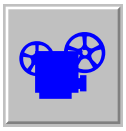
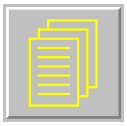
Toward Improved Intermodal Freight Transport Between Europe and the United States: Report of the Third EU–US Forum

Based on an Eno Transportation Foundation Policy Forum

held November 3-5, 1999, in New York





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Preface

Transportation is the cornerstone of the rapidly expanding and increasingly integrated global economy. An efficient, coordinated network of transportation services makes possible the full benefits of the global economy. A significant facilitating factor in national and international economic growth is the increasing role of electronic commerce, or e-commerce, which is revolutionizing business practices around the globe and creating a powerful dynamic in the transportation industry. Marketing and distribution requirements for all types of cargoes and involving all modes are in a state of flux, with pressures to reduce shipping costs and increasing calls for speed, safety, and environmental protection.

Intermodal transport—providing door-to-door service using more than one mode—has evolved, both domestically and internationally, in response to the demand for flexible, integrated transport services in the global marketplace. The unifying goal of this forum was to improve intermodal transportation between Europe and the United States. Forum participants—whether private-sector representatives of shippers and transportation carriers, consumers of the goods that are carried in this massive system, or government organizations responsible for improving economies and quality of life—shared this goal. The goal is difficult to attain, because no single organization can possibly improve this complex network by itself. Intermodal freight transport involves not only transportation systems and vehicles, but also a combination of business decisions, regulatory and competitiveness regulations, and liability practices. Extensive coordination is required between public and private sectors and among the various modes and different nations that make up this vast network.

The catalyst for these forums has been the European Union (EU) and the US Department of Transportation. Each of the forums has brought together top private-sector leaders and senior government officials who have devoted time and effort to come together sharing thoughts, helping develop an improved understanding of common problems, and strategizing potential solutions.

The first of these forums was held in 1997 in Washington, DC, where discussions focused on impediments to intermodal freight transport and on opportunities for improvement. The second forum, held in Munich in 1998, emphasized legal and regulatory issues governing the rules of competition in the two regions. Participants discussed intermodal liability issues, debated issues of equipment standardization, and introducted ideas on best practices.

The third forum, held in New York on November 3-5, 1999, continued progress towards the smooth and efficient movement of goods between Europe and the United States. Participants examined the issues and opportunities confronting intermodal freight transport and identified opportunities for action and priorities for continued progress. These included electronic commerce and intermodal transportation, infrastructure finance issues, best practices in intermodal transport, and prospects for greater equipment standardization.

The forums do not constitute a decision-making body. Instead, they offer an opportunity for individuals to go back to their own organizations and sphere of influence and take actions consistent with an increased understanding of intermodal transport. This report provides a summary of the discussions and the text of the commissioned background papers. In keeping with the e-commerce emphasis of the New York forum, a CD-ROM is packaged with this publication. The CD-ROM includes an electronic version of this publication, video highlights of the conference, additional publications handed out at the conference, and electronic versions of most of the presentation graphics used by the speakers.

The productive dialogue of the forums is helping to improve understanding and leading to joint pilot studies and the definition of areas for further work. The goal of seamless international intermodal transport now

appears to be achievable, and the benefits of achieving that goal have been highlighted. Continued efforts are warranted to build on the commitments by both private-sector leaders and governments on both sides of the Atlantic to work together to develop the full potential of international intermodal freight.

Third EU-US Intermodal Freight Forum Focuses on the Impacts on the E-Commerce and Third-Party Logistics

On November 4 and 5, 1999, 42 senior freight industry executives and government transport officials met in New York City to exchange ideas about streamlining the trans-Atlantic intermodal market. This was the third in a series of forums on intermodal freight transport cosponsored by the European Union and the U.S. Department of Transportation. Participants find them valuable in understanding issues that cut across modes and governmental lines, and this allows them to work within their own organizations and spheres to accelerate progress toward a seamless freight transport system between North America and the European Union. Co-chaired by Kenneth Wykle, US Federal Highway Administrator, and Karel Vanroye of the European Commission, the forum examined the implications of growth in e-commerce, the prospects for increased standardization of containers, recent advances in tracking and tracing of intermodal shipments, and the opportunities and risks of third-party logistics.

E-commerce promises to have significant implications for intermodal transport, and this was the subject of a lively exchange. Rapid growth in e-commerce, particularly in business-to-business transactions, will be matched by strong growth in demand for intermodal services. Package express services and national postal systems will intensify their competition to dominate service to the final destination. A variety of new businesses are being structured around e-commerce and efficient transportation services, particularly in the computer industry. This is increasing the number of parcels shipped at the retail level while resulting in more efficient larger loads in business-to-business transactions. While e-commerce is helping speed up transport, the greatest efficiency may come through the reduction of administrative costs. US and Europe leaders found that the implications of the boom in e-commerce appeared similar in both regions.

Significant differences in European and US port infrastructure finance policies and practices were examined in detail. The return on investment is declining for all US ports, squeezing port investment. Government investment is also declining, while the costs of building and maintaining port infrastructure is increasing at a very rapid rate, mostly due to the costs of environmental mitigation. In both Europe and the United States, many believe that new revenue sources must be found to finance port development.

Within Europe, there is continuing frustration with the difficulties of operating in a system with many technological incompatibilities and political boundaries. This has resulted in transport patterns in Europe that are characterized by much shorter average lengths of haul than in the United States. The relatively low market share of freight carried by rail in Europe is an economic and environmental concern. Improvements in standardization and interoperability are needed on many fronts, but significant improvements do not appear likely soon.

Prospects for greater standardization of loading units proved to be a particularly contentious subject. The range of container dimensions within the United States and international service to it has evolved to reflect its infrastructure and geography, and led to a different mix of units than is found in Europe. Some European executives have formed a task force to find ways to gain increased container standardization within Europe, and have come to a preliminary conclusion that existing European van length limits (13.61 meters, or 44 feet 7 inches) might work well. Others argued that this was unduly restrictive, and argued that a somewhat larger unit—45-foot containers—were increasingly gaining market share in certain international movements. A range of diverging views were expressed

regarding the advisability of 45-foot containers. There was consensus that the discussion of this issue could be improved by developing reliable information on the current use of 45-foot containers in terms of numbers in use, commodities carried, and countries served. This would be a useful next step in consideration of trans-Atlantic container standardization.

US executives described a system in which carriers provide the chassis for intermodal shipments. Problems in the current US system are being overcome by shared chassis pools with the benefit of fewer chassis required, less terminal capacity needed, and improved roadability. Railcar use has been made more efficient by fixed stanchion design, slack elimination, and double-stack operation. The current U.S. emphasis on improving intermodal connectors, terminal improvements, and movement toward a more rational intermodal network appears to be matched by similar priorities in Europe. The European Freight and Logistics Leaders Club Working Group on Best Practices identified concerns with the lack of intermodal tracking systems, terminal bottlenecks, lack of standardization, high costs of intermodal transfers, and rail reliability. They recommended improvements in the control of intermodal units, increased effectiveness of terminals, improvements in road access to terminals, and more focus on standardization.

Both regions face a range of issues associated with the growth of third-party logistics providers. US companies have outsourced noncore businesses as a means of removing assets from their balance sheets, thus providing a leaner and more aggressive corporate profile to potential investors. Accounting practices that require inclusion of pension liabilities have contributed to this trend. European firms make heavy use of third-party logistics operators, but generally maintain sufficient staff expertise and control of the information to retain logistics management as part of the core, in-house strategic business. In both regions, third-party logistics firms are often advantageous because of their ability to negotiate attractive volume rates, but firms in this area tend to specialize in the range of commodities carried and the geographic regions in which they have expertise. There are no truly global third-party-logistics providers, so many users of third-party logistics firms turn to several providers and manage the overall operation themselves. Opinions are divided about the prospects for increased use of fourth party logistics, whereby a logistics provider not only supplies all transportation services, but also deals directly with customers. This practice has been heralded as a growing trend, but many executives expressed concern that this was a strategic business element, and that they were reluctant to lose control and risk not having in-house staff expertise in this area.

