreliability.

An alternative transshipment scenario would involve the development of transshipment hubs for the African continent, perhaps on both the Atlantic and Indian Ocean coastlines. Goods would be subject to the costs of handling at the port of origin, port of transshipment, and port of unloading. An additional step may be necessary if this consolidated African cargo is transshipped again at a point along the East-West axis to benefit from the economies of scale offered by the main lines in global shipping networks. Each of these additional steps increases the risk of damage to cargo (van Klink and van den Berg 1998). A container hub is more likely to emerge along the Indian Ocean coast than on the Atlantic Coast of Sub-Saharan Africa. A port in Kenya or Tanzania is close to the East-West trade route that leads to both Europe and Asia. A port in West Africa can be used for Europe, but is much farther away from Asia.

Unfortunately, the largest market in Sub-Saharan Africa, and consequently the most developed ports, are in South Africa. The location at the end of the continent means that for a transshipment hub to emerge in either Durban or Cape Town, cargo from the rest of the continent would have to flow in the opposite direction of the consumer markets in Europe and North America. According to Iheduru (1996), the South African shipping industry has had a measurable impact on maritime trade in Sub-Saharan Africa. In the 1990's, Safmarine and Unicorn developed alliances with large ocean carriers and gained access to their global networks. They also pursued agreements with smaller African carriers to build on their already dominant position in African maritime trade. Safmarine, however, is now part of the Maersk group and their focus on African trade may have taken a different trajectory.

Allowing some ports in Africa to become regional leaders while others assume the status of feeder ports may be objectionable for many countries. Instability in all regions of the continent has caused distrust and suspicion amongst neighboring countries. This is on top of the unreliability from disruptions due to war and conflict. The port of Abidjan, Côte d'Ivoire is an example of how a country that had a relatively successful development history could fall apart rapidly. More directly related to the maritime industry, the rise in piracy and the inability of the international community to contain it threatens the viability of transshipment via Djibouti or Jebel Ali near Dubai. Spokes linking to a hub port use smaller ships which are more vulnerable to piracy, although it is worth noting that even large ships have been impacted by deteriorating maritime security near the Horn of Africa.

Regional Cooperation and Integration

Few Sub-Saharan African economies have the near-term potential of generating the economies of scale required for profitable container port development. Regional integration has the potential not only to remove legal and administrative barriers to trade but also develop a transportation infrastructure that can bring markets closer together. In this section, the case of the Port of Rotterdam and Western Europe is presented. It provides an illustration of how economic integration and efficient transportation links expand a port's hinterland. The section concludes with an analysis of the applicability of this approach to countries in Sub-Saharan Africa.

Although Italy is not far from the East-West trade routes, it does not have a major container port as compared to the ports of Northern Europe. The fragmented distribution of container traffic among a handful of Italian ports has not generated economies of scale in any individual location. Competition between the ports continues and limits the emergence of a dominant Italian port (van Klink and van den Berg 1998). What is emerging in the Mediterranean is a group of hybrid ports that continue to serve local hinterlands but have expanded their role as transshipment hubs (Gouveral, Debie, and Slack 2005). The European Union has helped finance the development of Gioia Tauro with use of the Regional Fund (van Klink and van den Berg 1998). Gioia Tauro has steadily increased the volume of containers handled since the mid 1990's, but much of this volume is attributable to transshipment. Some of the growth in traffic is linked to a prospering hinterland, as economic growth rates in Italy mirrored those of Europe in the

1990's (Gouvernal, Debie, and Slack 2005). Despite this, certain segments of trade continue to be routed through ports in Northern Europe. As of 2001, nearly 20% of shipments between Italy and Asia were routed through these ports.

To capture the economies of scale available through the use of load centers and rail infrastructure, the port of Rotterdam has worked to improve its connections with European countries beyond its traditional hinterland (van Klink and van den Berg 1998). Rotterdam serves as a gateway port, channeling containers and bulk goods to the rest of the continent via road and rail, or by feeder connections to countries in Scandinavia and the Baltics as well as the United Kingdom and Ireland. Rotterdam has also emerged as an attractive location because of its ability to offer competitive barge service to wide areas of the European continent. Antwerp also has well-developed barge connectivity. Barge transport is cheaper than road haulage and is increasingly emphasized as a freight transportation mode by European policy makers.

One of the target regions for expanding Rotterdam's hinterland is Mediterranean Europe. Because of the significant volume of trade between North America and Europe, Rotterdam is in a competitive location for capturing Italian trade despite the apparent distance between the two countries (van Klink and van den Berg 1998). First, Rotterdam's existing connections with foreign ports are very well-developed and offer Italy far more options than ports in Italy itself. Second, sailing times between Rotterdam and North America are much shorter than between North America and Italy.

The emphasis in Europe has been on the improvement of the continent's rail network. This is for a variety of reasons, including the alleviation of road congestion and the reduction of emissions due to a modal switch from road to rail. National politics in Europe serve as a barrier, just as they do around the world. The German government has subsidized the German railway Deutsche Bahn in the past and looked to create advantageous conditions for German ports (van Klink and van den Berg 1998).

Finding the appropriate mix of regulations and free market activity is essential to maximizing the advantages of the intermodal supply chain. While European policy has favored the development of rail, European regulators have not allowed the cooperative agreements that private actors feel is necessary to profitably operate container rail service (van Klink and van den Berg 1998). Van Klink and van den Berg (1998) go on to explain that without cooperation of port operators, railways, shippers, and logistics providers, container shuttle services between Rotterdam and Italy are virtually impossible to develop.

There are other issues in Europe that limit the ability to generate economies of scale. Government limits on the length of freight trains differ from country to country, and national railways have sometimes unpredictably changed prices for access to their networks (Gouvernal, Debrie, and Slack 2005).

Regional cooperation and integration of transportation and trade links may help develop the economies of scale necessary for the development of modern, competitive container

ports. Implementing this type of policy, however, would be problematic to say the least. Immediate security concerns threaten stability in many regions in Africa and there is little history of successful cooperation among neighbors on these matters. Governments have not developed the trust required to accept a dependence on a neighbor's infrastructure. Also, the importance and prestige of having a hub port in a country may guarantee that no African countries develop a load center in the foreseeable future. As was mentioned previously, ports generate jobs, opportunities for corruption, and political power both domestically and internationally.

Roads, water, and rail linkages would have to be improved for supply chains to cross borders. Common policies and regulations of transport modes may be necessary. It is important to remember that these problems are not unique to Africa. Rail gauges between Spain and France continue to be different, making impossible the movement of freight by rail from ports on the Iberian Peninsula to the rest of Europe. The port of Barcelona has worked to facilitate truck movements between the port and the French town of Perpignan in order to access a rail terminal with the necessary technical specifications (Gouveral, Debrie, and Slack 2005). Paperwork, registration, and licenses would need to be recognized by each country in order to ensure a smooth flow of freight across borders. The likelihood of developing these agreements appears low.

