4. North American Perspectives on Globalized Trade and Logistics

Jean-Paul Rodrigue and Markus Hesse


Global Production Networks

World trade has become a network of cross-border arbitrage on differentials in labor availability, wages, interest rates, exchange rates, prices, saving rates, productive capacities, liquidity conditions and debt levels. —Liu (2005)

Introduction

Recent contributions by Dicken et al. (2001) and Coe et al. (2004) have raised the issue of emerging global production networks (GPN) that have been established as a consequence of innovations in information and communications technology and of the increasing degree of global economic and social integration coined as globalization. GPN emerged to cover major parts of the globe, very dynamically in countries recently integrated to the new geography of global production. This is particularly the case for the Far East where initial settings occurred in Korea and Taiwan, but have expanded to locations such as China, India and Indonesia. In the western hemisphere, the U.S.-Mexican border region or parts of the European periphery (for example, Ireland, Scotland) and more recently in the middle-east of Europe have also seen developments. As Dicken (2003) pointed out in his seminal ‘Global Shift’, the establishment of GPN no longer occurs only in traditional, natural resource based and labor intensive branches such as the apparel industry but also in highly competitive, modern industries including electronics and computers (including components), machinery and automotive.

Indeed, there is a global shift in the making for GPN both in their sectors of operation and in their geography. It seems to be long ago that manufacturing branch plants have been founded in the context of a new international division of labor, which devotes assembly lines and their operation to developing countries, due to cheap labor and a much lower degree of regulation compared to the so-called developed world, whereas the value creating activities such as research and innovation, product design and marketing were being kept in home countries and home markets of global corporations. The more recent character of GPN implies that both subcontracting and production related services are fragmented and being shifted towards what was formerly being called the periphery. This is even truer for core service industries such as data processing, software development, call centers, etc. Particularly due to the benefits and opportunities provided by information technologies, GPN indicate that economic globalization is reaching a degree of global integration unknown before and the impacts of which are difficult to fully assess.

Furthermore, GPN are likely to shape not only global economic processes but also regional development, because the global network is embedded in local and regional geographies. Coe et al. (2004) are putting some emphasis on this point: It is a close interrelationship rather than a dichotomy between “the global” and “the regional” that is emerging out of GPN. They conceptualize regional development as “a dynamic outcome of the complex interaction between territorialized relational networks and global production networks within the context of changing regional governance structures”. Because global relations are taking “place” in concrete locales,
they are fostering regional development, and the material linkages that connect the different scales are provided by logistics. Yet these global relations are also likely to create a certain dependence of actors and processes in such places on decisions made in the corporate headquarters, possibly far away from the region that is affected by them. Such characteristics make GPN quite difficult a subject from the perspective of policy and planning, that is, regional development.

**GPN and supply chain management**

During the 1980s and 1990s, and accelerated by the globalization of manufacturing, logistics has been transformed into the more comprehensive mode of supply chain management (SCM). The framework of SCM is based upon both new information and communications technologies and also changing habits of corporate management, e.g. the elimination of inventories and the integrated management of the chains. Thus a major requirement for the global expansion of production networks has been built upon logistics. Sturgeon (2002) provides a comprehensive overview of new forms of production organization and how the provision of logistics services is involved in this. A major paradigm behind the model is called “modular production”, which means that production is driven by the contract manufacturing and a vertically disintegrated and horizontally integrated management of value chains. This modular form of manufacturing network happens against the background of organizational change (see Nelson and Winter 1982). It comprises both small and large firms, small and large geographical scales, and it aims at creating a large number of products within few processes, in order to receive maximum revenue through economies of scale (Sturgeon 2002, 477).

Logistics is becoming a key unit within this production system, because it has to provide for the agility (flexibility) of any module and the interaction of all modules in the entire network. The imperative of flexibility is not only considered organizational but also geographical. Thus a major shift has occurred in how and where commodities and their components are being assembled, manufactured and distributed. Innovations along major chains were also responsible for the emergence of new services such as third- and fourth-party logistics providers, a specialized branch that is committed to integrating the functions of freight transport, warehousing, logistics and physical distribution. These services often tend to be subcontracted out of the firm. The shift in logistics is an outcome of changes in patterns of production and consumption that are, in turn, likely to shape logistics and freight distribution (for example, just-in-time- or just-in-sequence-manufacturing, e-commerce, etc.).

In order to describe the transformation (or deconstruction) of the firm and the modularization of manufacturing, Suarez-Villa (2003) emphasize the emerging network logic of the modern economy and coined the term “techno-capitalism”. It is also being used as an interpretative scheme, a paradigm for analyzing structural changes that are primarily driven by information technologies and globalization. Network building, devolution of hierarchies and speed are the main characteristics of contemporary economies. The implications for transportation are a rising demand for shipping and delivery, particularly of smaller units in a higher frequency, an increasing importance of time, reliability or even speed, and also new infrastructure requirements both in terms of flows and in terms of nodes.

**GPN and global distribution**

As consequence of the ongoing process of developing globalized production networks, distribution is required to complement the manufacturing process and to carry the final
product to the market. Thus GPN depend upon a global distribution network (Capineri and Leinbach 2003). The functional and geographical integration of GPN is based upon the core components of the distribution network, as there are flows (information, money, commodities, vehicles) nodes (ports, airports, railyards) and, all bound together, networks. It is in fact the global distribution system, consisting of firms, modes and infrastructure, which makes GPN a functioning entity. Following a somewhat traditional perspective on the character of freight transportation, distribution is derived from the demand of the production system. This means that the amount of freight transport and its spatio-temporal performance is a function of the place and time of manufacturing and the necessity for timely delivery to the customer.