Intermodal liability issues remain a concern. More agreement is needed on who is responsible for goods during each segment of carriage. On the US side, a move to amend the 1936 Carriage of Goods by Sea Act, which had generated considerable concern in the previous forum, appears to have lost steam. In large part, the recently passed Ocean Shipping Reform Act, which permits the formation of confidential contracts, has allowed parties to arrange the terms of liability coverage through the contract. The emergence of third- and fourth-party logistics providers means that the strength, stability, and trustworthiness of these firms is also part of the liability equation.

Advances in cooperation in US/EU intermodal freight technology originating in the prior forums illustrate the value of these discussions. One pilot project, involving a number of firms in the automobile industry, is designed to support tracking and tracing of containers throughout the intermodal supply chain and to improve elements of supply chain management. This project was fleshed out at a joint US/EU meeting on Intermodal Freight Technology held in Seattle, Washington, in June 1999. A related EU-supported effort, the Simple Intermodal Tracking and Tracing Project, is designed to create an industry-owned and -operated planning and information service for the European transport industry.

All recommended that the forums be continued, and discussion suggested sev-

eral priority areas for attention at the next meeting. These included:

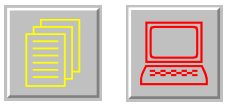
- Financing options and financeability of transportation infrastructure
- Best practices in intermodal transport with specific consideration of terminal efficiencies
- Future transportation technologies
- Comparable data on EU/US unit costs by mode, lengths of haul, and the like for shipments by rail, truck, barge, and short-haul ship
- Discussion of industries best suited for utilization of third-party and fourth-party logistics provider services
- Continuation of the excellent work to date on e-commerce, recognizing its facilitating and technology forcing role in intermodal transport
- Standardization of containers used in trans-Atlantic services, including a quantitative summary of what is actually moving in this region, and an overview of the market share of different container sizes in other international markets
- Liability considerations in intermodal services
- Intermodal issues arising before the World Trade Organization

Industry leaders and government officials strongly endorsed continuation of joint pilot project efforts in the area of tracking and tracing of intermodal shipments. This illustrates one of the tangible benefits of this unique international public/private dialogue. Equally importantly, the discussions allow participants to return to their respective organizations with a broader understanding of the surrounding system, and to take individual actions that collectively facilitate the rapidly growing, fast changing world of international intermodal freight transport.

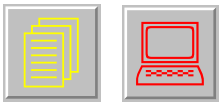
Introduction

On November 4 and 5, 1999, 42 senior freight industry executives and government transport officials met in New York City to exchange ideas about streamlining trans-Atlantic intermodal freight systems. This was the third in a series of forums on intermodal freight transport cosponsored by the European Union (EU) and the US Department of Transportation (USDOT). Participants have found that the forums help them understand issues that cut across modes and governmental lines and allow them to work within their own organizations and spheres to accelerate progress toward a seamless freight transport system between the United States (US) and the EU. Cochaired by Kenneth Wykle, US Federal Highway Administrator, and Karel Vanroye of the European Commission, the New York forum examined the implications of growth in e-commerce, the prospects for increased standardization of containers, recent advances in the tracking and tracing of intermodal shipments, and the opportunities and risks of third-party logistics.

The Outlook for E-Commerce



U.S. Perspective



European Perspective

E-Commerce

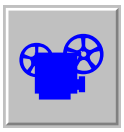
E-commerce is changing the way businesses are structured and revolutionizing the way goods are processed, sold, moved, and distributed to customers worldwide. It is creating new business roles and relationships while destroying others. Traditionally, business has stratified itself into discrete specialties, such as manufacturing, wholesaling, retailing, and purchasing, with transportation as the link connecting these elements. These business practices that have evolved slowly over many decades are now changing at a pace that is mind-boggling. Transportation providers are being challenged to adapt to the initiatives of others and to innovate in an attempt to stay ahead of market trends and to provide services that will preserve or grow market share in the current dynamic environment.

E-commerce has many elements. Most derive from the communications revolution that has been driven by the Internet. E-commerce is breaking down communication barriers, particularly with respect to distance. Companies on opposite sides of the world are electronically as close as those that share a building. The Internet stands apart from many earlier introductions of new technology in that it is cheap and flexible. One measure of this aspect is the fact that it is simultaneously finding its way into homes and businesses around the globe. Important components in the business world include Intranets that are internal to companies and allow greater vertical integration of business units than possible in the past. Extranets, Web services that have privileged access, are facilitating partnering between businesses.

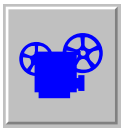
Dell Computer and amazon.com are often cited as companies with e-commerce business models, reflecting total reengineering of traditional concepts. IKEA is another growing company whose trans-Atlantic expansion is based heavily on an electronically rich model. By sharing information with members of their supply chain network, these companies are able to reduce inventory, or minimize the situations where inventory sits in a valueless situation. Their supply chain network is characterized by transparency with a continual

Robert Martinez, Norfolk Southern Corporation

Kevin Heanue, Transportation Consultant



"High capital transportation providers are at risk of becoming commodity providers, where other elements in the supply chain capture the premium."
—Robert Martinez



Kenneth Wykle, Federal Highway Administrator

knowledge of location of shipments and precise, rather than general, expectations of arrival times. E-commerce has no place for logistics practices where a shipment/container disappears into the "system" with a hope of arrival in a week, with no ability to be tracked or for customers to be notified if problems arise or rerouting is required.

In e-commerce, intermodal supply chains involve three elements. Goods are moved, information about the goods and their movement is exchanged, and money relating to the goods and their movement is exchanged. Traditionally, these functions have been discrete, involving different specialized companies. Today, however, service organizations as diverse as General Electric, the Port of Hong Kong, the Port Authority of New York and New Jersey, and City Bank are competing to offer a single, integrated package of intermodal supply chain services. Tensions exist because most businesses have long guarded knowledge about suppliers, quantities supplied, and most importantly prices, and they are uncomfortable making such information available to third parties.

E-commerce can also be thought of as markets and transactions, specifically supporting the transactions and monitoring their fulfillment. One model to help understand e-commerce is the airline passenger industry. Airlines have for many years practiced a form of e-commerce. A passenger can enter the system directly with the airline, through a travel agent, or in some cases, by using a discount ticket wholesaler. Once a ticket is purchased, a common record is established that is accessible from multiple places. The passenger may also make arrangements for hotels, rental cars, or meals to accommodate special dietary requirements. Travel frequently involves the use of multiple airlines. Increasingly, prospective passengers are conducting Internet searches for travel arrangements that offer the best value or that meet special needs. Regardless of how the arrangements are made, a common record is established. Airlines have worked out extranet arrangements that govern sharing of the common record.

The general public typically considers e-commerce a novel substitute for retail shopping, and it is. Yet 90 percent of e-commerce involves business-to-business transactions. The objectives of businesses adopting a market strategy based on e-commerce include increasing market share, improving profitability, and in some instances, survival. Partnering with supply chain companies is a key element in starting the process; merely negotiating for lowest cost is not sufficient. The supplier must be able to meet the broader logistics requirements of an e-commerce business. Logistics thus moves from a post-deal-closing arrangement to an essential ingredient of the contract, requiring that there be a marriage of logistics expertise and information technology. Eliminating redundancy in business practices is also an impor-

"Our experience with a particular e-commerce initiative at the Department of Defense is that at the end of the day it makes the process simpler, but getting there makes your life significantly more complex. You have many players to deal with. You have to look at the entire transaction, not just the shipper and carrier, but the financial community and others. Every integration we perform creates another opportunity. Looking at their billing, and payment process, we found an opportunity to make the entire transaction between the shipper and the carrier electronic. The pricing, ordering, billing and payment are all on the Web. We have been able to significantly reduce paperwork and labor costs while streamlining documentation and payments. It is truly turning out to be a win-win situation for the Department of Defense and for the transportation carriers."

—Mary Lou McHugh, Assistant Deputy Under Secretary of Defense

tant aspect. Reengineering for e-commerce attempts to sweep away myriad letters, phone calls, and faxes with their opportunities for error with a standardized multipurpose document.

Eliminating redundancy also cuts time from the process, with significant cost implications. Trust is another essential ingredient of supply chain management, as transparency of operations requires more sharing of business information in most situations, particularly where third parties are involved.