An example of regional cooperation for the development of port infrastructure is in Mozambique, where South Africa has worked with the Mozambican government to develop the port of Maputo. Maputo is closer to Johannesburg's large consumer market

than the largest container port in Sub-Saharan Africa in Durban, South Africa. Similarly, the relatively large Ugandan market benefits from improvements in Kenyan infrastructure. Cooperation and even joint investment in infrastructure linking Mombasa to Kampala would yield gains for both countries. Alternatively, competition between Dar es Salaam and Mombasa for Ugandan trade may have beneficial effects at the regional level. Cooperation between Uganda and Tanzania could put pressure on the port of Mombasa to improve its operations.

Cooperation between countries in Southern and East Africa is made possible by the generally peaceful conditions in both regions. Other parts of Africa may not be as well positioned to build stronger economic and transportation connections between countries. In between Dakar, Senegal and Abidjan, Côte d'Ivoire are the countries of Liberia, Sierra Leone, Guinea, and Guinea-Bissau. The conflicts during the past twenty years in Liberia and Sierra Leone have been highly publicized in the global news media, but the fighting spilled over into Guinea as the three countries share borders with each other. Democracy is in its infancy in Liberia and Sierra Leone, with a great deal of uncertainty remaining in the region. Stability is not better in Guinea-Bissau and is evidenced by the recent assassination of the president and army chief, presumably a result of conflict between the two officials. Without reliable actors in each country's government, the prospects of cooperation are weak. The countries, however, would certainly benefit from greater integration. The total population in each county is rather small. The four countries have inadequate transportation connections between them. Furthermore, they are far from the established ports in Dakar and Abidjan, especially when measured in the distance from

their capital cities, which are the largest centers of economic activity. Unfortunately, building up economies of scale within the region will remain difficult until prolonged periods of peace allow governments to turn their attention from basic rule of law to economic development. For this reason, port development is a matter left to the more distant future.

Outside of ports, rail infrastructure development in Africa provides more examples of intra-African cooperation. In Southern and East Africa, the South African rail company Spoornet has been active in improving the links between countries – both by initiating operational agreements and developing the ability to switch between two different rail gauges (Pedersen 2001). There are other agreements in East Africa that involve non-African investors and African governments. A key improvement of these new arrangements would be advances in the reliability of rail schedules throughout the continent.

Rail infrastructure that links interior regions to ports can play a role in spurring economic development for large areas of Sub-Saharan Africa. One example is the Benguela Railway that connects the Port of Lobito in Angola with the mining regions of the Democratic Republic of Congo (DRC) and Zambia (Fair and Jones 1991). The railway was built during the early 20th century in order to transport vast mineral riches to the port for export to Europe. Operations on the rail line were abandoned in the 1970's as Angola's civil war disrupted the country's economy and made activities along the route unsafe or physically impossible. In the past decade, the peace treaty in Angola that ended

the war has been reasonably successful and allowed for private investors to take interest in rehabilitating the line. Natural resources in the DRC and Zambia are still in demand and Angola itself would benefit from the railway as an export conduit for its own commodities. An opening of the railway and an increase in traffic at the Port of Lobito could generate a more competitive port industry on the Indian Ocean side of the continent as landlocked or isolated Zambian and DRC exporters would gain alternatives to ports in Mozambique and Tanzania. Economic prosperity in the DRC and Angola might reinforce the more peaceful trends and contribute to greater development in both countries. A potential limitation, however, is that the Benguela Railway is not designed to serve the Angolan capital of Luanda. The political payoffs for developing the Port of Lobito are therefore less interesting to policy makers since Luanda's large population would benefit indirectly, at best, from prosperity in the southern part of the country. Continuing efforts to improve the railway may require direct financial participation from the DRC and Zambia. The lack of experience in cooperating with regional neighbors suggests that the development of Benguela as an international gateway will be difficult but the benefits are quite promising.

Knowledge and International Organizations

There is room for international lending organizations to act as lenders and financial coordinators of large port infrastructure projects. In addition to financing, there is also a knowledge deficit in many developing countries. International organizations may be able to facilitate knowledge acquisition and exchange between governments, port managers,

and private firms. International efforts to improve management practices would be especially beneficial.

Pedersen (2001) notes that infrastructure development in Africa has been plagued by corruption and poor management, partially as a result of politically appointed managers. Port managers – corrupt or not – may acquire needed knowledge throughout their careers. Unfortunately, high turnover for political appointees can limit these possibilities. In Kenya, the rapid succession of chief executives of the Kenyan Port Authority is an example of this problem (Hoyle 1999).

An area that requires port managers to balance perceived public good with economic efficiency is customs. Requirements in some African countries that all containers be opened and inspected prior to leaving the port slow down the movement of freight (Pedersen 2001).

Ports can send representatives to potential trading partners or inland locations to help attract business to a port. This can reduce the psychological distance by increasing the familiarity of shippers with the services offered by a particular port (van Klink and van den Berg 1998). The ports of Dar Es Salaam and Mombasa have representatives in Uganda to represent them and serve shippers directly (Hoyle 1999).

More broadly, Van Niekerk (2005) points out the need for preventing private terminal operators from acquiring monopolistic positions in a port through concessions,

privatization, or other means. This is hardly an easy proposition for developed countries, and the burden on developing countries would be great. Van Niekerk (2005) notes that regulation would be needed for *tariff setting, return on investment, price caps, and revenue yield control*. The tension between regulators and firms is evident in the latest global financial crisis. Large firms with considerable influence in government have been able to craft the necessary economic environment that allows short-term gains without long-term consideration. If European, Asian, and North American government officials have difficulty properly regulating the market, it appears unlikely that public officials in the countries in question will be any more successful.

The integration of modes within the supply chain means that port developers must maintain strong links with domestic transportation actors. Coordinated policy can bring about complementary infrastructure development rather than disjointed investments that may optimize a section of the transportation chain but are suboptimal when considering the entire modern global logistics framework. Dialogue must occur between government agencies and with private firms who will be either the customers or operators of the infrastructure.

Leadership for the approaches listed in this chapter will have to come from a variety of actors. The African Union is an obvious choice for coordinating regional investments and improving economic cooperation. Since its existence, however, it has been overwhelmed by security issues on the continent and has not progressed as rapidly with regards to its broader aims of economic and social development. The World Bank has participated in

port and other infrastructure development projects but its budget is relatively small compared to the soaring costs of modern container terminals. Regional organizations such as the Southern African Development Community (SADC) and the Economic Community of West African States (ECOWAS) have not been able to achieve their ambitious agendas, although there have been some successes.

International organizations have undertaken efforts to improve knowledge sharing for the port industry in developing countries. One of the most active organizations is the United Nations Conference on Trade and Development (UNCTAD). Its aim is to assist developing countries integrate into the world economy. UNCTAD activities cover all aspects of trade facilitation, including logistics. With regards to ports and the maritime industry, UNCTAD publishes an annual report titled *Review of Maritime Transport* that includes information covering all regions of the globe. It also produces more detailed publications of issues related to port development in developing countries. Another international organization active in knowledge dissemination is the World Bank, which does so in addition to its financing activities. The World Bank published the *Port Reform Toolkit* (2003) and is available in print and electronic format. It covers topics such as port ownership structures, financing, regulation, and labor issues. According to this research, the *Port Reform Toolkit* is one of the most up-to-date and relevant publications on the subject of port development in developing countries.