To recognize the more developed role of distribution systems and their interaction with production, distribution is becoming “structural” (see Hesse and Rodrigue 2004; Rodrigue 2005). This means that the need for precise placement of consignments to the point of sale may further influence the way production systems are being operated or where they are located. This new notion of logistics and distribution as a relevant factor for production (and not the other way around) is quite different from the importance of transportation infrastructure for economic activity expressed by classical location theory: It is not only simple infrastructure provision that makes firms go to a certain area but the ability of regions and cities to cope with the extraordinary demand for flexible, timely and cost-efficient physical distribution. As far as distribution is becoming critical at major transport nodes, firms seeking new manufacturing locations may in the future favor locations that offer a competitive environment that combines labor, services and other resources with good access to markets and transport corridors.

Keeping this contention in mind, freight transport is undoubtedly a means and an outcome of GPN. This is also true for global trade, given the fact that trade is an early expression of what can be regarded as globalization. Before GPN were evolving, international trade increasingly contributed to the amount and the nature of physical distribution, because world exports have grown much faster than world production. This is indicated, almost constantly for decades, by average annual growth rates of world production and world trade (global imports and exports), the latter growing much faster than the former (Dicken 2003, 35). With the upcoming activity of transnational corporations (TNC) and thus the process of global integration via GPN, not only final products are being shipped from core to periphery and vice versa, but also raw materials and components. More than 40 per cent of America’s imports are from the overseas subsidiaries of its corporations. It is obvious that the associated demand for transport is growing. In this respect, globalization can be considered a major framework condition of goods exchange, carrying freight along the “rivers of trade” (McCray, 1998), which means that there are major corridors through which the global freight flows are being directed.

**GNP and regionalization**

Free trade agreements such as the North American Free Trade Agreement (NAFTA) or the European Single Market have also substantially contributed to the emergence of global flows, because they provided a basic and fairly homogeneous regulatory framework upon which foreign direct investments, TNC-activity and thus GPN have expanded. Deregulation was not only directed toward markets in general but also to the transport industries in particular, in the U.S. during the 1980s, in Europe and the UK mostly during the 1990s. Transport deregulation is subject to controversy, targeting salaries, labor or standards or safety issues. Also, the associated access of foreign firms to open markets earned criticism both by unions and by many medium-sized firms (compare to the dispute on Mexican truck drivers serving U.S.-markets or related activities of Eastern European firms in Western European countries). In fact transport
Deregulation has contributed to significantly lower transport costs and thus made the spatially extended manufacturing environment more tangible. More recently, and thus indicating further extension of globalization, global service providers have emerged. They operate world-wide trucking fleets, shipping capacity, container terminals, etc., thus re-directing freight flows and shaping the global map of distribution again.

North America, as a pole of the global economy, has been particularly impacted by the dynamics of GPN in terms of the nature of its production, consumption and distribution. In 2001, 15 countries alone accounted for 77 per cent of the value of U.S.-merchandise trade (USDOT 2003, 2). One-third of this trade was with Canada and Mexico as part of NAFTA. Due to strong growth in NAFTA and Asian Pacific trade relative to that with Europe, the share of trade passing through border crossings and freight corridors with Canada and Mexico and with West Coast ports has increased, as has related container and intermodal traffic. Specifically, the North American west coast, as a gateway, is being influenced by increasing trade flows originating from the new manufacturing poles in East Asia and arriving at its container ports. These goods flows are destined for the final points of consumption all over North America through an inland freight distribution system.

Changes in the labor force are a good indicator of the reorganization of the North American production network. While non-farm employment increased from 109.5 to 131.5 million between 1990 and 2004, manufacturing employment dipped from 17.7 to 14.3 million. The service (non-producing) sector was the major contributor to employment growth, climbing from 85.8 to 109.6 million jobs for the same period. Transportation and warehousing also grew remarkably, from 3.5 to 4.3 million jobs (USDOL 2005). While the economy shows important signs of “dematerialization” its increasing consumption function, accounting for close to 70 per cent of the GDP, underlines a growing need to trade and to organize freight distribution.

**North American trade and logistics**

The North American system of freight transport and logistics is developing as an outcome of changes in trade and industries, regional distribution of growth and the particular ratio of import and export in the economy. In 1998, the U.S. transportation system carried over 15 billion tons of freight valued at over $9 trillion (FHWA, Office of Freight Management and Operations 2002; see table 1). Domestic freight movements accounted for nearly $8 trillion of the total value of shipments. There are expectations about how freight distribution will unfold in the future. By 2020, the U.S. transportation system is expected to handle cargo valued at nearly $30 trillion. Herein, the truck moved 71 per cent of the total tonnage and 80 per cent of the total value of U.S. shipments in 1998. The motor truck carried the majority of both local distribution and interregional freight flows. Water and rail also had a significant share of total tonnage, but they accounted for much smaller freight values. Air freight moved less than 1 per cent of total tonnage but carried 12 per cent of the total value of shipments in 1998. Domestic freight volumes are expected to grow by more than 65 per cent, increasing from 13.5 billion tons in 1998 to 22.5 billion tons in 2020. The forecast suggests that the air and truck modes will experience the fastest growth. Domestic air cargo tonnage is projected to nearly triple over this period, although its share of total tonnage is expected to remain small. Trucks are expected to move over 75 per cent more tons in 2020, capturing an even larger share of total tonnage. Volumes moved by the rail and domestic water modes are also projected to increase over the forecast period, although they will not be likely to increase their market share. International trade accounted for 12 per cent of total U.S. freight tonnage in 1998 and is forecast to grow faster than domestic trade, projected to increase by 2.8 per cent annually between 1998 and 2020, nearly doubling in volume. The
performance of the freight system as indicated by these numbers bears major challenges to infrastructure, gateways and other issues internal and external to the transportation system.