Opinions differ regarding the growth potential of e-commerce and the nature and impact of that growth on transportation. In recent years the monetary value of goods purchased through e-commerce has doubled annually. If this trend continues to 2003, electronic commerce would amount to $1.3 trillion globally. It is, however, a risky business. Some estimates suggest that 75 percent of all Internet startups will fail. To date, the ability of the Internet to facilitate transactions has resulted in a large increase in the number of parcel shipments and a boom in business for parcel delivery firms. The Internet also makes it easier to do business with people at greater distance, but the actual effect of this technology leap on transportation is not yet known.

E-commerce got off to a faster start in North America than in Europe, but the growth rate in Europe is significant and it appears there will be no long-term differences in acceptance or application. The impact of e-commerce on transportation could differ between continents given the differences in transportation systems. It appears that the pressures of e-commerce will tend to favor larger, global companies that can afford to reengineer their businesses.

The e-commerce revolution has created a powerful dynamic in the transportation industry. In the public sector, transportation planners work with 20-year time frames in planning new facilities. Ports, airports, railroads, intermodal terminals, and large ocean-going vessels require large amounts of capital, and their profitability or use is predicated on a long-term horizon. At the same time, e-commerce companies with their reengineered business plans are poised to choose only those options that meet their needs today and to demand changes in traditional practices when deemed possible. E-commerce companies have a goal and a good track record of wringing costs from their supply chains. They have proven adept at finding profit margins in cutting costs, eliminating redundancies, and offering better service. Transportation, and generally intermodal transportation, has, along with the Internet, made it possible. Transportation companies operating on very low profit margins are at risk if they do not join the e-commerce revolution. Forum participants agreed that it would be very unfortunate if transportation providers were the source of major savings but derived little of the benefits of the e-commerce revolution.

Riccardo Vitale, Procter & Gamble

The driving force in the success of e-commerce is the ability to add value in the business cycle. For example, the efficient

Karel Vanroye, European Commission

Christine Johnson, Federal Highway Administration, US Department of Transportation

processing and use of information is one of the new functions that is most important in the intermodal transport business. Efficient data sharing within and between companies is the enabling ingredient of success. The ability to manage data sources and information flows is a crucial element to adding value. During the forum the term "infomediary" was used repeatedly to describe the new player in the logistics business, who by using e-commerce has been afforded a much more complete picture of transportation providers and their cost and service parameters. The infomediary has no emotional ties to one mode or vehicle type, but rather chooses providers based on cost, ability to meet fairly rigid time requirements, and the quality of tracking and tracing services. Transportation companies are having a hard time adjusting to the e-commerce reality, which says they must make a heavy investment in e-commerce ability and be willing to rapidly adapt services to the new requirements. The alternative is to be left behind.

Transportation assets will always be central to the movement of goods, but many transportation providers are too tied to their capital assets. In the past, ownership meant control. In the transition to e-commerce, knowledge assets are providing a greater return than capital assets. The crucial aspect for today's transportation providers is to link transportation assets into the knowledge/information base so as to leverage maximum asset utilization and profitability.

Three potentially successful e-commerce business models emerge in the global environment. First are the international transportation companies, such as Maersk Sealand, which provide competitive shipper-to-customer transportation service as well as the required information-laden services, such as tracking and tracing. The second model involves a partnering or marriage of efficient transportation service companies with e-commerce-based logistics providers. The third business model involves companies such as Dell and Amazon.com, which are engineered from the start to use the potential of e-commerce. They develop a product internally or purchase it externally under strict time, quality, and price criteria in a manner that uses business plans and logistics to create seamless, low-cost, efficient product delivery.

The jury is still out regarding the full impact of e-commerce on demands for transportation services. When large shipments move over long distances, shipping costs are lower. We have already seen that one impact of e-commerce is to eliminate the impediment of distance on communication. Potential sellers and purchasers can communicate and compare prices worldwide at no more cost than checking locally. Companies like Amazon.com in the current stage of e-commerce development have clearly increased the number of small parcel shipments. Private delivery companies such as United Parcel Service and Federal Express and national postal services such as Deutsche Post are positioned to benefit from the explosion in the demand for parcel delivery. The ability to aggregate the increased volume of parcel units into truck and container size scheduled services opens the possibility of additional providers moving into this expanding market.

Infrastructure Investment

Significant differences in US and European intermodal infrastructure investment policies and practices were initially discussed at the second US-EU Forum held in Munich in 1998. Based on those discussions the participants requested that a much more complete discussion of the policies, practices, and status of infrastructure investment be held

U.S. Port Finance

European Requests for Future Infrastructure

at the third forum. These discussions revealed that the priority interest regarding intermodal investment in the United States, at least infrastructure investment, related to ports. Interest in European infrastructure investment covered a broader set of issues, including dissatisfaction with the European freight rail system and the transitioning of the pre-EU national transportation networks into a pan-European system.

US ports have evolved from private entities to municipal functions, to creations of authorities set up under state law or, in the case of the few multi-state ports, interstate compacts. Port financing has varied considerably over time depending on the ability of the port to generate revenues to cover costs and on the willingness of state or local governments to subsidize port development.

The European Union has a policy of transparency with respect to port financing within member countries, and there was a desire to compare US port finances on a similarly transparent basis. The Maritime Administration (MARAD) of the US Department of Transportation has published a number of reports over the years that provide overviews and a degree of transparency to US port financing. A 1997 MARAD study, *An Analysis of US Port Profitability and Self-Sufficiency (1985-1994)*, found that with few exceptions there has been a steady decline in port profitability. There has also been a decline in the return, before subsidies, on the net investment in plant, property, and equipment. The study found that the declines held for all port regions of the US and concluded that competitive factors "may require the future growth of most US ports to be funded through taxes and sources other than port revenues."

The MARAD study also looked at profitability from the standpoint of the type of operation. US ports follow three operating models. First are the operating ports, where the port authority carries out all port operations. Second are the nonoperating ports, where the port authority may own the land on which the port exists but leases space to other parties that carry out operations with their own equipment. The third model is the limited operating port, where the port authority may undertake limited operating functions, such as warehousing or lift operations, but leave other functions to operating companies.

Harold Cerveny, TTX Company, Emilio Fernandez, Transfesa, and Johannes Fritzen, Volkswagen Transport (left to right)

To bring the MARAD studies up to date, a series of case studies were carried out in preparation for this forum. Unfortunately, the case studies point to a continuing decline in return on US port investment. Ports are under pressure to invest heavily in new facilities. At the same time, however, they face burgeoning costs, stagnating productivity, and reductions in subsidies from all sources. This holds true for all ports, and the larger the port, the greater the pressure. The case studies show that the very largest ports remain profitable, but their return on investment has plummeted in recent years. Overall, the case studies show that nonoperating ports fared better in terms of profitability than operating ports.

The case studies illustrated a unique feature of US port financing, namely, the use of tax-exempt bonds. These bonds, whose interest is not subject to federal taxes, provide a subsidy to port investment that is not always accounted for in port finance studies, and such subsidy is a finance element not available to European ports.

Mergers and business alliances in the ocean shipping community, along with the introduction of megaships, are creating the greatest pressure for port investment. Merged firms want more space for consolidated operations, but rarely propose productivity increases to reduce space requirements. Since ports typically have limited or no capability to increase operating capacity because of land constraints, they often consider creating new land through dredging and filling. Current environmental laws and regulations often make this option very difficult, and in those cases where it is possible, the costs greatly ex-

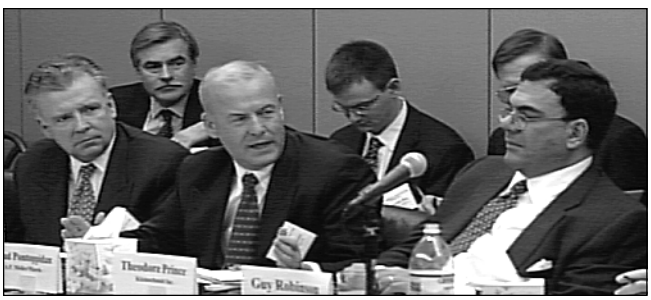
Guy Robinson, European Commission, and Rune Svensson, Volvo Transport

ceed what can be expected to be amortized through normal business operations.