Despite the value of UNCTAD and the World Bank's publications, there is still a limited amount of resources available for practitioners, policy-makers, and researchers interested

in ports and developing countries. An important publication in the field is UNCTAD's *Port Development: A Handbook For Planners in Developing Countries* (1985). It presents more technical information than the *Port Reform Toolkit*. This leaves a gap of nearly twenty years separating the publication of major documents on port development in developing countries. In comparison, extensive information is compiled on European and North American ports, and the authors – typically large and specialized consulting firms – can charge customers for their products. UNCTAD and the World Bank struggle to provide inexpensive and high quality information on a rapidly changing global maritime industry. Compounding the difficulties is the fact that port development is responsive to the specific conditions of a port's hinterland and geographic location. For this reason, the collection and presentation of information on developing country ports is unlikely to be profitable for private analysts and consultants. Non-profit, international organizations unfortunately do not provide adequate substitutes in terms of publications, reports, or current data on ports, shipping, and the relevant global economic conditions.

Privately financed container port development in locations near the global trade lanes will continue to be the focus of African maritime activity northwards. Dakar and Nairobi are candidates to benefit from this trend but may not be able to compete with ports such as Djibouti that are more directly on the East-West trade axis. Regardless of the location of future transshipment hubs, economies of scale will be critical to port development.

Countries in Sub-Saharan Africa would benefit from developing greater economic links that will stimulate their markets and create more substantial cargo flows in competitive ports. Cooperation is not limited to trade infrastructure, as the exchange of knowledge

will help governments and port authorities adjust to trends in the port industry, global supply chains, and the world economy.

CHAPTER 11: CONCLUSIONS AND FUTURE RESEARCH

Conclusions

This research has proposed that a confluence of trends in the port and maritime industry, as well as the global economy, have altered the way that countries can develop ports that serve as gateways to the global economy. The relocation of manufacturing activities from developed to developing countries took place as tariffs were either decreased or eliminated. Restrictions on global capital flows soon followed and enabled companies to set up production far away from the primary consumer markets. Containerization of manufactured trade improved the ability of firms to link producers and consumers through increasingly complex global supply chains. The cost of multinational production has decreased over time, but the resources needed for container handling at ports and in domestic infrastructure continues to grow. Specialized container terminals are costly and far more capital-intensive than the ports of the past. The soaring cost of port development took place at a time when the ability of government to finance it was eroding. Private entities have taken on a large role in financing port development. Their motivations, however, are very different from those of governments pursuing national economic development policies. Profits are expected in the short-term and ports have shed labor at a dramatic rate. The port industry seeks out economies of scale of considerable importance in order to offset the tremendous investments needed for the development of a globally competitive port.

These trends have created substantial port development barriers for many ports, especially those in developing countries. Many of them are located far from the world's centers of economic activity and are also remote relative to the major trade lanes running along an East-West axis around the globe. Ports in developing countries have poorly developed hinterlands with limited demand for imports and even less production of manufactured exports. Container flows are modest at best and cannot generate the economies of scale necessary to justify the substantial investment required to develop competitive container-handling terminals and ports. To close the gap with the world's leading ports, developing countries are likely to rely on privately led investment that has more stringent demands than the government-financed port development that took place in many wealthier countries.

Barriers to port development can have serious repercussions for a country looking to use trade as a contributor to economic development. Ports are critical components of global supply chains. Inefficiencies and unreliability because of outdated port assets or ineffective port management will penalize developing countries. Transportation costs must be minimized so that the relocation of production to a developing country is not deterred by an increase in distance to global markets.

Countries on the geographic and economic periphery of the global system are likely to be impacted the most by barriers to port development. The implications for Sub-Saharan Africa are especially significant. Geographically, the region is disadvantaged by its separation from the trade flows moving globally along an East-West axis. In West Africa,

a large expanse of territory encompassing southern Morocco, Western Sahara, and Mauritania creates a void of economic activity between major trade routes and the rest of the continent. A similar situation exists in East Africa as Somalia's dysfunctional economy, covering a considerable geographic space, interrupts a more continuous grouping of markets along the Indian Ocean. Compounding the peripheral status are the poorly developed economies in Sub-Saharan Africa. Demand for imports is weak and exports tend to be non-containerized commodities. This limits the economies of scale that allow ports to invest in more efficient equipment. Furthermore, population centers tend to be far from each other and poorly connected by domestic transportation infrastructure. Port hinterlands therefore remain small as expansion into new markets is not easy or cheap. These countries are left with the existing port infrastructure that is in most cases insufficient, underperforming, or non-functioning.

South America shares Sub-Saharan Africa's geographically peripheral status but has fared much better in terms of container port development. Overall, the continent has been peaceful and economic development has progressed more quickly than in much of Africa. On the East Coast of South America, Brazil has emerged as a leading economy in the developing world. The Port of Santos is the 38th largest in the world (TEU in 2005, Containerisation International). In Argentina, the Port of Buenos Aires was the 66th largest despite its remote location relative to the East-West trade lanes. Even the Port of Montevideo in Uruguay has become a competitive transshipment location in the region. Ports on the Pacific Coast of South America have also been able to somewhat overcome the problems of distance. This is in part due to Chile's economy creating considerable

maritime trade. Surprisingly, the Port of Callao, Peru is the largest on South America's West Coast, although the combined container flows of Chile's ports exceed those of Peru. One of the explanations for the Port of Callao's success is the concentration of Peruvian port activity at one location. The recent history of South American container ports shows that port development barriers are not impossible to overcome.

The impediments for port development have repercussions for neighboring countries, especially those that are landlocked. These countries rely on foreign ports as gateways to global trade and are adversely impacted by inefficient port infrastructure. They are also dependent on domestic infrastructure linking landlocked markets to ports. Participating in multinational production is contingent on exports being reliable and synchronized with other parts of the supply chain. Not only do landlocked countries have to gain access to efficient ports, but they also need good roads or functioning railways. The cost of modern transportation infrastructure has soared and landlocked developing countries have been unable to invest in the resources their economies need. UNCTAD has focused on the conditions unique to landlocked developing countries, as many of them are also the least developed. Examples in Africa include Chad, Mali, and Niger, and Bolivia in South America. For many of them, the nearest ports are in developing countries that are the most impacted by port development barriers. Their reliance on their neighbors for access to the world economy makes them highly vulnerable to the changes in the port and maritime industry.

The port industry is not the only one with barriers to entry that adversely impact developing countries. In service industries, language barriers make certain countries a less more natural fit for the relocation of global activities. High levels of tacit knowledge characterize many industries and new entrants are at a competitive disadvantage. In industries that are capital-intensive like the port industry, developing countries have always faced barriers. This research certainly does not assert that port development presents the most insurmountable barriers for developing countries. It simply suggests that these barriers are of more recent origin and may have been under-recognized by governments, international development practitioners, and prior researchers.