Table 4.1 U.S. Freight Shipments by Tons and Value, 1998, 2010 and 2020

<table>
<thead>
<tr>
<th>Mode</th>
<th>Tons (million)</th>
<th>Value (Billion $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>Highway</td>
<td>10 439</td>
<td>14 930</td>
</tr>
<tr>
<td>Rail</td>
<td>1954</td>
<td>2528</td>
</tr>
<tr>
<td>Water</td>
<td>1082</td>
<td>1345</td>
</tr>
<tr>
<td>Total</td>
<td>13 484</td>
<td>18 820</td>
</tr>
<tr>
<td>International</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Highway</td>
<td>419</td>
<td>733</td>
</tr>
<tr>
<td>Rail</td>
<td>358</td>
<td>518</td>
</tr>
<tr>
<td>Water</td>
<td>136</td>
<td>199</td>
</tr>
<tr>
<td>Other</td>
<td>864</td>
<td>1090</td>
</tr>
<tr>
<td>Total</td>
<td>1787</td>
<td>2556</td>
</tr>
<tr>
<td>Grand Total</td>
<td>15271</td>
<td>21376</td>
</tr>
</tbody>
</table>

Source: FHWA, Office of Freight Management and Operations (2005) includes international shipments that moved via pipeline or by an unspecified mode

It is, however, hazardous to make long term projections concerning freight transport as there are many factors at play that could change the environment in which it operates. The projections depicted above are very likely to be inaccurate for many reasons. Future freight demands are often predicted in a rather linear fashion and do not account for economic cycles that are composed of periods of growth and recession. The development of a globally oriented production and distribution system is likely to significantly change the assumptions made for these scenarios to include a greater share of long distance international traffic handled at major gateways. Further, the current substantial and likely long term increase in energy prices, especially oil, is likely to completely derail estimates made in 1998, at a time when oil prices were still low.

North American trade gateways

Transport systems are subject to remarkable geographical flexibility even if many of their infrastructures are fixed. Flows, origins, destination and the modes used can change rather rapidly, particularly in a global economy regulated by global production networks. Gateways remain a relatively constant component in the global space of flows. They can be seen as semi-obligatory points of passage linking the global with the regional and the local. Gateways come in three major categories linked with the mode of entry, whether land, maritime or air. Land gateways commonly have a simple transit function with some nearby logistics and manufacturing activities, particularly when there are significant wage and/or regulatory differences. The Maquiladoras exemplify this situation along the US-Mexico border, where manufacturing takes place on the Mexican part and logistical activities managing this freight take place on the US part. The US-Canada border shows a different dynamic as the gateway in this case is simply a point of transit for medium/long distance truck traffic (some rail) between manufacturing and consumption areas.
The border region itself, even near gateways, has not seen a significant accumulation of logistical activities, particularly because the Canadian and American economy are already fairly integrated and the bulk of the Canadian economic activities is located within 150 km of the border anyway. Air gateways are linked with an important metropolitan area and with regional air/road connections. They tend to have more inland locations as they are not bound to strong transshipment constraints but to the rationale of moving air freight as close as possible to its final destination. Maritime gateways are large terminals with strong high capacity inland connections (rail and road). Due to congestion and lack of space for logistical activities near maritime terminals, the emergence of satellite terminals or inland freight distribution centers appears to be a significant trend, well developed in Europe but emerging in North America.

Trade and physical flow imbalances are clearly reflected at major American modal gateways (Figure 4.1). Almost all the gateways—land, maritime and air alike—are characterized by traffic imbalances where inbound traffic far exceeds outbound traffic. This is particularly the case for maritime gateways linked with long distance international trade with Europe and more specifically Asia. The West Coast is notably revealing and is the most imbalanced both in the concentration and the direction of the traffic. Inbound traffic accounts for about 80 per cent of all the traffic handled by ports. The ports of Los Angeles and Long Beach handled 75 per cent of the total freight dollar value brought in through the West Coast. NAFTA land trade gateways tend to be more balanced, but still reflect a negative flow. A similar pattern is observed for air gateways. What also characterizes North American gateways is their high level of concentration in a limited number of gateway systems; a set of modal gateways within a relatively defined region that acts as a functional system linking that region to international trade (Table 2).

![Figure 4.1 Major Modal US Gateways, 2003](image-url)
Table 4.2 Major North American Gateways

<table>
<thead>
<tr>
<th>Gateway System</th>
<th>Gateways</th>
<th>Total share (%)</th>
<th>Imports/Exports ($ billions) 2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern California</td>
<td>Port of Los Angeles, Port of Long Beach, Los Angeles International Airport, Otay Mesa (Port of Entry)</td>
<td>15.2</td>
<td>226.5 74.8</td>
</tr>
<tr>
<td>New York/New Jersey</td>
<td>JFK International Airport, Port of New York/New Jersey</td>
<td>10.7</td>
<td>142.2 70.9</td>
</tr>
<tr>
<td>Detroit</td>
<td>Detroit (Port of Entry), Huron (Port of Entry)</td>
<td>8.3</td>
<td>86.9 77.2</td>
</tr>
</tbody>
</table>


Three major gateway systems, each including several modal gateways, account for more than a third of the value of the international trade: Southern California, New York/New Jersey and Detroit. Two are the Atlantic and Pacific main entry points of American trade, and the third (Detroit) underlines the functional integration of the American and Canadian economies along the Montreal/Toronto/Detroit corridor.

The emergence of these large gateway regions does not preclude growth in smaller gateways. An emerging pattern involves the location of mega–distribution centers, particularly in retailing, close to ports that were traditionally of smaller size. This process coincides with the de-industrialization of the United States, making the retailing sector increasingly dependent on foreign production and imports. Thus, locations near international gateways tend to become more important, but accessibility and land requirements induce major retailers to look for more suitable alternatives than the existing and heavily congested gateways. For instance, Savannah has attracted in recent years many new major distribution centers (for example, Target, Home Depot, Wal-Mart, etc.), namely because of available land nearby the port and uncongested access to the inland along the strategic I-95. Growing imports from China are the main driver of this change.