Although megaships offer productivity gains in load size and in-transit speed, they require new landside infrastructure for efficient loading and unloading, and channels must be dredged to accommodate these ships. This is not a technical problem, but rather an issue of environmental permits and cost.

These increased costs make it difficult for ports to lower their prices. Major shipping lines drive port charges down by threatening to take their business elsewhere. Ports and politicians do not fear the loss of shipping business itself, but rather the loss of jobs, development, and taxes at their facilities and in their economic hinterland. In parallel with the growth in costs and reduction in prices has been a reduction in subsidies available from all levels of government, in keeping with today's political philosophy to reduce taxes. Ports are given no special treatment when government expenditures are reduced.

Port productivity is stagnating, particularly in the area of port landside operations. The landbound, environmentally constrained ports of the US East Coast must become more productive if they are going to grow within reasonable cost constraints. For models, one need only look to the West Coast, where significantly higher port productivity is achieved, and to Asia, where productivity is higher still.



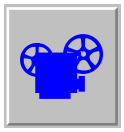
Front (left to right): Thomas O'Bryant, ABN-AMRO Bank N.V.; Knud Pontoppidan, A.P. Moller/Maersk; Theodore Prince, Kleinschmidt Inc.; Rear: John Reeve, Reeve and Associates; Christopher Ross, European Commission

Three port statistics are worth examining: lifts per hour, lifts per acre, and dwell time. Each of these measures is a way of looking at port efficiency/productivity. An evaluation of lifts per hour would obviously consider hours of operation—is the lift equipment being used more than 8 hours per day and 40 hours per week? Lifts per acre and dwell time are used to determine the degree to which valuable port space is being used for storage. Empty containers stored at the port consume valuable storage space, and sometimes even full containers are stored on port property because shippers find it cheaper than moving the goods to a warehouse.

Based on the port finance paper that follows in this report (see page 43) and the discussion that occurred at the forum, there is a high degree of transparency in US port financing. Nonetheless, difficulties arise in calculating the value of subsidies from tax-exempt bonds and in ascertaining the value of benefits that carriers achieve in service and rate negotiations with port authorities.

The issues confronting infrastructure investment in Europe are broader. The European intermodal market has not achieved the foothold that has been achieved in the United States. The US intermodal market includes only 4.5 percent of the rail market measured by carloads and, even at this share, the intermodal market must compete on cost and service for every load obtained. Large loads carried over long distances make for efficient transportation service. Europe is at a significant disadvantage compared with the US when the average haul length of transport (rail and inland waterway) is measured. In the US the average haul length is 1050 km, whereas in Europe it is only 200 km. It is very difficult for rail and water transportation services to compete with highway service at that shorter distance.

Other factors working against the increase in use of European intermodal transport include higher costs than equivalent road transport, longer transit times caused by pre- and end-haulage in the intermodal



describes one part of the problem

asks an important question

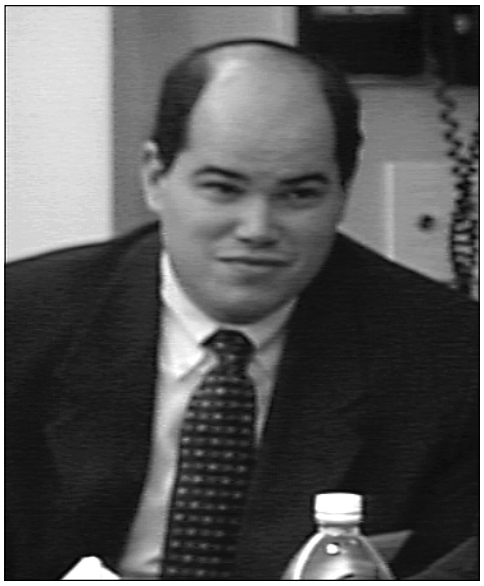
chain, the additional organizational and communication burdens required, lower reliability, limited applicability in terms of available cargo, dominance of state-owned companies that serve to limit international strategies, differences in rail gauge in parts of the EU, and incomplete intermodal networks in other parts of the region.

The current rail network in Europe is very dense, particularly in Germany, England, and the Benelux countries. Rail lines serve both passenger and goods movement, with very few lines dedicated solely to goods movement.

The European inland waterway network is very important in Germany, the Benelux countries, and northern France, where deep natural waterways or canals exist and inland barge transport is significant. Short-haul sea transport has a role in the coastal regions of Europe, but its use is limited by the need to transfer goods to other modes for shipment to areas outside the port.

Europe is well served by more than 1,000 intermodal terminals. This is in contrast to the significant reduction that has occurred in the US in conjunction with track consolidation following rail deregulation. Almost all European terminals are equipped to transship containers; 60 percent can handle swap bodies, and 50 percent are equipped for trailer transshipment.

The European intermodal network has many strong elements, but there are characteristics, policies, and practices that have led to bottlenecks, which retard use and hinder expansion of the network. The intermodal policies formulated by the ministries of transport of EU member countries range from liberalization/deregulation to continuation of state influence. Perhaps the most significant factors limiting intermodal use and frustrating expansion are the huge differences between the various EU countries in technical systems, loading units, and transshipment techniques. For example, the EU member countries have a number of different track sizes, signal systems, couplings, and power systems. In addition, there are variations in minimum and maximum operating speeds, maximum authorized lengths and weights of trains, and maximum authorized axle weights of wagons. These differences serve to frustrate companies operating across borders and cause many operational problems.



Robert Ritter, Eno Transportation Foundation

The EU intermodal infrastructure is also beginning to experience capacity problems. These problems are primarily due to the increase in freight transport resulting from growing economies, but are aggravated by the inadequate use of existing capacity, caused by many parties wanting to operate on the same routes. Compounding the infrastructure problem is the age of the rail network and the increased use of rail facilities for passenger transport. As high-speed rail transport has substituted for air transport, the frequency of passenger service between economic centers has sharply increased. Priority is typically given to passenger service, both in investment and operations. Forum participants from Europe expressed frustration at the priority given to passenger service over freight.

One problem common to Europe and the US is the environmental constraints that hamper extension of rail capacity. Before new capacity can be added, complex environmental hurdles must be overcome, and the cost of any necessary mitigation measures must be borne. A second problem involves terminal facilities located in older residential areas, where residents object to the steady stream of truck traffic. Many intermodal terminals once were rail yards that only served rail-to-rail connections and thus did not require efficient highway access.

Rolf Hellberg, Dow Deutschland, and Douwe-Frits Broens, TNO Inro, The Netherlands

The last infrastructure problem is an organizational one. The rail infrastructure in Europe is managed by organizations that for many years have primarily had an operating role within national boundaries. Today, they are being called on to have international vision in a much broader operating context. Until initiatives such as the Transeuropean Transport Networks (TENs) of the European Commission facilitate a change in attitudes and freight achieves equal priority with passengers in rail policy, intermodal progress will be difficult.

There are a number of extremely positive trends and developments that will likely facilitate intermodal development in Europe. First, the growing concern for the environment, which makes expansion of transportation facilities difficult, favors intermodal infrastructure over highway infrastructure. This trend, sometimes called "green logistics," has manufacturers demanding that their logistic service providers offer a broader intermodal array of services. Second, the very success of road transport is creating highway capacity problems and decreasing the reliability of road services. A number of EU governments, led by Switzerland, are demanding that through freight move by rail. Third, the trend toward storing and loading containers at rail depots away from ports is also serving to favor the development of intermodal services. Fourth, the formation of the EU, with its pan-European and increasingly global outlook, coupled with the globalization of many industries, has increased the demand for long distance transport—all of which makes intermodal transport more competitive.

The fact that US and European rail systems are evolving along significantly different business models was noted. Since their deregulation, US rail companies have merged into larger, leaner (in terms of track mileage and number of employees), vertically integrated, and more profitable companies. American participants noted that European policy is leading to disassembly of the rail network into infrastructure and operating components and expressed concern that it would be difficult to achieve profitability under such policies.

There are many proposals involving public/private partnerships on both sides of the Atlantic that are trying to combine the finances and creativity of the private sector with the authority of the public sector to construct new infrastructure. The problem is that while public /private partnerships may facilitate development, basic economics must be present and sufficient cash flow must be generated to amortize costs. Unfortunately, today's costs are so high it is very difficult to demonstrate positive cash flow even when a significant shipment volume is available.

