North American Logistics

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1. North American Logistics: A Regional Realm

Attributes of North American Logistics

Globalization induces the transport sector and supply chains to adapt to new functional and operational considerations. This is particularly the case for North America because of the geographical scale and scope of its production, distribution and consumption activities (Brooks, 2008; Rodrigue and Hesse, 2007). In a context where transport technology such as containerization has been a powerful force of homogenization in supply chain management, geography remains an important factor shaping freight distribution. The operational characteristics of freight distribution have to be reconciled with the regions they are taking place in. Regional characteristics, ranging from basic physiography to the regulatory framework, thus have a notable influence on how supply chain management is taking place. Modal preferences and locational behavior of terminals and distribution activities are among issues being influenced by regions that are taking place in. Four fundamental attributes characterize North American logistics:

1. Two major commercial orientations. The first is longitudinal and concerns national (commodities and manufactured goods) and global distribution (mostly manufactured goods for imports and commodities for exports). The second is latitudinal and related to NAFTA trade and a specialization of the factors of production within the North American economy, particularly along border regions.

2. Three maritime fronts serviced by a system of multimodal gateways. They include the Atlantic seaboard, the Pacific Coast and the Gulf of Mexico to a lesser extent. These gateways, such as Los Angeles and New York, provide an interface between global and regional systems of maritime and air circulation.

3. Long distance inland freight distribution serviced by rail corridors controlled by large private rail operators. These corridors service and connect inland freight distribution centers such as Chicago, Kansas City or Winnipeg.

4. A system prone to economies of scale in distribution (corridors and distribution centers) because of the geographical extent and the relative homogeneity of the market. This has favored the setting of high capacity highway and rail corridors as well as vast logistic parks.
An important commercial trend than impacted North American logistics in recent years has been the rapid industrialization of Pacific Asia, particularly China, and the enduring growth in the consumption of foreign goods in North America and Europe. Up to 2008 global trade has steadily been growing despite the increase in the average distance of trade relations. Parallel to this growth, the need to reconcile spatially diverse demands for raw materials, parts and finished goods has placed additional pressures on freight distribution 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 ratio of import and export in the economy. The development of a globally oriented production and distribution system has involved a greater share of long distance international traffic handled at major gateways. The performance of the freight system bears major challenges to infrastructure, gateways and other issues internal and external to the transportation system.

**A Realm Facing Regional and Global Changes**

Historically, the setting of national rail and highway systems has supported the emergence of a North American freight distribution market. Yet, this scale is being expanded further by the North American Free Trade Agreement (NAFTA) as well as the by the globalization of production. Jointly, they have created an environment where the transport sector is coping to adapt to higher volumes, particularly at major gateways, as well as more stringent requirements in terms of frequency and reliability of these expanded supply chains. Among the most common factors of change in supply chain management are related to the exploitation of comparative advantages, mainly in terms of labor, information and telecommunication technologies, foreign direct investments and technology transfers (Hesse and Rodrigue, 2006). All these have helped create a clustered and spatially diffused global economy, particularly in terms of production and consumption. Parallel to this growth, the need to reconcile spatially diverse demands for raw materials, parts and finished goods has placed additional pressures on the function of North American freight distribution and logistics.

Yet, the conditions behind globalization that were supported by the setting of long distance intermodal transportation chains have significantly changed in recent years. The current macroeconomic context is uncertain, volatile and prone to risks. It must be acknowledged that the surge of American imports was based on a debt driven process supported by a massive wave of asset inflation, namely in real estate, enabling many consumers to borrow against the paper value of their equity. As long as this process was taking place international trade and transpacific container flows were growing, placing pressures on the North American intermodal transport system to provide capital for additional and improved transport and logistical infrastructures. From 2006, as the real estate bubble started to deflate, intermodal traffic started to level off at major import gateways. By late 2007, the global financial system began a phase of deflation with massive defaults and downward revisions of asset prices, which cumulated in late 2008 and early 2009. The process of debt-based consumption was substantially curtailed, which led to a notable drop in port and rail traffic. Oil prices have also surged to about $140 per barrel in mid 2008 to retract to the range of $60-80 in 2009, which is well above the $20-30 range that prevailed until 2003. This has made long distance trade more costly and forcing many suppliers to reconsider their strategy that have over the last two decades depended in low input costs, particularly from China.
While supply chain management remain relatively illusive terms and that supply chains tend to be more effective when loosely integrated in a competitive environment (Bretzke, 2009), logistics deals with tangible flows that need to be functionally and operationally organized. The chapter thus addresses how freight distribution is organized in North America to fulfill capacity, time, flexibility, and reliability requirements of global, continental and regional supply chains.