Maritime and air cargo systems

The North American port system illustrates a concentration of container traffic in a limited number of ports and clusters (see figure 4.2). The share of containers handled by the five largest ports has remained unchanged for the last 20 years at around 55 per cent, underlining the cumulative advantages of capital investment in container handling facilities and access to the hinterland. The system is articulated along port clusters, representing a set of ports oriented along a coastal corridor such as Vancouver-Portland and San Francisco-Los Angeles along the West Coast and New York/New Jersey-Hampton Roads, Charleston-Jacksonville and Palm Beach-Port Everglades along the East Coast (de Langen 2004). All those clusters are connected to a North American land bridge and also include small but growing Canadian and Mexican components. However, inland freight distribution is challenging the relationships between many ports and their hinterlands and represents one of the most acute freight transportation problems (Notteboom and Rodrigue 2005). Congestion and delays at West Coast ports are forcing many maritime shippers to consider alternatives for their inland distribution. For instance, Hutchison Port Holdings has plans to build a major container port at Ensenada, just 110 km south of the California border. This new facility, which could handle more than 1 million TEU yearly, would require the construction of a rail link to Yuma, Arizona, bypassing the congested southern Californian transport system.
Ports along the southern East Coast façade (Charleston-Jacksonville range) also anticipate higher volumes because they have additional transshipment capacity and uncongested hinterlands. Further, the potential enlargement of the Panama Canal could expand the Gulf of Mexico ports because maritime shippers would benefit from economies of scale in addition to the untapped port capacity.

North America accounted for about 37 per cent of all global tons-km of freight carried by air transport, 25 per cent of which occurs regionally. Air freight reveals a system dominated by inland hubs along the Illinois-Ohio-Kentucky-Tennessee axis (Figure 4.3). The choice of these hubs is logical because they correspond to a demographic (market) central location in the North American air freight system, a fact underlined by the decision of major air freight providers to locate their hubs along this axis. Thus, they are neither origins nor destinations for air freight, and their function is mainly one of transshipment as hubs in their respective distribution systems (for example, UPS for Louisville and FedEx for Memphis). The majority of other airports act as conventional points of origin or destination for air freight, the nature and function of which is related to the local economy. What has also been remarkable is the steady decline in average line hauls since 1990, from 1389 miles to 973 miles in 2001. This is partially explained by the setting of a hub-and-spoke freight distribution system forcing the convergence of air freight in a few hubs with shorter hauls even if the amount of tons-km increased.
**Road and rail freight systems**

Road and rail freight transport systems account for 28.4 and 38.8 per cent respectively of all the tons-km carried in the United States. Their importance resides primarily in linking the gateways with the American production and consumption system. With containerization, road and rail systems are increasingly interacting and becoming interdependent. Compared with Western Europe, American rail freight account for a larger share of total tons-km than road, mainly attributed to the longer distances involved but also to systems designed to handle larger loads and able to support doublestacking services. Both modes are articulated along corridors with average hauls of 485 and 862 miles respectively, underlining their respective range in freight distribution.
Major road freight corridors form a mesh-like structure where the intensity of circulation expresses the hierarchy of distribution within the American urban system (see Figure 4.4). For instance, while the I-95 along the East Coast appears to have a continuous flow, most of the movements involve medium-distance trucking of a few hundred kilometers at most. Latitudinal truck flows are, however, long distance–based because they link different economic regions of the continent. There are also the so-called NAFTA corridors, mainly between Michigan and Texas. Again, even if such corridors involve long distance freight flows, there are specific distance-based market areas. Northbound flows from Mexico and the southbound flows from Canada decrease as the distance from their respective borders increases. The equilibrium point where Canadian and Mexican freight flows do no go much further is around the Tennessee/Kentucky range.

Rail freight has experienced a remarkable growth since deregulation in the 1980s (Staggers Act) with a 77 per cent increase in tons-km between 1985 and 2003. A significant share of this transformation concerns the emergence of long distance rail freight corridors. Figure 4.5 depicts that rail freight is articulated along major latitudinal corridors linking the two major gateway systems of North America, Southern California and New York/New Jersey via Chicago. The major gateways are part of a land bridge and mini-bridge system, fulfilling the requirements of long distance continental freight distribution. Rail freight transportation has also undergone the containerized revolution; container traffic represented approximately 79.6 per cent of all rail intermodal moves. The linkage of gateways with their hinterland could not have occurred otherwise, so rail, along with trucking, has become a dynamic element of North American freight distribution, able to offer time-sensitive services.
Challenges to North American freight distribution

This section addresses challenges to the freight and logistics system, with respect to both functionality and efficiency as well as the sustainability issue. It also presents an analysis of federal and metropolitan freight policies that have emerged during the late 1990s/early 2000s to cope with the growing demand for freight distribution, given that infrastructure supply, arterial capacity and public tolerance of freight traffic burden appears limited.

Trade imbalances and regional division of labor

The most important factors behind the reorganization of freight transportation are related to the macro-economic conditions of the global economy. Logistics and freight distribution are bound to this environment, which is quite volatile and unpredictable. Two factors are of particular relevance for North American freight distribution:

1) The growth of freight being carried both in tons and tons-km has placed additional demands on the capacity of modes and terminals to handle them; and

2) Imbalanced freight movements, the outcome of a global reorganization, is leading to disequilibrium in the division of labor, trade, production and consumption.
The case of China is by itself impressive; just 10 years ago it would have been difficult to forecast the current and still growing role of China in the global geography of production, not just for low costs and labor intensive goods but increasingly for technological products. In the last decade alone, China accounted for about 25 per cent of the global growth of GDP imposing a major shift in global freight flows. Comparative advantages are shifting rapidly, leading to de-industrialization in North America and Europe and a re-industrialization of Pacific Asia. It is interesting to notice that China was accounting for a third of the world’s output around 1800. The current situation can be seen as a reordering of the global geography of production to preexisting historical conditions.

While this global shift has been taking place trade flows have become dislocated, creating an array of challenges for the freight transport industry such as empty travel and inbound delays at gateways. Under normal circumstances, this imbalanced situation would have corrected itself with a recession in the United States, leading to a new equilibrium as consumers would have curbed their consumption of foreign goods. However, an intricate game of financial leverage came into play between the indebted United States government and consumer and its creditors. This has created a unique situation that conventional international trade theories do not grasp effectively. To simplify the situation, Asian capital gained from export based development was recycled in American securities (T-bills, bonds and equities), which in conjunction with an accommodative interest rate policy of the Federal Reserve led to an inflation of American assets, especially real estate. Consumers, because of cheap capital and a growth of the paper value of their residential assets, indulged in debt financed spending on imported goods. To put it bluntly, home equity loans were taken to pay credit cards used to buy cheap imported (Chinese) goods. Commodities flow dominantly in one direction while capital flows on the other. China has now begun a process of acquisition of strategic North American assets related to resources and manufacturing.