Competing forces are at work in the US, Europe, and Asia on the question of port productivity. Clearly one option in the US is for ports with smaller footprints and higher productivity, perhaps on the order of 5000 lifts per acre. At that scale, ports could perhaps amortize improvement costs. The problem is the railroads often want more terminals at ports, not fewer, more efficient ones. The high productivity ports of Asia (with lifts per acre in the range of 10,000 to 12,000) are based on a different business model. They prefer common user facilities rather than the stand-alone dedicated facilities characteristic of the nonoperating/landlord models prevalent in the US. The US port infrastructure case studies showed that common user terminals such as Charleston or Norfolk have been able to control bottom line costs and required lower investment levels than nonoperating/landlord ports. It has been argued that these common user terminals push some costs, such as dealing with the terminal operator, the vessel operator and, in some cases, the stevedore, on to the shipper.

Current trends in the shipping industry, particularly the megaship phenomenon, are creating a demand for dedicated facilities. Large shipping lines control such sufficient volumes of business that they have the ability, on both sides of the Atlantic, to negotiate with multiple ports. The results of the negotiations are most often determined by concessions that are premised on economic development rather than transportation considerations. In the US, the federal government typically does not play a significant role in such negotiations, even though federal entities such as the US Army Corps of Engineers ultimately become involved in dredging. In Europe, while the EU is attempting to develop trans–European networks, national considerations predominate in major port development investment decisions.

Several factors that appeared common to both sides of the Atlantic were the trend toward, and the need for, public/private partnerships in port development and a desire to see an allocation of customs duties to port authorities. Ports everywhere are under tremendous pressure to upgrade and expand their facilities at the same time that their ability to raise revenue is diminishing, and they lack access to the customs revenues collected at the port.

U.S. Europe

US and European Concerns Regarding Intermodal Practices

A discussion of best practices in intermodal transport turned out to be a popular feature of the second forum (in Munich) and was planned to be repeated at this forum (in New York). What actually occurred in New York was a session that focused not on best practices, but that provided a candid assessment of intermodal practices on each side of the Atlantic, with a look at what the future might hold.

The Intermodal Association of North America (IANA), which organized the US presentation, plays a unique role in US intermodal transport. They have anti-trust immunity from the US government to administer a standard industry contract that covers the interchange of intermodal equipment and cargo among railroads, water carriers, and motor carriers. This arrangement has served to foster harmonization and standardization within the US intermodal industry. IANA is now looking at the collection and dissemination of shipment information as a next cooperative effort.

Thomas Brown, Riss Companies, and Gary Maring, Federal Highway Administration, US Department of Transportation

Intermodal business in the US is changing and has grown significantly, with the international part of the business having doubled in the past 10 years. Consolidation of ports is under way. For example, one-third of all international intermodal business comes through the ports of Los Angeles and Long Beach (California). Containers dominate the rail intermodal business, accounting for 65 percent of combined domestic and international intermodal loads. The excess rail capacity that existed in the past and permitted intermodal freight shipments to grow has been used up. Further expansion of intermodal rail transport is difficult and costly. In addition, the US intermodal business has a number of critical constraints and operating difficulties. There is a huge problem in terminal capacity, particularly in gateways like Chicago. One bright note is the efficiencies resulting from the introduction of professional terminal operators at ports where operations have been outsourced. Additional successes have occurred when terminals have been built from the ground up rather than retrofitted from existing facilities.

Connectors present another series of problems. The links between terminals and the US interstate highway system are now being studied. Recent US surface transportation legislation has resulted in an encouraging start in investment in connectors between terminals and arterial highways. Peak hours present another significant problem. If highway intermodal movement could

Phillip Yeager, Hub Group, Inc.

be shifted to off-peak hours, there might be a significant increase in productivity. The port-to-rail connection problem is currently being debated. The Alameda Corridor project, serving the ports of Los Angeles and Long Beach, is a very expensive ($3 billion) solution to a terminal capacity/connector problem. The resultant costs of $400 per lift will be five times more expensive than typical rates (for example, lift costs in Chicago are in the range of $60 to $70).

Intermodal equipment presents a further series of problems. On the positive side there have been major improvements in rail rolling stock. Stanchions have become fixed and single axles developed. Slack has been eliminated between rail cars. Double stack capable mileage has increased, significantly boosting productivity. An intermodal equipment problem unique to the US is caused by the practice of carriers, not customers, providing the chassis. For example, railroads and steamship lines provide their own chassis, which creates problems and excess expense. Not only is a large supply of chassis required, but many domestic and international containers require special chassis. A considerable logistics challenge exists in repositioning chassis for use, storage, maintenance, and repair. The development of chassis pools is evolving, usually around a port or marine terminal. Until this practice takes hold, marine terminals will continue to be parking lots for chassis, a costly and inefficient use of valuable port space.

What does the future hold? Although some believe that the intermodal growth rates of the recent past cannot be sustained, there is no doubt that further growth will occur. The only question is the rate of growth. The current pattern of rail network and terminal congestion argues for a revised or rationalized network and a rethinking of terminal locations and operations. A vision was presented at the forum of a national network that would build on existing rail lines, but that would have radically different terminal functions and locations and a different operating scheme. Loadings from major points of origin, such as Los Angeles, would be to major on-line destinations only. These would have sufficient volume to permit maximization of car utilization and lane density. Existing gateways, such as Chicago, St. Louis, and Kansas City, would be limited to local traffic only.

The former rework functions of the existing gateways would be moved to rural areas with low land costs and where there would be minimal environmental impact. These new rework terminals would not be designed to support local businesses, but would serve rail-to-rail transfer and also have run-through capability. Enhanced rail-to-rail transfer capability would have to be developed to support the new rework terminals. While the development of rework facilities away from major metropolitan areas was presented as a new national concept, individual railroads are already moving in that direction.

"The past cannot be the future for intermodality in Europe."
—Riccardo Vitale

The European working group on best practices focused on what the transportation market has to offer the shipper who wants to use intermodal transport. A shipper's decision about whether to use rail, road, or intermodal transport is based on service, cost, and the environment. The process is the same regardless of the outcome. The group looked at available intermodal services in Europe with respect to (a) the ability to meet shippers' arrival time expectations, (b) flexibility (the ability to accommodate peaks and valleys of shipping requirements), (c) terminal efficiency, (d) equipment availability, and (e) cost. In addition, the shipper is interested in having updated information on the location of loads at any point in the shipping cycle. In Europe such information is difficult to obtain because the elements of the national systems have not been fully integrated.

The quality intermodal service that does exist in Europe is based on block and shuttle trains. However, the current intermodal volumes are not sufficient to warrant organizing block trains or shuttle trains on a systematic basis. Railway companies are under great pressure to show positive financial results. Unfortunately, intermodal service is not part of the profit-making side of the European rail business.

The working group identified four critical areas that need significant improvement if intermodal freight transport is to succeed:

- information technology
- terminal performance
- standardization in both equipment and operating conditions
- overall reliability.

Reliability was not only a question of speed, but also the ability to predict load arrival times with greater certainty.

The European perspective on the future of intermodal freight transport came in the form of a preview of the Simple Intermodal Tracking and Tracing (SITS) project, a study funded by the European Commission. This study is looking at the intermodal supply chain from end to end. Weaknesses in technologies, gaps, barriers, and legal, political, financial, and environmental constraints have been identified. The study found that there were few end-to-end tracking systems. Where systems did exist along a route, they were not interoperable. The study found that customers are demanding more information and concluded that better tracking and tracing are needed. Information is needed for both short- and long-term planning, as well as for customer service. The final report for the study will include a proposed data collection interface capable of being interoperable with the many systems and service providers that will constitute European intermodal transport. It is anticipated that the SITS project will be the forerunner of an industry-owned and -operated planning and information service for the European transport industry. This will require a critical mass necessary to make the service meaningful and the statistics useful. A key feature will be low-cost, Internet-based access to registered participants across Europe.