2. North American Gateways

Trade Synchronisms and Imbalances

The emergence of China in the global manufacturing market had profound impacts in terms of the volume and pricing of a wide variety of goods. There was a strong impetus, either implicit or explicit to undertake strategies, many potentially macro-economically unsound, aimed at accelerating economic growth and the modernization of China. This strategy turned out to be highly successful in turning China into a major manufacturing center and exporter. China also applied an export-oriented currency debasement strategy particularly because the Yuan was kept devalued compared with other currencies, particularly the US dollar. For instance the Yuan was purposely debased by almost 50% in comparison with the USD between 1993 and 2003. During that period, China mostly focused on the lower range of the added-value manufacturing process in addition to have low labor costs. The unfolding recession created pressures to maintain the value of the Yuan in order to maintain a competitive advantage for exports even if normally the devaluation of the USD should continue in light of the staggering trade imbalances and accumulated debt.

The usage of China as a privileged location in the global manufacturing system has thus been linked with low input costs (mainly labor) as well as low long distance transport costs brought by containerization. The longer distances of shipping freight from China were positively compensated by lower input costs as well as the setting of massive economies of scale in maritime shipping through larger containerships. This explains why integration processes in North America, namely the use of Mexico as a low cost manufacturing base, were mainly by-passed in the last decade. Also by-passed was the setting of regional North American supply chains in light of the dominance and efficiency of global supply chains. However, from 2005 the price of oil surged, which started to erode the comparative advantages of China in freight intensive goods (such as steel and other ponderous goods). North American supply chains may be positively impacted by such a trend which will put a greater emphasis on NAFTA as a comparative advantage structure. Changes in the structure and direction of freight flows in North America are to be expected with a higher level of regional orientation.

Trade Gateways

Gateways remain a relatively constant component in the global space of flows. They can be seen as semi-obligatory points of passage linking global, regional and local freight distribution. Gateways come in three major categories linked with the mode of entry, whether land, maritime or air. Like other gateway system around the world, North American gateways (see Figure 1), particularly maritime and air gateways, have been quite stable in time, implying that the dominance of gateways such as Los Angeles or New York is not much been challenged. Still, this does not prevent new gateways to emerge, capture opportunities and consolidate their position, such as Savannah and Prince Rupert (maritime) or Laredo (land).
Land gateways are those that have experienced the most changes, as NAFTA helped restructure commercial flows in North America. They commonly have a simple transit function with some nearby logistics and manufacturing activities, particularly when there are significant wage and regulatory differences, such as the case between the United States and Mexico. The Maquiladoras, a border region system of manufacturing activities mostly servicing North American supply chains, are interfacing with the North American transport system through a series of land gateways, mainly centered around Southern California, El Paso and Laredo. They are dominantly servicing an import function, expanded under NAFTA trade, and connected to corridors of continental freight circulation. Manufacturing tends to take place on the Mexican part and logistical activities managing this freight take place on the US part.

![Map of Major North American Gateways, 2007](image)

Trade and physical flow imbalances are clearly reflected at major American modal gateways. 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% of all the traffic handled by ports (a 3 for 1 ratio). The ports of Los Angeles and Long Beach handled 75% 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 surge in oil and commodity prices has increased the share of ports along the Gulf Coast that are focused on energy and raw material trade.

A similar pattern is observed for air gateways, with New York, Chicago and Los Angeles being the most important. The two largest freight airports in the United States, Memphis and Louisville are not gateways, but hubs in a national air freight system. Although they handle some international traffic, this traffic is too small to rank these hubs as major air freight 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. Logistical activities obviously congregate around these gateways.

The North American port system illustrates a concentration of container traffic in a limited number of ports and clusters. 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). 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.

**Inbound Logistics**

An important characteristic of North American logistics is the imbalanced traffic, a reflection of the negative trade balance that has endured in the United States since the 1990s. For instance, of the total value of trade handled in 2007 by American maritime gateways, imports accounted for a staggering 73%. The structure of global trade thus impacts heavily on the operations of North American gateways that are essentially a system dealing with the intricacies of inbound logistics.
North American retailers account for a substantial share of containerized imports, mostly involving finished consumption goods bound to major inland freight distribution centers. The largest importers, such as Wal-Mart, Home Depot, Target, Sears, Costco, Ikea and Lowe’s, are all mass (Big Box) retailers relying on high volume and low margin goods, which are dominantly produced abroad. It is worth mentioning that about 60% of all Chinese trade surplus with the United States is the outcome of American owned firms operating in China and importing their output in the United States. Exporters show a completely different profile and thus completely different supply chains. A major category of containerized exports concerns recycled products with exporters such as America Chung Name, Potential Industries or Cedarwood-Young. Other major exporters include forest and paper products (e.g. Weyerhaeuser, International Paper), agribusiness (e.g. Cargill, Archer Daniels Midland) or chemicals (e.g. Dow, Dupont).