It is unclear at this point how this unstable situation will unveil. Economic history dictates that all asset inflations are eventually corrected. The outcome is a much likely decline in consumption and a recession that could last a decade as America’s staggering public and private debt is paid back, repudiated or inflated away through reckless monetization. In such a context, international trade would stabilize and even decline as demand drops. However, a significant change in the origins and destinations of trade is unlikely because it would require a very significant drop in the value of the US dollar to start to make the American economy competitive from an exchange rate perspective. Production costs are so low in China that even if the US dollar was to depreciate by an additional 50 per cent (it has already lost about 30 per cent of its value compared to a basket of currencies such as the Euro since 2000) and/or the Chinese currency was allowed to appreciate, it would not have much of an impact on the comparative advantages of China. The global labor arbitrage continues unabated, and nothing short of strong protectionist policies would prevent a long term trend towards global wage equilibrium. Average wages in North America, compounded with inflation, have not increased in more than a decade while wages in developing countries are steadily increasing. In the long run, by 2015–2020, American wages are likely to be on par with several developing countries such as China and India.

The current balance of payments is a clear indication of the worsening disequilibrium in which the United States is caught in spite of the systematic decline of the US dollar over the last four years. In 2004, it stood at $665 billion and reached $760 billion in 2005. Such figures reveal a freight distribution structure which is dominantly inbound. The only way out of this imbalance is a recession, a growth in savings and higher interest rates.
The staggering negative trade balance is reflected in physical flows that have followed accordingly in their imbalances, which have increased rapidly between 2000 and 2004 (figure 4.6). Particularly, there is an acute US-Asia imbalance in container flows in which containerized exports have not kept pace with imports. The outcome is rate imbalances as it costs more per TEU for westbound flows than for eastbound flows, making freight planning a complex task for container shipping companies. Thus, production and trade imbalances in the global economy result in imbalances in physical flows and transport rates. Eastbound trans-Pacific rates are lower than westbound trans-Pacific rates, substantiating the argument of the lack of competitiveness of the American economy and its inability to take advantage of this benefit.

**Congestion, land use and connectivity—a metropolitan perspective**

Global production and distribution networks are connected to local places, where the transshipment of consignments, the unloading of freight or additional logistics services are performed. The connectivity of all components of the network at various spatial scales makes it both global and regional. Depending on the accessibility and functionality of such locales, network organization and efficiency can become critical once congestion takes place, leaving limited additional capacity or unreliable usage (delays). This is particularly visible at the major North American gateways of international freight flows discussed above. According to the tremendous growth of these metropolitan regions (in terms of population, employment, gross domestic product) and as a consequence of structural and spatial changes, freight transport in core areas is complicated by congestion, scarcity of infrastructure and sometimes even labor (for example, Southern California). The American West Coast is facing serious difficulties for inland freight distribution. Trans-Pacific container shipments often have to wait several days at ports such as Los Angeles/Long Beach because of the lack of terminal capacity, labor availability and the ability of inland shipping, mainly trucking, to handle such volumes. Rail capacity is the major strategy to mitigate the problem, although it is also the object of many challenges. There is a lack
of on-dock rail facilities in many West Coast ports, delaying intermodal transfers. A call for “Freight capacity for the 21st Century” is increasingly being felt (TRB 2003).

Figure 4.7 reveals several chokepoints of the American road transport system, corresponding to major gateways, metropolitan areas and corridors of freight circulation. A volume to capacity ratio higher than 0.7 represents a serious level of congestion on a road segment and may incur systematic delays and disruptions. Thus, strategic segments of the North American freight distribution system have a high congestion level, requiring logistical adjustments such as modal shifts.

![Figure 4.6 Volume to Capacity Ratio of Road Transportation, 1998](image)

The New York/New Jersey Metropolitan Region is one of the country’s major platforms of goods exchange. This is due both to the significance of the Port of New York and New Jersey for international trade and to the concentration of millions of customers in the metropolitan region (Chinitz 1960, Regional Plan Association 1997, Strauss-Wieder 2001; Rodrigue 2004).

Warehouses and distribution centers were once concentrated in and around New York City, close to the port, to airports and a certain part of the customers. Over the last decades, the core region is suffering from congestion on all major roads and bridges, a problem exacerbated by the local geography. Hinterland access is more and more becoming critical. As a consequence, distribution is increasingly being pushed out of the core region towards the periphery. The New Jersey Turnpike (I-95) functions as the backbone of this movement. Competitive distribution land markets emerged in Northern New Jersey. A more recent market has emerged along the I-80 in eastern Pennsylvania, where several DCs are taking advantage of cheap land and corridor-based accessibility. This spatial movement is important not only for the regional land use structure but for the entire system of freight transportation in New York/New Jersey: Port and airports are still major import and export gateways, but a majority of goods handling and transshipment takes place at the regional periphery. This locational mismatch generates a high volume of freight
(truck) traffic through New York City and weakens the competitive position of the New York/New Jersey Port. Freight issues are subject to a wide range of planning activities under the auspices of the Port and government agencies in New York and New Jersey, for example, a statewide freight plan in New Jersey and respective frameworks (Parsons Brinckerhoff-QD 2004).