The need for additional financial resources to help developing countries applies for the port industry as well as others. Because they cannot afford port development, this research has maintained that developing countries are forced to concentrate on improving conditions that will attract private investors. The experience of the private sector in developing countries, however, has been mixed. Private investment in all sectors of infrastructure has yielded lower returns than expected, according to Ramamurti and Doh (2004). Infrastructure FDI in developing countries peaked in 1997 and has declined significantly in the decade that followed. FDI as a whole has continued to increase, suggesting that investors have grown wary of foreign infrastructure projects but not foreign investment as a whole. This is cause for concern as the drying up of foreign infrastructure investment flows reduces the likelihood of what appears to be the most viable option for improving port infrastructure in developing countries.

Throughout this research, the assumption has been made that developing countries want to increase their participation in world trade. Some governments however would reject trade-enhancing policies, and the reasons for this vary. Developing countries have often asserted that the rules of global trade favor exploitative trends rather than global economic development. There are fears that better access to trade will decimate existing domestic industries without offsetting benefits. In some cases, improved transport to peripheral regions can reduce manufacturing as increased competition from imports erodes what had been captive markets (Hilling 1996). In other cases, governments have benefitted from economic inefficiencies by collecting fees and taxes on imports or exports. Corruption in ports is certainly a factor, as has been noted in earlier sections.

In the end, all of these factors lead to impediments for economic development. Port development barriers are in addition to the need for improved rule of law, political stability, and other preconditions for development. As developing countries are overwhelmed by the myriad of challenges, the developed world continues to revamp the global economy and the supply chains that connect it. Massive investments at leading ports such as Rotterdam and Norfolk show that the aggressive pace of change in the port and maritime industry is not letting up. The gap between competitive container ports and those lagging behind is growing.

Overcoming port development barriers is important for many countries wishing to plug into the world economy. As mentioned above, some areas such as Sub-Saharan Africa are more impacted than others by port and maritime industry changes. However, it is

important to recognize that port development barriers are of far less consequence for much of the developing world's population. Nearly 2.5 billion people live in China and India – more than one third of the overall world population. Both of these countries have been able to make needed investments in port infrastructure to help meet domestic demand for imports and increase the competitiveness of their exports. Initially, it was China's low labor costs that attracted foreign investment and spurred the relocation of global manufacturing production. China's ports have adapted to the new system of global supply chains by rapidly expanding its ports. In 2005, seven of the top 25 container ports (Table 10) were gateway ports in China. (The Port of Hong Kong functions as both a transshipment and gateway port.) India is a more recent participant in the global manufacturing economy and its large population demands a substantial amount of imports. China and India have been politically stable in recent decades and conflict with neighbors, or between themselves, has not deterred foreign investment. Private firms have been willing to invest in port infrastructure in both countries. When private investment has been insufficient or undesired, the Chinese and Indian governments are often able to fund infrastructure development with public funds. Their level of involvement in the economy allows them to act more directly in areas such as port development.

The Chinese and Indian examples demonstrate that port development barriers are not equally important for all developing countries. Multinational production and containerized trade has actually opened up possibilities for many countries to participate in world trade and bring about economic development. China and India account for

roughly one third of the world population. Increased manufacturing and industrialization has had far reaching benefits for much of their populations. Unfortunately, the modern global system that has economically empowered certain developing countries has also created a group of economies that remain on the margin. Port development barriers reinforce the marginalization of these countries and may present persistent challenges in the future.

Anticipating these challenges will not be an easy task. The changes in the port and maritime industry occurred rapidly and caught many in the private and public sector by surprise. The preceding chapters have focused on a few of the global trends, but new ones are emerging. The following sections present some areas where future research will be useful in order to understand forces and events in the port and maritime industry and how they will continue to reshape how port development takes place.

Future Research

This research has proposed that changes in the port and maritime industry have created port development barriers that are of particular concern for developing countries that are on the geographic and economic global periphery. There are significant developments around the globe that will redefine some of the issues presented in preceding chapters. Location will continue to be an important determinant of port development patterns as global trade routes are impacted by the Panama Canal expansion, the opening of shipping lanes in the Arctic, and the increase in piracy off the coast of Somalia. Technological

changes in the port and maritime industry will potentially reinforce and undermine some of the barriers to port development. Containerization of non-manufactured goods will offer opportunities for developing countries to generate economies of scale. The replacement of container ships may result in the trickling down of older vessels to routes serving developing countries. Similarly, technological changes could permit old container-handling equipment in developed countries to be sold to developing countries. This would allow for a more affordable upgrade in port infrastructure. The following sections of this chapter address the Panama Canal expansion, Arctic shipping lanes, and Somali piracy and their impact on developing countries. The chapter concludes by noting the potential for increased containerization of developing country products, as well as the benefits and limitations of acquiring containerships and port assets no longer needed in developed countries.

Geography and Location

Panama Canal

The existing dimensions of the Panama Canal limit the size of ships that can bypass South America as they move between the Atlantic and Pacific Oceans. At present, container ships using the canal are no larger than 4000 TEU. In contrast, some of the ships operating between Asia and the US West Coast exceed 8000 TEU. This has reduced the economies of scale available to shipping lines. Despite the size restrictions, the Panama Canal remains a heavily used transit point for containerships and other

vessels. The high demand has allowed the Panama Canal Authority to charge hundreds of thousands of dollars per ship in fees. Ships often spend days waiting for an available slot to pass through the canal. The canal's inability to handle increased traffic has caused a bottleneck on the East-West route.

The Panama Canal Authority has begun an expansion project that will greatly increase the dimensions of the canal, as well as the ability to handle increased volumes. The depth, width, and length of the locks will be expanded so that ships of 12000 TEU can use the canal. The access channels will be modified so that vessel traffic can be better managed.

For containerized trade, US East Coast ports will be the primary beneficiaries of the canal expansion. Cargo that typically goes via LA/Long Beach, Oakland, and Seattle will be able to use an all-water route to reach destinations on the East Coast. The expected surge in container traffic is projected to increase container port activity along the Gulf Coast as well. Containerized goods from Asia may arrive more quickly and cheaply.

From an Asian perspective, the expansion will increase their countries' ability to export to all corners of the globe. Asian exports will benefit from decreased transportation costs and greater flexibility in transport options. The expansion will reduce the negative impact of fuel price increases, as water transportation is far more efficient than rail- and road-based options.

The benefits of the expansion should also reach South America's East Coast. Large markets in Brazil and Argentina will have improved access to Asian imports. They will also be better able to export their own containerized and agricultural products to Asia. On South America's West Coast, countries will be able to trade with the US East Coast and Europe. Although these countries are primarily exporters of commodities, their competitive position will be enhanced by the Panama Canal expansion.