Two important logistical functions are linked with inbound logistics; transloading and empty container repositioning. Transloading involves the transfer from one load unit to another, which can be a complex task if the load units are significantly different. Repositioning involves making a container available for export activities once its import function has been fulfilled. If export cargo is unavailable, such as due to trade imbalances, then the container needs to be repositioned globally, which comes at a cost. There are several causes that may favor container transloading, which tends to take place in the vicinity of port terminals or inland (satellite) terminals (see Table 1).

**Table 1: Causes for Transloading Containers**

<table>
<thead>
<tr>
<th>Cause</th>
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**Weight compliance**  Transferring the contents of heavy containers into loads meeting national or regional road weight limits.

**Palletizing**  Placing loose (floor loaded) containerized cargo unto pallets. Adapting to local load units.

**Demurrage**  Handing back containers to owner (maritime shipping or leasing company) by transferring its contents into another load unit (e.g. domestic container).

**Consolidation**  Transferring the contents of smaller containers into larger containers (e.g. three maritime 40 foot containers into two 53 foot domestic containers). Cost savings (number of lifts).

**Equipment availability**  Making maritime containers available for exports and domestic containers available for imports. Trade facilitation.

**Supply chain management**  Terminal and transloading facility as a buffer. Delay decision to route freight to better fulfill regional demands.

- **Weight compliance.** Simply involves shifting the contents of heavy containers into lighter loads such as domestic containers or twenty footers. This is particularly the case for the containerized movement of commodities.

- **Palletizing.** Very common for the shipment of consumption goods. To gain shipment space in imbalanced container flows many containers are "floor loaded" and once arriving near consumption markets, the shipments are broken down and assembled into manageable pallets. This also gives the opportunity to adapt to local load units that involve different sizes, such as the difference between North American and European pallets. Doing such a task at the point of origin would be logistically complex.

- **Demurrage.** Containers are commonly rented for a specific time period and/or the leasing contract specifies that the maritime container cannot leave the vicinity of the port (or cannot spend more than a specific amount of time inland). Transloading is thus performed to insure that the leased container is handed back to the maritime shipping or the leasing company without additional charge.

- **Consolidation.** In many cases where this is a significant market for domestic containers and that the domestic load unit is larger than the maritime load unit, a consolidation of the shipments is often performed. For instance, in North America the largest domestic load unit is 53 foot, which represents the maximal legal size of a truck load on the highway. Thus, in distribution centers in the vicinity of several major ports the contents of three maritime containers are transferred into three domestic containers. This enables cost savings as shipment costs, including terminal costs, are established in terms of loads. A domestic rail terminals charges by the number of lifts, which means the costs are the same to handle a 40 foot or a 53 foot container.

- **Equipment availability.** This often takes place in conjunction with demurrage. Transloading enables a more efficient use of both container assets (international and domestic) and can facilitate international trade by freeing transport capacity. For instance, moving maritime containers over long distances in the North American transport system can be considered a suboptimal usage of transport equipment. Conversely, the global maritime shipping industry is mainly designed to handle 40 foot containers.

- **Supply chain management.** A transloading facility can act as a buffer within a supply chain, enabling shippers some room to synchronize the delivery of goods with the real
time needs of their customers. This is particularly the case for long distance trade where a shipment can be in transit for several weeks while the demand conditions at the destination may have changed.

Transloading thus offers an opportunity to delay the decision about routing freight to the final destination by using the facility as an opportunity to do last minute adjustments in terms of which shipments should go to which markets. Transloading accounts for a substantial activity at major port terminals. For instance, more than 25% of all the containerized traffic handled by the ports of Los Angeles and Long Beach is transloaded into domestic containers. In many cases transloading requires specialized equipment and a facility where it can be performed.

3. North American Corridors and Inland Freight Distribution

The North American Lattice

Although North America has a lattice of highways connecting all the major metropolitan areas, it the long distance rail corridors supported by an intermodal rail system that plays the most significant role in commercial flows. It accounts for close to 40% of all the ton-miles transported in the United States, while in Europe this share is only 8%. Rail freight in the United States has experienced a remarkable growth since deregulation in the 1980s (Staggers Act) with a 102% increase in volume between 1985 and 2008. The main growth factors for rail activity in recent years have been linked with a surge in international containerized trade, particularly across the Pacific, a growth in the quantity of utility coal moving out of the Powder River basin and a growth of the Canadian and Mexican transborder trade. Intermodal and coal represent the two most important sources of income for most rail operators. The two largest North American railroads, UP and BNSF, derive a sizable share of their operating revenue from long distance intermodal movements (landbridge) originating from the Pacific Coast. The construction and upgrade of intermodal rail terminals has been a prevalent trend to support this system of freight distribution.
A North American lattice of trade corridors where freight distribution is coordinated by major gateways (container ports) and inland freight distribution clusters (IFDC) has emerged in the recent decades (Figure 3). While gateways and IFDCs are significant markets, they also command distribution within the market areas they service as well as along the corridors they are connected to. They thus have a significant concentration and logistics and intermodal activities. The extent of the market area of an IFDC is mainly a function of the average length of domestic truck freight haul, which is around 550 miles (880 km). About a third of the American trade took place within NAFTA, mainly through land gateways (ports of entry) that are gateways in the sense that they are obligatory points of transit commanding access to the United States. For truck and rail flows, virtually no intermodal activities take place at land gateways, although several distribution centers are located nearby borders and along corridors. Laredo and El Paso, Texas and the Detroit / Windsor complex are notable exceptions with the presence of significant freight distribution activities.