Fabio Capocaccia, Genoa Port Authority

Equipment Standards

The evolution of container size in the US is traced to 1956, when the first containers were set at a length of 35 feet to conform to the then-legal highway trailer length. The International Standards Organization (ISO) entered the field when the US patents ran out on the first containers. Modularity, interchangeability, and interoperability were the characteristics desired in setting the standards. Ten-, 20-, 30-, and 40-foot lengths and an 8-foot width were the basis for the original ISO standards. Today, 20- and 40-foot lengths have become the norm, and the original 35-footer is gone. Two heights, 8 feet and 8.5 feet, have become standard, and a new height of 9.5 feet is increasingly seen. There are containers for every imaginable purpose, demonstrating the flexibility of the concept. Containers are used in rail, highway, and shipping modes and are readily interchangeable. While external dimensions are important, equally significant are the structural requirements, which provide that all containers, even those longer than 40 feet, be capable of being loaded, unloaded, and secured at the 40-foot points.

The standardization discussion focused on the fact that 45-foot containers are being used increasingly in US and Asian shipping, and are accepted in Europe under a time-limited exception to ISO standards. This discussion came after the forum participants heard a summary of the preliminary results of the European Freight and Logistics Leaders Club's Working Group on Standardization. A controversy arose about the Working Group's tentative conclusion that existing European van length limits (13.61 meters/

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Karen Vanroye

Antti Vehvilainen

44 feet 7 inches) should be the standard. The Working Group did not recommend continuing the existing special exception for 45-foot containers.

All US participants and some Europeans expressed a strong preference for continuing the 45-foot dimension. It was pointed out that the 45-foot unit need not be feared as the first step in what could threaten to be an endless cycle of length increases because the 45-foot dimension both fits within and is limited by the rack lengths of container ships. The original dispensation was granted with the understanding that the existing 45-foot containers would probably be phased out. However, the opposite has happened, as the use of these containers has increased significantly. Maersk reported the recent acquisition of 2,000 containers measuring 45 feet in length. There was a dispute regarding the actual numbers and role of 45-foot containers in international trade, particularly Asian trade. There was unanimity, however, in the view that a study should be immediately undertaken to document the utilization of 45-foot containers in the global intermodal market as a basis for further discussion. All participants agreed that the proliferation of container dimensions had to cease, but it was unclear where the leadership would come from that could achieve this universally desired outcome.

European participants raised the problem of US weight limitations on 40-foot containers that are legal elsewhere around the globe. US participants responded that the best hope for resolution will result from the negotiations currently taking place between the US, Canada, and Mexico under the North American Free Trade Agreement (NAFTA), although it was conceded the issue is very contentious.

Juhani Korpela, Ministry of Transport and Communications, Finland

Third-Party Logistics

The concept of third-party logistics providers has become a growing reality in Europe and the US in recent years, allowing shippers to outsource logistics activities that had previously been conducted in house. This growth has been spurred in the 1990s by increased emphasis on supply-chain management as a tool to improve efficiency and lower costs. The third-party logistics businesses use information to significantly reduce inventory through the use of sophisticated and expensive data management/analytical tools. At the same time, these firms provide opportunities for shippers to outsource labor. When a good match occurs between the shipper and the third-party logistics provider, the result is enhanced service quality and lower costs.

In the 1996-1997 period, the use of third-party logistics services grew at an annual rate of over 10 percent in both the US and Europe. In spite of the recent high growth rate, studies of the logistics market indicate room for considerable additional growth, although the magnitude of that growth is debatable and the use of third-party logistics logistics services have not achieved the levels predicted by many analysts.

In Europe major new third-party logistics providers, such as Deutsche Post, have emerged as a result of rationalization brought about by mergers and alliances. The concentration/rationalization is primarily centered in the Benelux countries as favored locations for European-centered logistics firms, which also serve the US and Asian markets. The focal point of logistics in Europe is evolving from being country-centered to pan–European and global. Despite the relative growth in third-party logistics providers, there are currently no truly comprehensive international firms. The current third-party logistics service providers tend to specialize either in the US or in Europe and often specialize in specific commodities. The challenge for one firm to be expert

in all commodities and all continents was illustrated by an example of a hypothetical shipment originating in Kansas, destined for inland China. An examination of all the links in the supply chain would be extremely difficult for any one firm. Such a role would require the firm to be expert in both domestic and international transport options and providers in the US and China, as well as be able to supply all other full-service logistics support.

Case studies of third-party logistics experience in the United States indicate a positive, though mixed, picture. There are many success stories, but there are also instances of shippers backing off from fully outsourced logistics work when the firms realized they had relinquished too much control and were not obtaining the anticipated benefits, or had lost valuable business information and even management control. The third-party logistics providers have had difficulties in realizing profits, finding qualified staff, and achieving truly global, multimodal, and intermodal competence. There are some noteworthy national firms that have been successful. Geographically specialized firms, market niche firms, and modally biased firms are also meeting with success. There is debate as to how far the third-party logistics trend will move toward the universal firm.

Opinion varied about the prospects for further growth of fourth-party logistics, whereby the third-party logistics concept is extended and the logistics provider not only arranges all transportation services, but also deals directly with customers, even taking orders. This growing trend has received much publicity in the press. The growth potential of fourth-party logistics is evidenced by software firms such as Oracle and Microsoft moving into this market with new software products that are designed to lower costs and facilitate service. The executives at the forum expressed the view that whether you are dealing with third-party logistics or fourth-party logistics, logistics is a strategic business element and the overall management and key staff must remain in-house, even if operations are outsourced. Similarly, participants—particularly those from Europe—felt that with respect to fourth-party logistics, any firm with expensive products and long-term customer relationships must protect and nurture direct lines of communications with customers. Anything less could destroy a business.

Edward Blank

Kund Pontoppidan

Ted Prince

Stephan Seeck

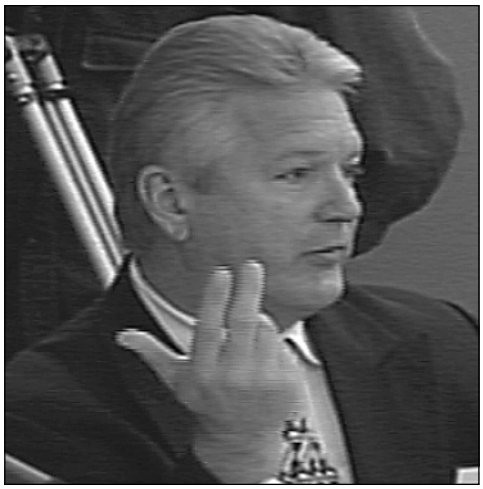
International Issues and Governmental Initiatives

Intermodal liability issues remain a concern. More agreement is needed about who is responsible for goods during each segment of carriage. On the US side, a move to amend the 1936 Carriage of Goods by Sea Act, which had generated considerable concern at the Munich forum, is at a stalemate. In large part, the recently passed Ocean Shipping Reform Act, which permits the formation of confidential contracts, has allowed parties to arrange the terms of liability coverage through the contract. The emergence of third- and fourth-party logistics providers means that the strength, stability, and trustworthiness of these firms are also part of the liability equation.

Advances in cooperation in US/EU intermodal freight technology that had originated in the prior forums were reviewed. One pilot project, involving a number of firms in the automobile industry, is designed to support tracking and tracing of containers throughout the intermodal supply chain and to improve elements of supply chain management. This project was fleshed out at a joint US/EU meeting on Intermodal Freight Technology held in Seattle, Washington, in June 1999. A related EU-supported

Klaus Groeger, Federal Ministry of Transport, Building, and Housing, Germany

Richard Biter, United States Department of Transportation



effort, the previously discussed Simple Intermodal Tracking and Tracing (SITS) project, is designed to create an industry-owned and -operated planning and information service for the European transport industry.