Sub-Saharan Africa is the least likely to benefit from the expansion of the Panama Canal. The level of trade with the US West Coast is negligible, as is true with South America's West Coast. Trade between Asia and Africa uses the Indian Ocean route. The expansion may actually be harmful to Sub-Saharan Africa's economic development. Improvements to the canal deepen the advantages of the East-West axis and afford these routes greater economies of scale and improved transit times. The increased competitiveness of the Asia-Europe-North America trade flows may further marginalize Sub-Saharan Africa in the global economy.

Arctic Shipping Routes

Changes in the global climate have led forecasters to predict that new arctic shipping routes will be available in the next ten years. The melting of the polar ice caps will allow ships to travel between North America, Northern Europe, or Russia and the North Pole. Initially as a seasonal opportunity, it is possible that in 50 to 100 years the route will be accessible year round. For shipping lines to use these new routes, they will have to

develop economically viable ships that offer protection from collisions with ice.

Although this technology may be expensive, the expected savings generated by using Arctic routes is likely to spur technological and operational developments for ocean carriers.

The potential new routes parallel the existing East-West Axis. Asian goods could be shipped to Europe using a route passing to the north of Russia. Exports to the US East Coast from Asia might pass above Alaska and Canada and arrive in the North Atlantic after passing by Halifax. In the Pacific, China, Japan, and South Korea would be well positioned as greater shipping traffic would pass through the region. In the North Atlantic, ports in Halifax, Iceland, and possibly Greenland could become transshipment hubs as cargo could be distributed to Europe and North America as it travels south from the arctic routes. Russia would also become a more important actor in global trade as significant cargo might flow along its northern border.

For South America and Sub-Saharan Africa, the development of arctic shipping routes would increase their peripheral status, as countries would be even further removed from the economies of scale in global shipping. The concentration of global economic activity would be pushed farther north. Shipping networks would have to be reorganized to reflect the arctic opportunities and this might come at the expense of operations in the Southern Hemisphere.

Piracy

During the past five years, the rise of piracy off of the Somali coast in the Horn of Africa has brought a surprising amount of public attention to a problem that has plagued the maritime industry throughout its existence. Media interest has been primarily a result of the growing boldness of the attacks. Pirates have fired rockets at cruise ships and boarded large oil tankers with increasing success. Western governments have also paid closer attention as global security concerns appear. The ransoming of a Ukrainian ship with tanks and other military equipment provided a warning of the dangers of uncontested piracy. The implications for shipping and global trade have been more infrequently discussed, but the impact of piracy has already been manifested in the supply chains of both manufactured goods and bulk commodities.

Prior to the deterioration of maritime security off of the Somali coast, the Malacca Straits in Southeast Asia was the region most vulnerable to pirate attacks. Using the numerous islands and inlets on the Indonesian and Malaysian side of the channel, pirates would board vessels and take fuel, parts, and valuable items from the ship's crew. Theft of the ship's cargo was rare and pirates targeted small and medium vessels. Similar incidents of piracy are common around the globe, especially off the coast of Nigeria and in the Caribbean.

Somali pirates present a different threat to ships passing through the Red Sea or around Africa. Once boarded, ships are typically brought to Somali ports where they are held for

ransom. Because of the lack of a central government, Somali pirates are free to operate in plain sight. Local economies have sprung up to support piracy as crews and pirates need to be fed and cared for while negotiating a ransom. Some ships have remained anchored in port for months before resolutions are obtained. Shipping lines frequently pay ransoms to secure the release of crew and cargo.

The immediate result for the shipping industry has been an increase in insurance rates for ocean carriers. The ships can be damaged in the initial attack, sabotaged, or stripped of essential or valuable machinery and parts. The cargo may be damaged or decline in value due to the delay in reaching the customer. Another cost to the ocean carrier is the ransom paid for the release of the vessel. Depending on the value of the cargo and the negotiations between ship owners and pirates, the ransom can amount to millions of dollars.

In response to piracy, ocean carriers have explored alternative routes in order to avoid especially dangerous areas. Piracy off of Somalia is a contributing reason to ships being diverted around the African continent. In addition to avoiding Suez Canal fees, ships benefit from lower insurance rates and a more reliable route. Ships are now sailing farther off of the East African coast, although more sophisticated pirate attacks are expanding the area at risk.

Piracy in the Malacca Straits was contained before it reached the levels seen off the coast of Somalia. The route from Asia to the Middle East remained unchanged, although

insurance rates for ships transiting through the region increased substantially. There have been proposals to build a canal in Thailand that would allow ships to bypass the Malacca Straits and subsequently shorten the time and distance to ship goods between China, the Middle East, and Europe. With fewer incidents of piracy in the region, this development appears unlikely.

Effectively combating piracy requires an improved multinational response. In the case of a failed state like Somalia, international maritime law does not have provisions for anti-piracy measures when an involved state has no functioning centralized government. The UN has adopted specific measures with the transitional government of Somalia to allow for foreign navies to pursue pirates into Somali waters. Nations with significant economies such as Russia, China, and India, as well as EU countries and the US, have begun to form governance structures to address piracy and respond militarily.

Somali piracy is an area where African countries and organizations such as the African Union (AU) could take the lead in developing responses to regional problems. As mentioned in the previous chapter, regional integration and coordination will be critical in adapting to a globalized world with economic, political, and security concerns that are unimpeded by national borders. Functioning multilateral mechanisms not only help fight piracy, but foster ties between countries and regions that help in other areas. The landside effects of Somalia's problems are seen in Northern Kenya and Ethiopia as both countries have intervened in their failed-state neighbor's affairs.

The rerouting of ships around Africa is unlikely to seriously benefit Sub-Saharan Africa. Ships on these routes do not usually stop along route, although some call at the port of Durban. Because the most vulnerable ships are small and medium ones, there is a possibility of new services, but anti-piracy initiatives are likely to yield greater stability before the rerouting becomes permanent. If anything, the costs of increased freight rates due to piracy will simply make the cost of imports higher for developing and peripheral countries.

Technological Change in the Maritime Industry

Containerizing Non-Manufactured Goods

Most containerized goods in Africa are imports, as containerized exports remain relatively rare. There has been an incentive to containerize agricultural commodities due to the trade imbalance for many African countries. Because import containers are usually returned empty to the port and ocean carrier, export freight rates tend to be low and are increasingly inducing exporters of agricultural products to containerize their goods (Branch 1998). Containerization of agricultural goods has advantages other than benefitting from lower transport costs for export containers. Because these goods are generally exported by the shipload, the quality of agricultural products can decline while the exporter waits to generate enough quantity. Additionally, the uneven cash flow stemming from these practices can cause difficulty for suppliers (Pedersen 2001).

Containerization allows for smaller flows to be exported, improving quality and regularizing cash flow.

A barrier to the containerization of agricultural goods is that rural transportation infrastructure is still poor in many of the producing areas. Containers are unlikely to be brought to these areas, necessitating that the goods be packed and unpacked in port (Pedersen 2001). Because of the low labor costs in Africa, this may prove to be less expensive than in other global regions.