Due to congestion and lack of space for logistical activities near maritime terminals, the emergence of inland ports (such as satellite terminals) appears to be a significant trend, well developed in Europe but emerging in North America. Such a process is associated to changes in the organization of inland logistics.
**Rail Corridors**

The North American rail transport system shows a high level of geographical specialization with large rail carriers servicing large regional markets. Each carrier has its own facilities and thus its own markets along the segments it controls. The rail system is the outcome of substantial capital investments occurring over several decades with the accumulation of impressive infrastructure and equipment assets (Rodrigue and Hatch, 2009). However, such a characteristic created issues about continuity within the North American rail network, particularly in the United States. Mergers have improved this continuity but a limit has been reached in the network size of most rail operators. Attempts have been made to synchronize the interactions between rail operators for long distance trade with the setting of intermodal unit trains. Often bilateral, trilateral or even quadrilateral arrangements are made between rail carriers and shipping companies to improve the intermodal interface at the major gateways or at points of interlining between major networks. Chicago is the largest interlining center in North America, handling around 10 million TEUs per year, a location at the junction of the Eastern, Western and Canadian rail systems.

![Figure 4 The North American Rail Transport System](image)

The North American system of operational intermodal rail terminals handling COFC and TOFC traffic accounts for about 206 facilities covering major inland markets. The great majority are
intermodal terminals accessible by truck only, but about 20 of them are on-dock rail facilities enabling to directly move containers from the port to the hinterland. Most intermodal terminals are clustered around major maritime gateways (Los Angeles, New York) and intermediary locations having strong inland logistical activities and inland ports (Chicago, Memphis, Kansas City). The location of intermodal rail terminals is a balancing act between gateway location, market density, interlining and complementarity with trucking. In spite of a system controlled by only seven major operators, the great majority of inland load centers are serviced by a least two operators, which confers a level of competitiveness and offers options for regional shippers. For the western system, most load centers are serviced by both BSNF and UP, while for the eastern system, most load centers are serviced by both UP and CSX. A similar pattern is observed for the Canadian system with CN and CP. There are however a few notable exceptions serviced by only one intermodal terminal and with no nearby competitors such as for Halifax (CN), Salt Lake City (UP), Billings (BSNF), Albuquerque (BSNF), Amarillo (BSNF) and Prince Rupert (CN). On the opposite range of the spectrum several locations, particularly at the interface between regional systems, have three or more rail operators (Detroit, Chicago, St. Louis, Kansas City, Memphis, Dallas-Fort Worth, New Orleans and Atlanta). They are thus particularly prone to a more competitive inland terminal setting offering shipping options to both the east and the west coasts.

**Air freight hubs**

North America is the most important region world-wide in terms of air freight. More than half of the global volume of air freight in ton-kilometers is performed in and between North American regions (Bowen and Slack 2006, 41). It is also the air freight sector that was characterized by strongest growth rates until recently. In response to the increasing demand for rapid delivery of small consignments in the courier, express and parcel services, major air freight hubs have evolved. This applies both to established airports that are engaged in freight handling and to newly emerging hubs as well, often constructed on remote airports or on the terrain of former military air bases. It is notable that in terms of throughput the *Federal Express*-hub in Memphis, Tennessee, and the prime hub of *United Parcel Service* in Louisville, Kentucky are now considered the two biggest cargo airports in North America, followed by, LAX/Los Angeles and New York/JFK (ibid.). Both single corporations represent the two biggest air cargo corporations worldwide, according to recent IATA-statistics, with 15 million tons of cargo (Fedex), and about 10 million tons, respectively (UPS), transported in 2008. Only these two have, by performing sustained growth and establishing their own network with hub locations, thus shifted the geography of air freight in North America significantly.