In the case of the San Francisco Bay Area, the East Bay has been the traditional industrial and distributive “hub” of the region. The core East Bay Area around the city of Oakland and Alameda County offers excellent access to all major locations in the region. This includes the old industrial corridor along the I-880 Freeway, the bridges connecting the East Bay with the San Francisco Peninsula, and the freeways to the Central Valley, connecting the region with the rest of California (via Freeway I-5). The Oakland area also offers intermodal access, that is, the container port (Port of Oakland) and the Oakland International Airport. Warehouses and DCs were traditionally concentrated along the I-880 and close to both international hubs, particularly at the Port of Oakland, which serves as the fourth largest container port on the U.S. West Coast. The port is situated in close proximity to the city center, is scarce of traffic access and also of land (not only for loading operations but also to store empty containers, etc.). Due to the increasing competition among the West Coast hubs and the dominance of both the San Pedro Bay ports and the Port of Seattle/Tacoma, the future role of the port is questioned. In response to rising congestion, increasing land prices and agglomeration costs, distribution firms recently tend to move to the Central Valley, located 50 to 70 miles east of the Bay Area. The Central Valley, traditionally a rural area based on agriculture and agroindustrial businesses, is going to attract distribution investments to a large extent. The locational preferences of distribution and warehousing firms are based on circulation, particularly improvements for access to the freeways I-205, I-580, and I-5, availability of rail-lines, proximity to ports and to airports. Real estate prices and the housing market in the Bay Area also play a role in explaining the increase of the respective Central Valley’s appeal as distribution activities are priced out of central areas. Freight transport, infrastructure capacity and land use will remain important issues over the next years. MTC, as the region’s responsible planning body, has initiated the development of a regional goods movement study (Cambridge Systematics et al. 2003).

In the greater Los Angeles area the picture is quite mixed due to the unproportionally high amount of manufacturing in core areas of the region compared to other metropolitan regions. Despite this, the distribution pattern seems similar: Older distribution sites are located close to the ports of Los Angeles/Long Beach and north of them (North Long Beach, South Central LA). Because both ports together comprise the highest amount of container loads in the old world and have experienced a tremendous growth of shipments over the last decade, limitations in capacity are evident. Firms are facing problems of congestion, land availability or, more recently, labor shortages that hindered the transshipment of container freight. This quote quite eloquently states the problem viewed from freight shippers: ‘Even when they finally reach the docks, those ships probably will wait for as many as four shifts before being assigned labor. And the containers they unload may sit for several days once they leave the ship because railroads are under-equipped and understaffed. Trucking isn't much better: Fewer motor carriers are frequenting West Coast ports because they burn so much time and fuel waiting for containers’ (Byrne 2005).

A major effort to improve landside access to two of the nation’s busiest seaports is the Alameda Corridor freight rail expressway, opened in April 2002 (USDOT OST 2002). The Alameda Corridor, an almost $2.5 billion project funded by private and public investments, connects the ports of Los Angeles and Long Beach to the rail yards near downtown Los Angeles and the national railroad network. The project consolidates 90 miles of branch rail tracks into one 20-mile railroad expressway and eliminated about 200 street-level railroad crossings, thus allowing trains to travel more quickly and easing highway traffic congestion. The Alameda Corridor is one item within a larger collection of measures to improve the freight system developed by the regional
Metropolitan Planning Organisation (SCAG 2005). Although the Alameda corridor triggered a lot of expectations, the project is facing a slow start. Among the many reasons of this shortcoming, a significant share of the traffic being bound locally and the difficulty of rail transport to compete over short distances due to higher transshipment costs.

There are other ways in which logistical firms are adapting, including moving the distribution centers toward inland areas. This is also true for the Los Angeles area. Further development occurred mainly at places such as Vernon, Commerce or Industry City (SCAG 2001). More recently, Ontario is developing as a modern distribution hub in the inland empire, combining locational advantages of open land, freeway access, and proximity to air freight (Ontario International Airport). At the intersection of I-15/I-60 freeways, a major node of warehousing and DC land uses is emerging. More recently, developments are moving even farther beyond the Greater Los Angeles area. One of the largest DC in the American West is operated by the Swedish furnishing retailer IKEA at Tejon Ranch in Kern County, a newly developed industrial park that was established on former farmland. The site is located near Bakersfield, almost 70 miles north of Los Angeles, at California Highway 99 and I-5 intersection. The DC is 1.85 million square feet in size and serves IKEA’s all Western North America Distribution, from San Diego to the West of Canada. Kern County gives a good example for the matter of fact that the strong development of the distribution economy is going to transform “Hill county” into “Industrial hub” (Newman 2004).

Because distribution is increasingly planned and operated on the basis of nationally designed networks, due to scalar changes and the premise of cost reduction by economics of scale, appropriate locations come into favor that serve as hubs for such networks. Respectively, as a consequence of both congestion at gateway locations and long-distance accessibility served by the interstate highway system, so called “inland hubs” are becoming more and more important, where primarily road and air freight is consolidated. One of the most famous examples for this is the evolving national DC cluster across the Ohio River Valley (OH/IN/TN). It is one of the new DC areas that are mainly affiliated with the interstate network and air cargo facilities, not with the traditional port gateways. The DC cluster along the Ohio River Valley, particularly following a corridor from Ohio and Indiana to Tennessee, hosts warehousing, trucking, freight forwarding and air cargo activities to a large extent. Such development has been additionally fostered by the growth of the new economy: ‘The “first generation” e-fulfillment providers are gravitating towards the preferred location for a single, centralized distribution facility, the greater Ohio River Valley, namely the states of Ohio, Indiana, Kentucky, and Tennessee. Industrial markets such as Columbus, Ohio, Indianapolis, Indiana, Hebron, Kentucky (Cincinnati, Ohio) and Louisville, Kentuck, have seen substantial demand from these users.’ (Abbey et al. 2001, 15). In 1997, more than 150 distribution centers larger than 50,000 s.f. were located in the city of Columbus, Ohio. Both inventory and absorption rates in the Columbus industrial real estate submarket belong to 80 per cent to warehousing (source: SIOR database 2001). The reasons for the tremendous growth of this region as a major distribution location are manifold: Besides the long tradition of the Midwest as a preferred manufacturing location (with certain distribution experience and competence), these locations are ideally suited to serve major markets both on the East Coast and in the Midwest. Columbus, Ohio, is within a ten-hour drive of 50 per cent of the North-American population. In general, 60 per cent of the entire U.S. population can be reached by overnight truck services along the corridor between Northern New Jersey and Indianapolis. In terms of logistics, the location is characterized by major interstates and a freeway intersection (I-70, I-72), rail connections and intermodal terminals, and two airports, among them Rickenbacker International Airport. Large investments of single firms have also to be taken into account, triggering “leader-follower” impact chains. Among recent corporate investments were the DCs established by Emery Worldwide (Dayton, Ohio), Lowe’s Home Improvement (Allen, Ohio), UPS (Louisville, Kentucky) and FedEx (Memphis, Tennessee). It is no coincidence that this
growth is spurred by air freight carriers and integrators, firms who are among the winners of the structural change. At the same time, the road and air based distribution systems cause a variety of problems and planning challenges that have to be addressed in the region. A respective set of responses is being developed by the Mid-Ohio Planning Commission (University of Wisconsin-Madison 2005).