Next Steps

There was a consensus among the participants that the forums be continued. In the ensuing discussion several priority areas were recommended for attention at the next meeting. Focus areas included:

- Financing options and financeability of transportation infrastructure with an emphasis on new revenue sources and innovative financing mechanisms
- Best practices in intermodal transport, with specific consideration of terminal efficiencies
- Future transportation technologies within the intermodal transportation business, continuing the successful Munich presentations
- Development of comparable baseline data on US/EU costs by mode and lengths of haul, with the objective of obtaining a better comparative description of US/EU systems for shipments by rail, truck, barge, and short-haul ship
- Discussion of industries best suited for utilization of third-party and fourth-party logistics provider services
- Continuation of the excellent work to date on e-commerce, recognizing its facilitating and technology forcing role in intermodal transport
- Development of statistics on the use of 45-foot containers services, including a quantitative summary of what is actually moving and an overview of the market share of different container sizes in trans-Atlantic and other international markets
- Continuation of the discussion of liability considerations in intermodal services
- Development of a resource paper on the intermodal issues arising before the World Trade Organization
- Development of process mapping of trans-Atlantic intermodal operations

Summary

The participants expressed the view that the forum was highly successful. Industry leaders and government officials strongly endorsed continuation of joint pilot project efforts in the area of tracking and tracing of intermodal shipments, illustrating one of the tangible benefits of this unique international public/private dialogue. Equally important, the executive discussions between high-level government officials and key industry executives allow forum participants to return to their respective organizations with a broader understanding of US, EU, and trans-Atlantic intermodal systems. Finally, forum delegates acquire information to lead programs and to take individual actions that collectively facilitate the rapidly growing, fast-changing world of international intermodal freight transport.

How Electronic Commerce May Reshape the Future of Intermodal Freight Transport

John G. Reeve, Reeve and Associates

Background on Electronic Commerce

Business poll after business poll tell the same story: senior executives of leading companies in Europe and the United States are staying awake late at night wondering how they may best exploit the very real opportunities provided by the explosive growth of the new "digital economy"—while avoiding the many pitfalls that await the unwary. The emergence of this new economic model, as different from the industrial economy it is replacing as that model was from the preceding agrarian one, has been driven by the extension of information technology into all aspects of business and the creation of a global communications web provided by the Internet. Business as conducted over this "World Wide Web" has been christened electronic commerce, or e-commerce. This paper evaluates the current and likely future impact of e-commerce on the global supply chain, focusing in particular on the intermodal transport sector.

E-commerce is currently transforming the way business is done across the globe. The volume of business-to-business and consumer-to- business transactions conducted via e-commerce has been growing exponentially—more than doubling each year since 1997 (see Figure 1). Despite the great deal of public attention paid to direct to consumer retail applications such as amazon.com in recent years, the fact is that the vast majority of e-commerce sales are business-to-business transactions, accounting for over 90 percent of current and projected e-commerce volumes. Recent forecasts by Forrester Research of Cambridge, Massachusetts, project business-to-business sales over the Internet to exceed $1.3 trillion by 2003.

In order to cope with business and consumer needs for secure and confidential access for the conduct of business, while still providing ease of access and communication, the basic technology of the Internet has been further developed to provide three main channels along which e-commerce is being conducted today on a global basis:

- The basic Internet that provides complete global access over the World Wide Web to any member of the public with the means to log on—e-commerce retailing such as amazon.com is an example.
- Intranets for intracompany networks that use Internet-based communications and control protocols in conjunction with special Internet-compatible Electronic Data Interchange (EDI) software and security ("firewalls") that restrict access to members of the same organization—internal company email and knowledge base systems are examples.
- Extranets that provide an intercompany communications network, again protected by firewalls, for communications

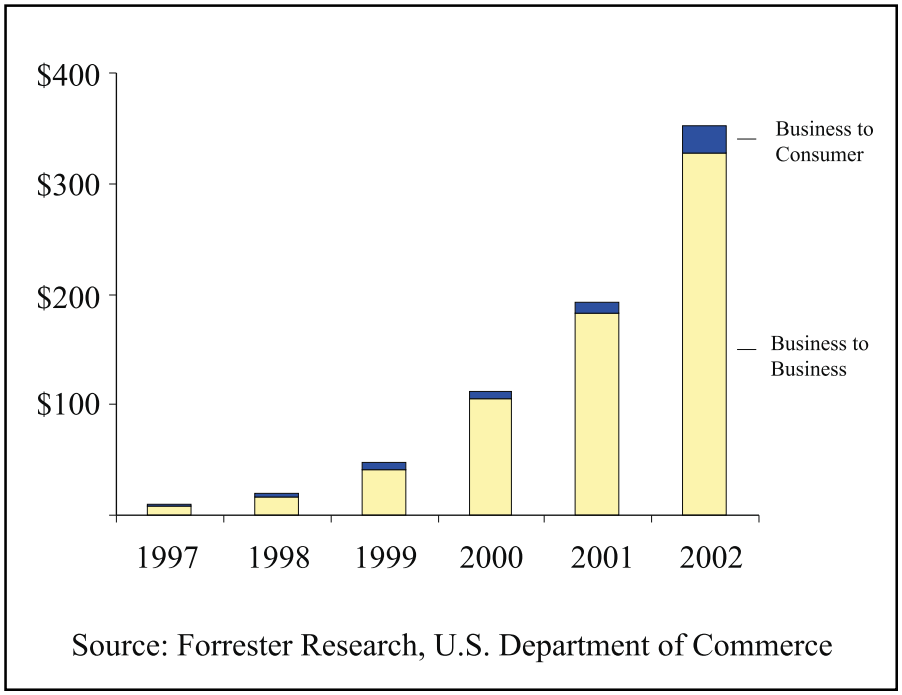


Figure 1. *Electronic Commerce Projections ($ Billions) 5 Year CAGR 105 %*

between a restricted number of affiliated users to exchange confidential and proprietary information—a sourcing system connecting suppliers with a major buyer is an example.

Consumer-to-business e-commerce is essentially conducted over the Internet. Business-to-business commerce will generally occur over the Internet or extranets. The larger the supplier-buyer relationship, the more likely it is that their business will be conducted over a secure extranet. By either mode, the growth of e-commerce has been driven by the Internet's powerful combination of easy-to-use information technology and telecommunications that enable faster, lower cost, and more efficient commercial transactions among enterprises and individuals.

An example of a successful business to business extranet is the Automotive Network eXchange (or ANX) that was created by the major North American automobile producers to provide a common purchasing and parts scheduling/tracking system that connects them with their major suppliers. Through ANX, order fulfillment processes and parts specifications have been standardized across the industry, considerably speeding up the order process while reducing inventory and parts costs. Reportedly, ANX's first test case for car seats generated savings of about a billion dollars for the industry participants. Extranets focused on a particular major buyer's supply chain have been created in other industries by such leaders as Wal-Mart in retail, DuPont in chemicals, and Hewlett-Packard in electronics. The evident advantages of an industry creating a common set of e-commerce processes and channels to facilitate the conduct of business between members of a particular supply chain is one of the key factors behind the bullish forecasts of business-to-business e-commerce growth.

Impact of E-Commerce on the Supply Chain

Driven by the recognition that an innovative and effective supply chain strategy may be a major contributor to a company's profitable growth and enhanced shareholder value, logistics as a management function has moved up from the ranks of middle management to the chief executive officer (CEO) level at a number of leading e-commerce practitioners. Dell Computers has used the power of e-commerce to redefine computer-retailing and distribution. Dell's business model uses e-commerce as critical links with both customers and suppliers. Dell markets its products to consumers over the Internet. A highly customized product may be ordered on-line for delivery within a matter of 1 to 2 weeks. Outside suppliers of the necessary components (drives, screens, keyboards, etc.) are linked by an extranet to Dell's assembly and integration sites. Transport providers are also linked to the same network. When a customer's order is entered, the suppliers of the required components are notified, and those materials begin moving through the necessary stages of assembly until the final product is completed and shipped to the ultimate consumer. Via its creative use of e-commerce Dell has built what is essentially a "virtual company"—an enterprise that behaves and thinks as a single organization, yet that is created from several separate parts. Dell focuses on what it is really good at—namely, designing and marketing computers, managing its supply chain, and then partnering with others who have special competence in a particular area to provide those capabilities to the overall enterprise.

Dell Computer's outstanding financial performance speaks for the quality of its value proposition. Despite the fact that its sales are only 22 percent of IBM's, the stock market values Dell at 56 percent of IBM's market capitalization. Dell has achieved recent results of annual growth of 42 percent in sales, 47 percent in net income, and a return on invested capital of 217 percent, while keeping its average number of days of inventory to 6. Dell's customer receives a relatively low cost, customized end product on a timely basis. Dell's strategic partners in its supply chain network are able to reduce inventory levels, cut product lead times, and eliminate many redundant and overlapping intermediate process steps through joint problem-solving, effective real-time information exchange, and an overall transparency of the

complete supply chain. Dell's value proposition has given the company, and its supply chain partners, a major competitive advantage in an industry in which product shelf life is measured in months or even days, not years.