Air freight has especially contributed to the emergence of the DC cluster along the Ohio River Valley, following a corridor from Ohio and Indiana to Tennessee, that hosts an ever growing number of warehouses, freight forwarding and air cargo facilities. 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. Starting from the Ohio Valley, about 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. The region is characterized by offering access to major interstates and a freeway intersection, 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 major corporate investments were the DCs established by Emery Worldwide (Dayton, Ohio), Lowe’s Home Improvement (Allen, Ohio), UPS (Louisville, Kentucky) and Federal Express (Memphis, Tennessee). It is no coincidence that this market position is spurred by air freight carriers and integrators, since they are well suited with respect to broader structural changes in the economy.

4. Inland Logistics

Inland Freight Distribution

There have been large inland terminals in North America since the development of the continental railway system in the late 19th century. Their setting was a natural process where inland terminals corresponded to large inland market areas, commonly around metropolitan areas commanding a regional manufacturing base and distribution system. Although exports were significant, particularly for agricultural goods, this system of inland terminals was mostly for domestic freight distribution. Inland distribution expanded further with the completion of the Federal highway network and due to the advantages offered by the motor truck. The growth of metropolitan areas was accompanied by the establishment of associated distribution infrastructure, particularly linked to the demand of retail and manufacturing industries for transportation and warehousing services. Such warehouses were predominantly located in the vicinity of core urban areas. As logistics and supply chain management evolved, further changes occurred, particularly characterized by the evolution of separate distribution networks. The related nodes (DCs) were increasingly located remote from the core metro areas and thus supported further processes of deconcentration (Hesse 2008).

One reason behind is the tendency of logistics chains to expand from the locales of big intersections into their hinterlands; another one is the proximity of agglomerations to customers. In the course of the economy's growing demand side-orientation, distribution locations have been moving away from production and towards consumption, i.e. partly back towards the agglomerations. This is where clusters of distribution centers form, sometimes at single, more or less unconnected locations, sometimes planned as freight transport centres (Hesse 2004). The locational advantage of agglomerations is less their position in an important infrastructure intersection, but rather their combination of short- and long-distance accessibility and also access to major distribution areas. Decisions on the location of new DCs are primarily based on the criteria of size and accessibility. In the past few decades, this combination of factors has brought a greater proportion of distribution uses to the areas surrounding agglomerations, as manufacturing had already done earlier. Considering the present conditions of flow-oriented economy, this movement out of the cities has become stronger because the core cities and their traffic congestion create more and more obstacles to flow-oriented distribution.

This sub- and exurban drift of warehousing and freight distribution that was already foreseen by Chinitz (1960) in the case of New York City was recently analysed more in depth (Bowen, 2008; Cidell, 2009). In the United States warehousing and storage employment between 1998 and 2005 grew by 383 per cent, being the highest growth rate among all transportation subsections, and the number of establishments with more than 250 employees jumped from 26 in 1998 to 520 in 2005 (Bowen, 2008). Regarding the location of such establishments, air and highway accessibility
were considered most important. The degree and direction of the spatial transformations this industry experienced as also been evidenced, with a pattern of concentration along inland ports emerging in the Midwest, the Pacific Northwest and the Piedmont (Cidell, 2009). Against the background of a strong correlation between the distribution of population and the number of freight establishments (and given that highway access is almost ubiquitously provided for in U.S. metro areas), railway accessibility turns out to be one important factor in explaining warehousing distribution patterns per capita. Also, a certain inland (Midwest) shift of the industry is related to lower salary levels compared to metros at the East and West coast, explaining the strong performance of cities such as Memphis or Oklahoma City. This underlines again that Chicago stands out in any regard among the metro areas studied, given its role as a prime railway hub and traditional inland gateway city (see Figure 4). Regarding locational dynamics within metro areas, of a suburban drift of distribution establishments was also observed with locations close to central cities attracting the establishment of DCs, particularly due to accessibility advantages.

Following the increasing extent and spatial reach of freight flows in the course of globalization and intermodalism, two main categories of inland terminals have emerged in North America. The first is related to ocean trade where inland terminals are an extension of a maritime terminal located in one of the three major ranges (Atlantic, Gulf and Pacific) either as satellite terminals and more commonly and inland load centers (e.g. Chicago). The second category concerns inland terminals mainly connected to NAFTA trade that can act as custom pre-clearance centers. Kansas City can be considered the most advanced inland port initiative in North America as it combines intermodal rail facilities from four different rail operators, foreign trade zones and logistics parks at various locations through the metropolitan area.

The setting of large distribution centers, often part of distribution clusters, has been a dominant trend, particularly among major retailers which have set the standard in terms of inventory management of their supply chains. These intermodal facilities require a large array of equipment which can vary based on the freight they handle. Large distribution centers tend to develop on the principle of internal economies of agglomeration (within the distribution center). Logistics parks expand these advantages through external economies of agglomeration implying that the concentration of distribution centers within the cluster, even if they concern different supply chains, has the potential to reduce an array of costs.