The Chicago metropolitan area is the most important inland hub in North America: Chicago serves as the nation's primary consolidation and de-consolidation center for carload and intermodal freight, because it functions as a network endpoint for both eastern and western railroad carriers. Surprisingly its role tends to be overshadowed by maritime gateways such as Los Angeles/Long Beach and New York. Chicago is also the nation's largest rail-to-rail interchange point. For instance, about 50 per cent of all American rail freight transits through Chicago, accounting for 500 freight trains per day carrying more than 2.5 million tons. All the class I rail carriers in the United States are present in the region, reinforcing Chicago as the nexus of America’s inland freight distribution. Chicago accounts for the largest amount of containers handled in North America, 12.4 million TEU in 2003, twice as much as Los Angeles/Long Beach and three times as much as New York. This staggering amount of freight involves large distribution facilities, including 200 truck terminals carrying more than 400,000 truckloads each day. In fact, about 47 per cent of the industrial real estate in the metropolitan area is devoted to the function of warehousing and distribution. Because of the large number of railroads operating into and out of Chicago, numerous classification yards were built to accommodate the interchange activity taking place there. Such a high concentration of freight traffic is creating congestion problems as the rail system is unable to accommodate additional transcontinental traffic. One of the most acute problems concerning rail is that it is not well separated from road traffic, implying that the two systems impede one another with a multitude of grade crossings. Besides this, the Chicago region is one of the few places in North America that has a long-standing experience in addressing freight related issues, collecting data and developing plans for improving the system. More recently, a comprehensive metropolitan freight planning framework has been developed to facilitate coping with these challenges (Reebie Associates et al. 2004).

A freight and logistics policy framework at metropolitan and national levels

The enormous growth of freight shipments and the associated transport needs have caused a wide range of problems and conflicts that are primarily visible in metropolitan and urban regions. These problems are due both to capacity and acceptability constraints of the current distribution system, of which the former is generally accepted as a serious challenge to policy and planning. In contrast, sustainability of freight transportation is (still) subject to minor consideration, because economic interests are often ranking much higher than social or environmental goals (Black 1996, 2001). Yet air pollution, noise emissions and the degradation of infrastructure (roads, bridges), mainly caused by heavy-duty vehicles, happen at a certain cost for environment and society—not to mention the extraordinary demand for space at major gateway locations for warehousing, vehicle operations, transshipment, or the storage of empty containers.

Judging from the perspective of policy and planning, freight transport and logistics is an increasingly important issue, and it also represents a target extremely difficult to manage (compare with respect to intermodality [Slack 1998] and regarding nodes and networks [Priemus 2002]). This is due to the cost-sensitive character of freight transport subject to corporate management and decision making, which is different from passenger transport where decisions are mainly made by individuals, following more than just cost-based rationalities. Freight is both an outcome and a component of highly abstract network architectures that are not necessarily
open for external management, for example, for governance in the public interest or in response to local issues. Freight transport remains in private interests that seek to maximize system-wide utility. Finally, the potential degree of any planning intervention depends upon the regulatory framework which has been changing significantly over the last two or three decades, thus driving freight growth through shrinking barriers for trade and transport, falling freight rates and a highly competitive environment in the logistics service industries.

If we take a closer look at the regulatory framework and the physical operationality of the freight distribution system, the current situation appears quite contradictory, with de-regulation and market liberalization on one hand, in order to allow for accelerating freight flows, and increasing constraints due to infrastructure bottlenecks, urban density and scarce land on the other hand. As a consequence, there is a remarkable contrast between the fluidity of flows and the inertia of the physical infrastructure, even if we acknowledge the rising significance of information flow and managerial competence. Because transportation systems, particularly infrastructure and land supply, cannot accommodate the growing amount of freight traffic, the question is how the associated problems might be solved in future, with much higher transportation volumes in addition to the performance of the current systems.

To answer this question, it makes sense to look back and raise the issue of how municipalities and transportation planning authorities have tackled these problems in the past (see Banister 2002). In general, transportation planning has long been focusing on passenger transportation and did not extensively develop plans and strategies for distribution. In many cases, distribution has been considered an undesirable land use at the local level, at least in economically prospering regions (in others, logistics firms have been welcomed for the sake of certain economic benefits, such as jobs, local tax revenues, etc.). Planning activities with respect to truck transport and rail freight have been undertaken only recently, compared to passenger transportation and the respective tradition of modeling, traffic counting, etc. Regarding the way freight distribution and logistics have been covered by policy and planning, different stages can be distinguished: During the 1960s, freight has not been particularly addressed by transportation planners yet, except the matter of fact that port development in general represents a primarily freight related issue. Planning practice in the 1970s/1980s was likely to pay more attention to freight yet mainly followed the traditional guidance of “predict and provide”, focusing on measures that were devoted to widening and expanding the infrastructure network. Not earlier than in the 1990s, the issue of intermodality emerged as a generally accepted paradigm for policy and planning. Whereas the deregulation of transport markets have substantially lowered the degree of government intervention, to some extent air quality policies have been introduced as new regulation tools, for example, addressing emission standards. At the end of the 1990s and early 2000s, there is a substantial increase in freight related activity at both metropolitan and national levels. According to the accelerated growth of freight transport and the rising degree of conflict, urban economists, transportation planners and the trade sector share a rising interest in freight issues (Eno-Foundation/The Intermodal Association of North America 1999). This happens in order to make freight and logistics more efficient and more acceptable, by integrating freight into planning schemes and frameworks and also by offering training and education capacity.