The containerization of agricultural products, as well as forestry products, would help developing countries cope with the barriers to port development described in the preceding chapters. The process would generate greater volumes of containers at container ports and allow terminals to capture economies of scale. This would also facilitate port terminal specialization as on-site activities devoted to agricultural products could be moved elsewhere or eliminated altogether. Increased containerization of exports is of interest to the shipping lines serving developing countries and may result in improvements in maritime links to the rest of the world. Ocean carriers can better justify serving a particular port if the call results in both the unloading and loading of full containers.

The containerization of minerals, however, is not as likely. Bulk terminals differ from container terminals in the level of private participation and ownership (Van Niekerk 2005). Coal and other natural resource companies are very reliant on the port nearest to

the source where commodities are extracted and have a vested interest in developing competitive infrastructure. Because bulk terminals are based on expectations of long term returns and what is often only one private entity, forming a cooperative agreement with port authorities – or alternatively an entirely private investment – is far more likely than in the case of container ports. Bulk transportation is far cheaper than containerization, and mining operations offer the scale needed for dedicated terminals.

Cascading of Ships

Ocean carriers have been aggressively expanding their containership fleets and replacing their older vessels. The newer vessels are typically introduced on routes between Asia, Europe, and North America. The ships are larger and are profitable as a result of the millions of containers being shipped along the East-West axis. The replaced ships have been reassigned to less active routes including feeder networks and those serving developing countries. The cascading of ships has allowed developing countries to be served by larger and more advanced ships relative to their previous levels of service. These ships, however, could still have a higher cost to operate and load/unload since the ships are old, unreliable, less efficient, and environmentally hazardous. Competitive container ports will not necessarily welcome these “older” ships as the cost of doing business is too high. The implications for developing countries might be important if these smaller ships do not cascade down to lower level routes and carriers.

The Mobility of Port Assets

The development of a market for used container-handling tools would be of tremendous benefit to developing countries. Using ship-to-shore cranes as an example, new gantry cranes cost upwards of \$6 million dollars and are rarely ordered individually. The bulk of new cranes are made in China, with multiple cranes loaded onto a transport vessel for shipment. Ordering and transporting one new crane alone is relatively more costly than bundling orders, again representing an inhibitor to incremental port development. Existing gantry cranes that are being replaced are expensive to dismantle and costly to ship. There are not yet clearly identifiable trends as to what will happen to the early generations of gantry cranes. This is an area where the international community can implement a system to foster the resale of old but functional port assets to developing countries.

In summary, the recommended areas of focus for future research contain some trends that are likely to be beneficial for developing countries, while others may be detrimental. On one hand, the expansion of the Panama Canal and the opening of transoceanic Arctic trade routes will further shift global economic activity to the north. Countries in the Southern Hemisphere will become even more geographically peripheral, which in turn could result in the reinforcing of their economically peripheral status. On the other hand, technological developments such as the containerization of bulk commodities can improve the likelihood of container port development by creating the necessary economies of scale that attract private investment and increased maritime links.

More fundamentally, port development will be constrained by the contradictory characteristics of global supply chains and infrastructure investments. Supply chains seek out not only reliability and low cost, but flexibility as well. The production of low cost and low skills goods is sensitive to global demand swings and firms are continuously adjusting the volume and location of the economic activity. This is in contrast to the development of port infrastructure that requires long-term predictability. Private firms in the port industry invest in locations where container flows will remain stable for a much longer time horizon than that used by firms in multinational production. This mismatch favors port development in more established economies where future economic conditions are easier to predict. In the past, governments took the lead in providing infrastructure where private firms would or could not do so. Ideological changes have deemphasized the role of government, but more importantly, the dramatic increase in the cost of port development has priced out developing country governments that would be willing to finance container-handling infrastructure.

The resulting global economic system is not necessarily more unequal than was previously the case. The extractive nature of colonial relationships did not produce a greater level of economic development around the world. The gap between rich and poor countries has always been staggering. Port development barriers are simply an additional layer to the complex challenge facing developing countries. Economic globalization had been heralded as an opportunity for some countries to use trade as an engine of growth. In many cases, developing countries have successfully become producers in global

supply chains and generated wealth for improving the well-being of their populations. In other cases, countries have seen little to no improvement since the system of multinational production reorganized the global economy. There are many approaches that developing countries can take in order to address the challenges that they face, one of which is increasing trade. To do so, they must improve a variety of aspects of their economies, including developing the physical tools needed to plug into the global economy. Container ports are one of the many tools required. The aim of this research has been to demonstrate the barriers that developing countries may encounter as they attempt to use port infrastructure improvement as a means to national economic development.

AFTERWORD

During the course of this research, two major developments have occurred with surprising rapidity and were generally unanticipated in existing research and the news media. There had been predictions of the collapse of the global economy, but the speed with which it occurred and the prominence of the victims – both private firms and countries – was shocking. Similarly, the volatility of oil prices in 2008 caught many individuals, firms, and countries by surprise. Another global concern – climate change – continues to challenge policy makers. The following three sections present some thoughts on the economic recession, fuel prices, and climate change while noting the impact on the global system and, in particular, developing countries.

Global Economic Recession

The global economic downturn that began in late 2008 has had a strong impact on the maritime industry. The epicenter of the economic downturn may be in North America, where the collapse of the housing market induced the unraveling of the financial sector. Credit is in short supply and economic growth has been curtailed as a result. Stock market losses and diminished confidence in the economy have created a staggering amount of job losses and reduced economic activity. The upheaval in the United States, particularly on Wall Street, has spread quickly to other parts of the globe. In Europe, countries have struggled to confront the economic downturn. Small countries and large countries have been dealt severe blows. The government of Iceland has been paralyzed

by the global meltdown, and Belgium and the Netherlands have had to intervene in their banking sectors to avoid catastrophic repercussions.

Larger countries such as France, Germany, and the United Kingdom have taken steps to stabilize or manage their economic woes by injecting money into banks and large commercial enterprises. As Western countries have decreased consumption, the price of oil and other natural resources has declined. Once fast-rising economic powers like Russia and Venezuela have seen their fortunes reverse as the values of their assets and currencies were eroded.

The reduced global demand has taken a toll on centers of international production. Economic growth in China and India has slowed down and it appears that their impressive gains are unlikely to be replicated in the near future. Factories in China have fewer orders to fill and unemployment is rising.

Excess Capacity on Routes and Lower Rates

As a result of the economic slowdown, there has been a surplus of capacity on most existing shipping routes. The cost of shipping a container has rapidly declined from the high rates of 2007 and early 2008. Rates on the return leg to Asia have been especially decimated.

Ocean carriers have begun to consolidate various services. This has occurred on the primary East-West routes as well as on connections to peripheral regions. Alliances have paired down their offerings and created new services to replace those eliminated by individual carriers.

Another response to excess capacity has been the laying-up of containerships. Ocean carriers are finding it less expensive to anchor their ships in ports around the world. Low freight rates cannot offset the operating costs of these vessels. Recent estimates indicate that as much as 5% of the world's container fleet may be out of service. While initial indications are that these measures are temporary, the ships could eventually end up being scrapped should the global economy fail to recover fast enough.