**Added Value in Inland Freight Distribution**

There are two major types of added value related to freight distribution. The first involves performing an activity that improves the efficiency of freight distribution. Added value thus results in benefits that are carried to the shippers or theirs customers, notably in terms of cheaper products delivered in a reliable and flexible way (see Table 2). The second is extracting a form of rent from the existing flows, notably through tolls and taxes. Added value results in financial gains for various levels of government, which can be used to fund infrastructure projects and improve competitiveness. There is however a risk of a rent seeking behavior where freight activities are targeted strictly in terms of a source of revenue. The "added value" they generate for the rent seekers thus comes at the expense of the productivity of the supply chain.
**Table 2: Common Added Value Activities Associated with Inland Freight Distribution**

<table>
<thead>
<tr>
<th>Function</th>
<th>Overview</th>
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<tbody>
<tr>
<td><strong>Processing</strong></td>
<td>Operations on the goods. Includes sorting, packaging, testing, assembling.</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td>Operations on the cargo. Consolidation, deconsolidation, transloading or cross-docking. Assembling LTL shipments.</td>
</tr>
<tr>
<td><strong>Customs clearance</strong></td>
<td>Releasing and/or inspecting inbound cargo. Assumed by a national customs authority.</td>
</tr>
<tr>
<td><strong>Foreign trade zone</strong></td>
<td>A sanctioned site where foreign and domestic goods are considered to be outside of the customs territory. Requires bounded transport and bounded warehousing.</td>
</tr>
<tr>
<td><strong>Container depot</strong></td>
<td>Handle containers (leased or carrier owned). Transfer custody of containers between shippers. Storing and servicing/repairing containers.</td>
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North American logistics has particularly been impacted by the setting of Foreign Trade Zones, mainly at inland ports. A FTZ is an area that is considered outside the customs jurisdiction. It makes possible to import specific categories of goods without going through custom procedures as long as the goods remain within the FTZ. In the FTZ, the goods can be transformed (e.g. assembled) into other goods and then "exported" out under a different customs category. The main advantages of FTZ are thus regulatory and financial:

- **Custom clearance.** Since the FTZ is a bounded facility, the custom clearance can be done inland instead of at the port of entry and the consignment can stay in the bounded area for an unlimited amount of time. It is likely that this can be done faster inland because the facility is less congested than a large gateway port. The consignee thus gets a better notice about the availability of his shipment and can plan his supply chain management accordingly.

- **Duties.** In spite of decades of trade liberalization, duties are still levied on international trade. With a FTZ duties are not paid until the consignment is shipped out and can be deferred further if moved to another FTZ. If a transformation (e.g. assembly, labeling, testing) is performed within the FTZ, this added value activity is not subject to duties and can change the duty class of a product to a more preferential level. Commonly, duties are not levied if a product is damaged, defective or obsolete since its commercial value is considerably reduced. Thus, by inspecting products in a FTZ, the duty will be waived for any defective products. This is particularly useful for products that have a higher propensity to be damaged or defective.

- **Settlement.** For most transactions, particularly through letters of credit, the vendor is not paid until the consignment has left a facility (FTZ and/or transport terminal). A FTZ can thus be used to delay settlement until judged suitable by the consignee and also offers the opportunity to readily remove the value of damaged or defective products from the settlement.
5. Corporate Logistics and its Role in North American Freight Transportation – Three Cases

Wal-Mart

Corporate management in logistics and distribution has become extremely important not only for the generation of freight transportation demand, but also as a driver of organizational changes and technological innovation. Integrated supply chain management has developed in response to new modes of production, in the context of globalization, and with respect to a highly competitive market environment. Supply chain management has shifted focus from maintaining inventories aimed at approximately satisfying a demand towards a comprehensive system insuring that supply matches more closely with demand. This is mainly to be achieved through on-demand or pull- rather than push-distribution. Thus, physical flows also involve a significant amount of information flows. Hence, major inventions in information and communication technologies were the requirement for making the new logistics systems operational. This applies particularly to the management of information flows, regarding load units (being these single items, small consignments or 20 or 40 foot-containers), transport vehicles, distribution center operations or the entire inventory management of a firm.