Regarding both capacity and sustainability constraints of the current freight system, there is a need for developing a balanced framework of policy and planning measures that consist of more than just adding to infrastructure. It comprises generic policy approaches (with respect to energy, climate change, infrastructure policy and modal share), intermodality as a key tool, and also balancing the freight sector with community demands, for example, with respect to traffic generation or neighborhood issues of inner-city distribution centers (cf. TRB 2003b). Regional examples such as the Seattle/Tacoma ‘FAST Corridor’, the Alameda Corridor or other initiatives in the metropolitan regions named above underline attempts to try to divert freight in a firmly
established national trucking market. Although on paper these initiatives appear quite reasonable and promising, the existing distribution system takes time to adjust. So the modal shift they were designed for may take much longer than expected, whereas in the meantime road freight transport is growing further. Case studies may even provide evidence to suggest that attempts at freight planning are not that useful unless coming from the private sector or at least in close cooperation with it. For example, the Port Inland Freight Distribution Network of the Port Authority of New York and New Jersey has also shown a rather slow start with much less traffic than expected in spite of subsidies and incentives. Thus modal shift strategies, either planned or left to market forces, are facing substantial inertia reflecting accumulated investments, routes and management practices.

A sound strategy for policymakers will be to favor freight distribution systems that are able to cope with changes, particularly not only those that are exclusively business related. Surprisingly the issue is more of adaptability and flexibility, which reflects what freight distribution systems have become, than anticipation. A national freight policy should mainly be articulated first at distributing case studies, good practice and policy experience to attract business and planning communities to put freight on the agenda, to collect data and develop strategies, and only then should plans be implemented.

A second issue is to identify strategic locations where transport investment is required to ensure adequate and reliable freight transport systems. They often correspond to congestion bottlenecks. Once these high priority locations are identified and adjustments made to satisfy various interests, private investments should be secured by guaranteeing protection against short-sighted local nimbyism through the rationale of national strategic importance. On one hand, local opposition has been one of the most powerful forces that has impaired the development of transport systems. In California, things have even gone to the extreme; their philosophy is to build absolutely nothing anywhere nearby anything, which partially explains the growing difficulties freight distribution is having along the West Coast. On the other hand, corporate activity in logistics and distribution still lacks more sustainable and responsible modes of management that are becoming increasingly accepted in major parts of the manufacturing industry.

### Energy and North American freight distribution

Finally, the issue of energy is certainly starting to change the environment in which global and particularly North American freight distribution evolves. This system is particularly vulnerable to petroleum price increases, namely due to a high reliance on trucking and air freight to support time-based distribution. In addition, North American logistics and freight distribution operates on the assumption of low energy costs, and most investments in logistical infrastructures were made in such a context and with expectations that they would remain within a specific range. The fast development of the logistics industry in the 1990s was based on the assumption of very low energy prices, implying that energy considerations were limited in the planning and operation of freight distribution. The long term trend of rising oil prices, the convergence of supply, distribution and refining constraints will make an undeniable mark on the economic sustainability of the transport industry and force substantial adjustments. Among those, a shift to more energy efficient modes can be expected, notably towards rail. However, rail freight transport systems are already fairly congested, notably along long distance east-west corridors. Substantial investments will be required in rail infrastructures to insure an efficient and low energy intensity inland freight distribution. This system could be complemented by coastal and fluvial barge systems, much in the line with Western Europe. A better usage of existing resources will take place, notably in terms of existing capacity and locations, inciting innovations in the management of distribution.
Intense productivity pressures will be placed on existing transport capacities, especially trucking. Location and accessibility, traditional components in costs-based assessments of transportation, will see renewed focus. Balances between modes, locations, times and costs are to be reexamined to mitigate growing mobility costs with the timely requirements of distribution. A reverse trend in logistics may take place with several customers willing to trade more time for lower costs. Significant entropic forces have been unleashed in freight distribution, making the issue of environmental sustainability less relevant.

Conclusion

North American freight distribution is adapting the major macro-economic changes linked with globalization, namely an acute division of production. In turn, efficient transport systems have made this modern, large-scale and network oriented mode of production possible. Both respective interrelations are contributing to an increasing amount of freight transport. This development is causing new challenges, particularly between major gateways and inland freight distribution systems. Among the problems identified are imbalances in freight flows, congestion at points of transshipment and the difficulties of inland freight distribution to accommodate additional long distance flows. Regarding the supply side of freight transport services and infrastructure, the state and the future operability of infrastructure is becoming one of the most critical issues because at least in major metro region, a simple expansion of infrastructure and thus a traditional widening-bottlenecks policy is restricted by a range of political problems and fiscal constraints. In this context, an interesting question is whether there will be a certain reorientation on the global manufacturing and distribution map that reflects the rising degree of risk within the global transport network architecture. The more restricted transportation infrastructure and efficiency becomes the more attractive it will be to search for options of reorganisation and regionalization.

In the foreseeable future, the biggest momentum towards higher efficiency and sustainability of the distribution system will be provided by rising energy prices. Achieving major modal shifts from road and air freight towards rail and shipping modes could make the entire system more transport and energy efficient, so this is one of the strategies usually being developed as a response. Yet under current circumstances, both supply and demand side operations and requirements may delimit the needed flexibility of shippers and thus the desired change within transportation systems. However, rising transport and logistics costs will be the greatest stimulus among any other measures to reorganize the way materials flow and goods are delivered. This will trigger a phase of investment in real productive assets to guarantee future economic growth. The reliability of freight transportation infrastructures and operations is likely to be one of the top priorities.

References