One way to reduce the operational costs of containerships is to reduce their speeds. Slow steaming has been increasingly adopted in order to save money. Carriers had previously chosen speed over efficiency in order to meet the demands of global supply chains. With the downturn in demand, the cost of faster speeds could no longer be justified. Slow steaming has in part been enabled by the extra capacity available in the existing global containership fleet. Ocean carriers and alliances can insert extra vessels into their services to offset the slow speeds. Extra vessels ensure that the frequency of services does not decline despite the decrease in speed.

The impact of lower freight rates has led to a more surprising change in shipping practices. Ocean carriers have begun to reroute ships around the Cape of Good Hope in

Southern Africa. The cost of transiting through the Suez Canal (roughly \$600,000) is avoided at the cost of greater fuel expenses for the extra distance (currently estimated at \$300,000). Unfortunately for the Sub-Saharan Africa, the rerouted ships do not stop along their detour and proceed from Southeast Asia to Europe uninterrupted.

Potential Recovery

Freight rates for containers do not appear poised for a recovery in the near future. There are substantial deliveries of new containerships that will occur during 2009. This is a result of overly optimistic estimates by ocean carriers and the long lead times for ship ordering, construction, and delivery.

Anticipating the global economy's recovery is also troublesome as a further restructuring may yet take place. Foreign direct investment is drying up as investors seek the least risky environments. Factories in Asia are closing due to decreasing demand in Europe and North America. China's response will be especially important as it adjusts to a major global consumption slowdown for the first time since it became a manufacturing powerhouse.

Furthermore, there is evidence that the liberal economic ideology that has dominated the past decades is facing growing resistance. Demonstrations in Europe may be just the beginning of a backlash against an economic system that is perceived as inherently flawed and responsible for the tumultuous economic times. Should the displeasure with

neoliberalism gain greater traction politically across the globe, governments may reintroduce protectionist measures that limit the amount of world trade.

Implications for the Global Periphery

The economic slowdown severely hampers the development of new production centers. With decreased demand for exports, Asian locations are likely to decrease their costs to remain competitive and thus choke off development prospects in other developing markets.

The lack of financing, ranging from reduced interest in FDI to constrained bank lending, limits the prospects of private investment in infrastructure development. Donor financing will also be slashed as wealthy countries cut back on their commitments to developing countries. Pressing concerns of stabilizing the global economy are likely to take precedence over development assistance.

Developing countries on the periphery have a poor record of capitalizing on natural resources and the depressed prices during the global recession are likely to make matters worse. Across the board, the high prices for commodities of the past few years have been erased. The price of oil has the highest global profile, but other minerals found in Africa and South America have also experienced vast declines in value.

Oil Prices

The price of oil peaked at \$147 per barrel in July 2008. As energy became more costly, the global economy, including international production systems and the logistics industry, made changes in response to the higher prices of fuel.

Maritime Transport

As explained in the previous section, many ocean carriers have resorted to slow steaming as a way to cut down on fuel. Companies also focused on improving the efficiency within the supply chain and moved to eliminate unnecessary activities. The higher prices were occasionally passed on to the consumer as ocean carriers and other firms applied fuel surcharges that trickled up through the supply chain.

The higher fuel costs increased the demand for transit via the Panama and Suez Canals. All-water service to the US East Coast from Asia cut costs due to water's fuel savings as compared to land transportation. Some ships that had circled Africa from the Middle East and Asia on the way to Europe were diverted to the Suez Canal.

International Production

As the effects of fuel costs grew, multinational corporations and purchasers of internationally traded goods began to reevaluate the spatial organization of the system of

international production. The build up of manufacturing in Asia relied heavily on inexpensive oil used to transport the goods across thousands of miles of oceans. With fuel prices eroding the competitive advantages in Asia, companies sought opportunities to bring manufacturing closer to consumption centers in North America and Europe. This process – nearshoring – did not fully take place before oil prices declined to \$40 in January 2009, but there were notable examples of companies opening factories in Northern Mexico and the United States for goods previously produced in Asia.

Global Periphery

Nearshoring's potential to redistribute the world's manufacturing activity to other developing regions is limited. Europe could potentially shift some of its production to Morocco, Algeria, and other North African countries. Turkey might assume an even greater role in supplying Europe, as might other Eastern European countries. Many African countries enjoy strong commercial connections with European colonizing nations, but they are likely not close enough to offset their competitive disadvantages such as high port and logistics costs, political instability, and unproductive labor.

Mexico stands to gain a greater role in export manufacturing given its well-established links with the United States. In many ways, the rise of China and the rest of Asia came at the expense of Mexican development. Poised to reap immense benefits following the signing of NAFTA in 1994, Mexico's manufacturing growth proved to be less than expected. With higher fuel costs, their competitive position may improve. Numerous road

links between the US and Mexico make trade possible, and strong government and business ties between the two countries increases the potential for relocating production to Northern Mexico.

There are unlikely to be significant spillovers in South America from increased manufacturing in Mexico and the United States, or in Africa from Mediterranean and Eastern European manufacturing. Trade will continue between North America, Asia, and Europe with some substitution from regional production. The most obvious benefit to countries on the global periphery is that their domestic production may become more competitive. Fuel had been cheap enough to allow Asian producers to compete in remote markets in Africa and South America. High fuel prices will reduce Asian competitiveness, though it is unclear whether this will actually spur local development of manufacturing. It is possible that the price increases for Asian imports will be passed on to consumers without triggering domestic competition.

The Future of Gas Prices

The attention given to the high oil prices in 2008 has declined tremendously since the start of the recent global economic recession. Policy makers, corporations, and individuals are far more interested in plummeting consumption and investment levels than they are in continuing to seek improvements in the use of fuel. From a long-term perspective, this shift in attention is delaying a much-needed reevaluation of the world's production and consumption patterns. There is a dwindling amount of global oil reserves

and the high prices of 2008 will reappear, even if not as quickly and dramatically. The geographically dispersed economic system where products are manufactured thousands of miles from where they are consumed is highly vulnerable to fuel price increases. For North America, Asia, and Europe, this presents immediate “quality of life” concerns. For countries on the periphery this could mean an even greater barrier to economic development as their distance from consumer markets becomes even more of an issue.

Global Environmental Issues

There are numerous environmental concerns are likely to shape the global economy in the coming decades. Some are specific to certain countries or regions, while others will impact the world as a whole. They include environmental degradation from pollution and the physical destruction of local natural habitats, but are also systemic, as in the case of global warming. The port and maritime industry has already begun to implement measures in response to these issues, but others may be imposed on them from outside the industry as governments and international organizations formulate their responses. More broadly, environmental concerns – particularly global warming – may lead to more fundamental changes in the global economy as consumption patterns are altered due to the changing world climate.