It is hence no coincidence that contemporary logistics activities and thus freight transportation performances are increasingly driven by corporate management, rather than by infrastructure policy or the geographical conditions for moving vehicles and handling consignments. This becomes indicative once discussing the case of a single corporation that is already considered emblematic for the development of 21st Century capitalism (Lichtenstein 2006). This is the case of Wal-Mart, the U.S. retailer that is currently ranked second on the Fortune 500-list of the largest corporations (based on turnover). Wal-Mart has achieved its position as the largest retailer world-wide – among others factors – particularly through the development of a sophisticated distribution system that was constantly improved over time (Bonacic 2006). The spatial expansion of the firm by placing new retail outlets was usually centered around a DC, in order to allow efficient supply of goods. As of 2009, Wal-Mart operates a network of 147 distribution centers that service its approximately 7,800 stores world-wide (4,200 of that domestic) and that receive commodities from about 60,000+ suppliers (Walmart 2009), about 80 per cent of which are located in China (Gereffi and Christian 2009, 579). Such an extended network requires an extreme degree of control and velocity of both inventory and flows, in order to avoid dead capital, given the marginal revenues that can be achieved in the retail industry. “Wal-Mart revolutionized the speed and efficiency of getting products to stores through its distribution center location strategy and cross-docking techniques. All Wal-Mart stores are typically located within a day’s drive of a distribution center, and the company works closely with its suppliers to streamline deliveries.” (Gereffi and Christian 2009, 576-77).

In contrast to the majority of its competitors, all distribution activities including trucking and warehousing have remained under control of the company, rather than being outsourced to service providers. Wal-Mart has always been introducing new technologies from early on, particularly those technologies that allow for an efficient flow of data and materials. This policy comprises electronic data exchange (EDI) that enabled the management to track the entire data flow, satellite systems that provided control of vehicle operations, and lastly RFID-technology that was supposed to increase inventory control through improved on-time information flow. The
acceleration of average turnover allowed for not only to diminish costly inventory but to mobilize further interest rates before the account had to be settled. The massive expansion of Wal-Mart did not occur without affecting other companies, particularly competitors in the retail industry and also suppliers who had to follow the rather rigid imperative of the purchasing and supply chain management regimes of the retailer (cf. Gereffi and Christian 2009, 577). It is noted by the authors, also referring to other studies (e.g. Brunn 2006; Lichtenstein 2006) that the particular business model pursued by Wal-Mart would be essentially driven by its extraordinary power in supply chain management.

Whereas the introduction of RFID-technologies did not succeed as yet according to the firm’s expectations, Wal-Mart is going to reorganize its supply and purchasing policy, following a 2005 commitment to reflect both ethical and environmental standards for achieving corporate responsibility (Plambeck 2007). This can be read as a response to wider criticism of the company’s attitude against competitors, vendors and employees articulated by the public or by community organizations (Christopherson 2007). As part of a comprehensive scorecard-approach, the firm aims at improving the overall sustainability of its products and processes, emphasizing 14 focal areas within three broad categories: renewable energy; zero waste; and sustainable products. One of the focal areas targets the logistics network, e.g. for improving the efficiency of the trucking fleet. The measures will also be undertaken as a means of maintaining the firm’s profitability: “In the first year of the program following [former CEO] Lee Scott’s announcement, the logistics network achieved roughly a 25 percent improvement in fuel efficiency, meaning almost $75 million in annual savings and 400,000 tons of CO2 per year that did not enter the atmosphere.” (Plambeck 2007, 4)

**BNSF Logistics Park, Chicago**

Distribution centers operated by the freight distribution industry are increasingly part of logistic park projects co-located with intermodal rail terminals (Rodrigue et al. 2009). The BNSF Logistics Park Chicago began operating in 2002 and is entirely private, the terminal constructed by the class 1 rail operator BNSF for about 1 billion USD with ProLogis and CenterPoint responsible for the provision and management of distribution centers. Thus the world's largest rail company is in partnership with two of the largest promoters and managers of logistics space. It is a suburban logistic center taking advantage of the principle of co-location; the rail terminal and the logistics park have been constructed at the same time, which reduces drayage considerably. A wide array of freight distribution activities is present, including free trade zones. Most of the site is a reconversion of a former Army munitions depot (Arsenal), which account for 2,200 acres (excluding the rail terminal). The rail terminal handles the largest volume in North America and is directly linked to the most important North American rail corridor, the Los Angeles - Chicago axis. The rail lines of this corridor are either owned by BNSF or UP. The terminal is therefore modern and productive with limited dwell time and demurrage. This productivity and capacity obviously benefit the co-located activities that use such advantage in their marketing as the site benefits from massive economies of scale and an excellent accessibility to the North American freight distribution system.

A large share of the real estate of 12 million square feet are leased, underlining the business model is based upon revenue generation from location to amortize capital investments. The main
tenants are Wal-Mart (retailer with 3.4 million square feet), DSC Logistics (third party logistics service provider; 3PL), Georgia Pacific (the world's largest wood product manufacturer in the world), Potlatch (forest products), Sanyo Logistics (distribution), Partners Warehouse (3PL), California Cartage (3PL) and Maersk Logistics (3PL). The presence of the maritime shipping company Maersk underlines the setting of a hinterland strategy pursued by several shippers around the world, which help better manage their containerized assets. The BNSF Logistics Park is an important component for inland distribution for imports from the West Coast and its dynamics are thus strongly linked with transpacific trade. About one mile north of the site, a second component is planned with 3,600 acres that have been acquired by Centerpoint, but in this case the rail terminal will be provided by UP.

**CenterPoint-KCS Intermodal Center, Kansas City**

With the ongoing integration of the North American economy, Kansas City has seen the emergence of a new corridor towards Mexico, often dubbed the “NAFTA highway”. The rail operator Kansas City Southern (KCS has been a major proponent of this corridor by establishing a Mexican subsidiary (Kansas City Southern de Mexico; KCSM) with rail terminals at the port of Lazaro Cardenas. The system is labeled KCS International Intermodal Corridor. However, the setting of this corridor requires supply chain managers to consider the Lazaro Cardenas option, thus the setting of an inland port at the end of the corridor in Kansas City to help anchor this freight. KCS and CenterPoint Properties began in 2007 building a 1340 acres inland port labeled CenterPoint-KCS Intermodal Freight Gateway over a reconverted military base (Richards-Gebaur). This reconversion is managed by the Kansas City Port Authority that can sell or lease the land under its jurisdiction. The developer Hunt Midwest is also involved in projects related to underground warehousing facilities.

Like many inland ports in North America it follows the landlord model where a real estate promoter seeks revenue generation through a partnership with a rail operator, building logistics activities in co-location with the rail terminal. This park is a geographically specialized inland port within the Kansas City cluster with an orientation towards Mexican supply chains or global supply chains going through Mexico. It is thus interesting to note that the complex is labeled as a gateway to underline its status as a point of entry of global trade transiting through Mexico to an inland port deep inside the United States. Like many commercial projects, the development of the inland port is divided in phases (five in this case) where facilities are incrementally provided to the location market. What is also particular to the project is due to its adjacency to a major interstate highway and its proximity to Kansas City (25 km south), a retailing component is planned with the sole purpose of revenue generation.

### 6. A freight and Logistics Policy Framework

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. 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.

The strategies of policy and planning with respect to freight distribution and logistics have changed remarkably over the last four decades. With regard to the style of policy making and intervention, different stages can be distinguished: During the 1960s, freight has not been particularly addressed by transportation planners yet, except the matters of fact that, first, infrastructure had to be provided and, second, in the case of port cities, that port development in general was a major policy issue that shifted some attention to freight distribution. 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. As a consequence of 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. Metropolitan planning organizations and also the Federal government were developing elements of a freight related policy framework (e.g. developed and distributed under the auspices of the Federal Highway Administration). 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.

With respect to the capacity constraints and the sustainability deficiencies of the current freight system, the need for developing a balanced framework of policy and planning measures is undoubted. Different from more traditional routines of infrastructure expansion, it would comprise a comprehensive policy approach with respect to energy, climate change, infrastructure policy and modal share, within which intermodality would play a key role. It is also time for better balancing the freight sector with community demands, for example, regarding traffic generation or neighborhood impacts 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 have 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, Climate Change and North American freight distribution**

Energy issues, climate change and the related environmental and economic impact will clearly affect the North American freight distribution network. Because of its high reliance on trucking and air freight to support time-based distribution, the freight distribution system is particularly vulnerable to petroleum price increases as they were already observed during the year 2008. Even more than this is the case in Europe. 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 became accelerated by the deregulation of most transport sectors, making the design of large scale distribution networks attractive, with the effect of an increasing amount vehicle miles travelled. This mode of rationalization was based on the assumption of very low energy prices, implying that energy considerations were limited in the planning and operation of freight distribution.

However, 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. As 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.

Environmental changes will be of importance for future developments, since on the one hand freight transportation, particularly the operation of trucks, contributes significantly to air pollution and related damages. According to a study commissioned by the FHWA, freight transportation is a major source of national NOx and PM-10 emissions. Particularly, freight vehicles contribute approximately half of mobile source NOx emissions and 27 percent of all NOx emissions at the national level. Freight transportation also accounts for 36 percent of U.S. mobile source PM-10 emissions (ICF-Consulting 2005). Such emissions are usually concentrated
along major truck routes and close to freight facilities, such as ports and large DCs, where neighborhoods are thus exposed to health risks.

7. Conclusion

North American logistics and 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 North American gateways and inland freight distribution systems. 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 reorganization and regionalization of supply chains.

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.

The fact that North American logistics is a trans-jurisdictional issue involves two major dimensions. First, the commercial context is shaped by forces well outside the control and to some extent the comprehension of any political jurisdiction. Second, freight transportation and logistics are mostly a private industry and the allocation of assets is the outcome of profit seeking and efficiency maximizing strategies. The phase of deregulation that North American transportation went through in the last decades was mainly aimed at the national transport industry. It was not expected that because of the growing level internationalization of supply chains, global freight shipping companies, such as maritime shippers and port operators, would play such an important role in North American logistics.

References