Port and Maritime Industry

Port authorities, governments, and international organizations have already created some important regulations to mitigate some of the adverse impacts of global shipping. Ports on the US West Coast have instituted more stringent requirements relating to emissions from containerships. On the open seas, ocean carriers use a type of fuel that is relatively inexpensive and generates a tremendous amount of emissions. Vessels serving West Coast ports now switch to low-sulfur fuel when they arrive in the vicinity of the ports and the cities that surround them. This is in response to community and political pressure that has been directed at ports regarding their contribution to regional pollution. At the Port of LA/Long Beach, the port authority has initiated a program to allow for “cold ironing” – a process where ships plug into electric power provided by the terminal and can then shut off their engines while in port. This is expected to significantly decrease the level of emissions associated with the loading and unloading of ships. The port authorities may soon impose the requirement that terminals offer this service to ships.

Other environmental issues have led port authorities, governments, and international organizations to implement additional regulations in the port and maritime industry. At a local and regional level, the disruption of such marine life as whales and reefs has led to greater guidelines for ships using certain trade routes. A concern receiving an increasing amount of attention is the discharge of ballast water from ships. Ballast water is used to stabilize vessels depending on the load they are carrying. To achieve this, water is taken on and stored in tanks aboard the ship when needed, and discharged when it is not. This

process can transfer biological materials from one marine ecosystem to another, resulting in an increase in invasive species. As ships come larger, the volumes of water held in ballast tanks can increase and further aggravate the problem. The US government, European Union, and International Maritime Organization (IMO) have issued guidelines for the proper discharge of ballast water.

The responses to environmental issues are attempts to eliminate some of the externalities in the port and maritime industry. The vessel fuel restrictions and the cold ironing impose costs on the shipping lines, terminal operators, and port authorities. The rerouting of ships around sensitive ecosystems and the restrictions on ballast water discharge force ocean carriers, and ultimately global supply chains, to act in a way that recognizes not only the economic cost of their operations but the environmental costs as well. The problem of externalities in global transportation, however, extends far beyond maritime shipping. Much of the world's transportation depends heavily on fossil fuels and has never accounted for the adverse impact that this causes. The cost of bunker fuel for ships, diesel for trucks, and gasoline for cars does not reflect the environmental damage from emissions, including smog, increased asthma rates in many populations, or oil spills from transporting the fuel itself.

While the political language and action around the world, especially in the United States, makes little mention of making users pay for the full cost of oil-based transportation, responses to global warming may end up addressing some of the externalities. Researchers, scientists, and policy makers have created sophisticated methods for

assessing carbon footprints of products, individuals, transportation, countries, and the entire world. While measuring the carbon footprint does not, in and of itself, solve the problem of externalities, it is a necessary step. The change in presidential administrations in the US is likely to offer greater support to climate change research and policies. The US's participation will be critical for the much needed coordinated global action.

The most probable near-term responses to global warming will be greater caps on emissions from industry and transportation sources. The limited ability to generate emissions will drive up the cost of polluting and lead to a decrease in those activities. The price of products resulting from polluting processes will then be higher. As an example, restrictions on pollution from port trucks delivering containers will drive up the cost of imports and exports. Trucking companies at ports have been able to use older trucks that consume more fuel and generate more emissions. Programs at LA/Long Beach and Oakland requiring the use of more modern trucks will drive up costs for the industry while the immediate benefits will accrue to the communities and cities surrounding the ports.

The Global Economy and the Environment

Within the supply chain, the logistics industry made some adjustments to high fuel prices that will benefit them should more stringent caps on emissions be put in place. Consumer products (e.g. laundry detergent) have been repackaged in recent years in order to reduce the physical volume being shipped. There are two chief advantages to these efforts. The

first is that minimizing the dimensions of a product allows for more items to be sent in fewer containers, crates, or boxes. This reduces the number of trucks, ships, and warehouse space needed and leads to lower logistics costs. Second, reducing the size of packages lowers the production costs by eliminating a portion of the inputs used in manufacturing. In response to fuel prices, logistics firms also focused on optimizing their supply chains, minimizing empty repositioning of vehicles, and searching for lower cost modes of transportation such as barges instead of trucks. These actions were not directly related to climate change and global warming, but they are complementary to the strategies that are likely to be employed when private industry and government begin to act more forcefully.

The changes mentioned in the preceding paragraph are needed but may not be enough to offset a broad reorganization of the global economy. To fight global warming, far-reaching changes will be required in terms of how things are produced. The pace of climate change, however, is exceeding the pace of our efforts in reducing our reliance on fossil fuels. An important unanswered question is what the world will do when more directly confronted with climate change. Caps on emissions may accelerate the development of alternative production methods, but will global consumers be willing to pay more for products when the full cost is included in price? If not, there will be less global economic activity as the rising prices of inputs, transportation, and even waste disposal become relatively more important.

In terms of transportation costs and the overall economic system, a decrease in the demand of internationally produced products can mean fewer opportunities for developing countries to become part of global supply chains. The cost of shipping goods over great distances might rise so much that countries on the periphery are priced out. Additionally, increases in production costs as the economy internalizes environmental costs will drive up the price of manufactured products. The ensuing decreased global demand translates into the reduced likelihood for developing countries to use trade as a much needed engine of economic growth. The uncertainty of global warming, as well as the response from the international community, is yet another factor that complicates the way forward for developing countries.

APPENDIX A

List of exports classified by UN Statistics Division as *Other Manufactured Goods*

Manufactured goods classified chiefly by material:

- Leather, leather manufactures, and dressed furskins
- Rubber manufactures
- Cork and wood manufactures (excluding furniture)
- Paper, paperboard and articles of paper pulp, of paper or of paperboard
- Textile yarn, fabrics, made-up articles, and related products
- Non-metallic mineral manufactures
- Manufactures of metals

Miscellaneous manufactured articles:

- Prefabricated buildings; sanitary, plumbing, heating and lighting fixtures and fittings
- Furniture, and parts thereof; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings
- Travel goods, handbags and similar containers
- Articles of apparel and clothing accessories
- Footwear
- Professional, scientific and controlling instruments and apparatus
- Photographic apparatus, equipment and supplies and optical goods; watches and clocks
- Miscellaneous manufactured articles

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CURRICULUM VITAE

Date of Birth: May 2, 1980

Place of Birth: New Orleans, Louisiana, USA

Education

- Benjamin Franklin High School, New Orleans, LA, August 1994 – May 1998
- University of Florida, August 1998 – May 2002
 - BS, Food and Natural Resource Economics
- Georgetown University, Washington, DC, August 2002 – May 2004
 - MPP, Public Policy
- Rutgers University, Newark, NJ, August 2004 – May 2009
 - PhD, Global Affairs

Employment

- World Bank, January 2004 – June 2004
 - Consultant / Intern, Corporate Social Responsibility Program
- Division of Global Affairs – Rutgers-Newark, August 2004 – May 2008
 - Teaching Assistant, Economics and Political Science
- Port Authority of New York and New Jersey, Summer 2007 and 2008
 - Intern, Port Commerce Department
- Center for Advanced Infrastructure and Transportation – Rutgers, 2008 – 2009
 - Research Assistant, Freight and Maritime Program