The process of getting to Dell's level of supply chain networking extends back several years. Initial initiatives to improve supply chain management (SCM) tended to focus on the purchasing and logistics functions. During the 1980s many companies sought to reduce the cost of purchased goods and services by leveraging purchasing power with a selected group of core suppliers. Typically these quantity discounts proved difficult to sustain if there were no reciprocal benefits to the supplier from such an arrangement. More recently, companies have looked to improve their internal functional excellence, seeking to seamlessly integrate internal processes through the implementation of enterprise resource planning (ERP) systems that enable real-time communication and the sharing of critical information across an organization. However, such ERP systems typically have not been successful when working outside a particular organization to connect to other members of the supply chain. As the Dell example shows, e-commerce now provides a medium for such supply chain networking.

Scott McNealy, chief executive officer of Sun Microsystems, has been a leading proponent of developing a tightly integrated supply chain network as a critical ingredient in his company's strategy: "At Sun, partnership is at the core of our business model…The right alliances can help influence gross margins, reduce costs, and allow us to focus on our core competencies."

Examples of the win/win propositions that are shared between participants in such a supply chain network utilizing the power of e-commerce include the following:

- Real-time forecasting of production based on actual demand rather than historical "rules of thumb"
- Open and transparent production scheduling processes that enable customers to view what is in the pipeline and time orders effectively while cutting safety stocks
- Postponement of product differentiation/customization until later in the process, enabling inventories to be reduced and production to be more responsive to actual demand levels and specific customer needs

Transportation and logistics service providers play a critical part in such a supply chain network. Carriers are expected to provide timely and accurate information on the status of a shipment, to meet increasingly narrower delivery windows, and, as important, to be able to identify and report potential service disruptions. Within a transportation industry that is increasingly taking on many of the trappings of a "commodity" business (relatively undifferentiated products, high price competition, and resulting industry consolidation), the quest for areas of "value-added" service takes on new meaning in this context. With greater visibility of all participants along the supply chain, it should be easier to identify where value may be truly added—to the advantage of the overall service provided by the complete supply chain network, not to just one participant. For example, this could involve a carrier transporting goods to a final regional assembly center where they may be packaged for delivery to the ultimate customer. International retailers will be able to use carrier services to bring goods into the country from a number of sources and then cross-dock them into shipments to store destinations based on demand levels at their time of entry into the country, not when they were loaded onto vessel, aircraft, truck, or train weeks earlier.

These examples indicate the power of e-commerce in providing a tighter level of integration along the supply chain. When one examines the international intermodal transportation and logistics supply chain, three major "dimensions" or process flows along which e-commerce-enabled integration may occur stand out: (1) the actual movement of goods; (2) the flow of information concerning the status of the goods; and (3) the flow of funds connected to the transfer of ownership of those goods.

There are currently major e-commerce initiatives focusing on each one of these dimensions.

Current leading examples of e-commerce initiatives along the goods flow/transportation and logistics service dimension are con-

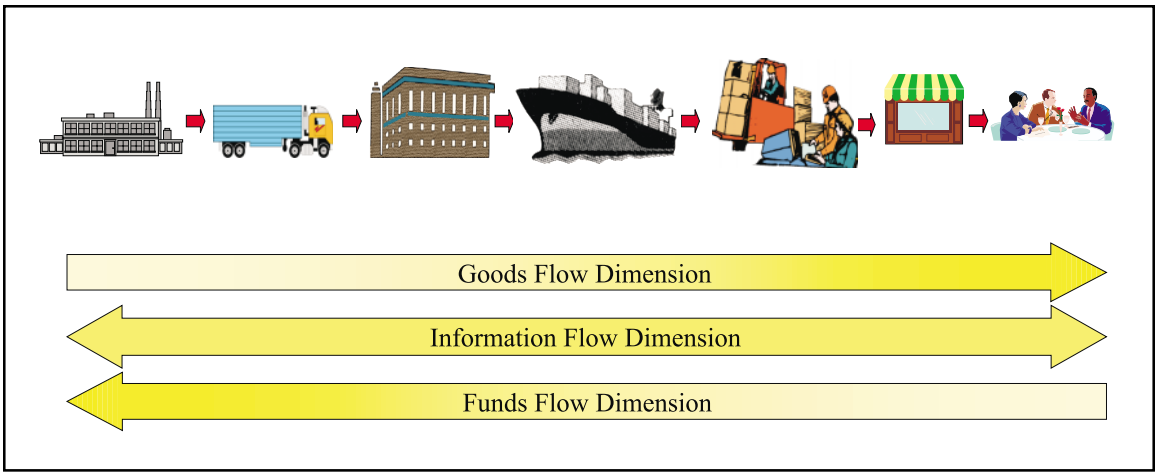


Figure 2. Simplified Intermodal Supply Chain

centrated primarily on the initial order function and purchasing of transportation and logistics services:

Integrated electronic sourcing services that are primarily driven from the shipper side have been developed including the ANX initiative mentioned previously and General Electric's Internet-based in-house sourcing system that it is now marketing to outside users as the Trading Process Network (TPN).

To a varying extent, most major transport service providers, including container shipping companies, railroads, trucking companies, and freight forwarders, provide some level of on-line rate quotation, booking, documentation, and cargo-tracking services over an Internet site.

Leading freight integrators such as United Parcel Services and Federal Express offer "integrated supply chain management services" through global divisions created to focus on this business line (UPS Worldwide Logistics and FDX Global Logistics, respectively).

On-line freight markets selling transport services on a spot basis are also being offered over the Internet by such companies as National Transportation Exchange (NTX), which arranges backhauls for trucking in the United States, and Celarix, also in the United States, which is initially focusing on ocean transport. A number of other companies are also reported to have similar services under development.

In terms of the information flow dimension, there are also a number of major e-commerce initiatives:

- The Bolero project, a joint venture of the Through Transport (TT) Club, an insurer that covers the liability of intermodal intermediaries and port operators, and the Society for Worldwide Interbank Financial Telecommunication (SWIFT), a bank-owned cooperative, is putting in place a global electronic network to handle trade documentation (bills of lading, for example) on a paperless basis.
- The Microsoft-led Value Chain Initiative is seeking to bring together software, hardware, and supply chain companies to deliver an "integrated architecture" that will facilitate the sharing of critical supply chain information between supply chain partners on a global basis, regardless of the format and communications methods of existing systems, and integrate the supply chain communications with operational systems.
- General Electric Information Services (GEIS), in partnership with OceanWide Inc. of Canada, is marketing the Maris Cargo Document Exchange that provides an e-commerce solution for shippers, freight forwarders, and trucking companies to exchange documents (bills of lading, delivery instructions, etc.) with ocean carriers and U.S. Customs.
- Several major ports around the world, including Rotterdam, Hong Kong, and New York, are in the process of developing "electronic port communities" that use e-commerce to connect the various parties involved in moving freight through the port, including shippers, forwarders, in-

surers, customs, terminal operators, and land, ocean, and air carriers.

Within the funds flow dimension, there are also a number of examples of e-commerce initiatives that affect the intermodal supply chain:

- Warburg Pincus, GEIS, and Marsh McLennan (global insurance brokers) are partners in TradeCard, a global trade finance network that uses e-commerce to process, control, and transmit funds connected to a trade transaction.
- Citibank has recently unveiled CitiCommerce.com, which provides cash management and security services for business to business e-commerce transactions.

Behind this dizzying array of e-commerce applications, several companies have emerged in recent years with particular expertise in developing supply chain software solutions. These include i2 Technologies, Manugistics, Manhattan Associates, PeopleSoft, Baan, and SAP. It is worthy of note that the two leading freight integrators, UPS and Fedex, have recently announced strategic alliances with software developers focused on e-commerce supply chain solutions—UPS with Manhattan Associates and Fedex with SAP. Similarly, IBM has teamed up with i2 Technologies to pool their e-commerce and supply chain expertise.

What is clear from the laundry list above is that are a wide variety of e-commerce initiatives currently under way that impact the intermodal supply chain along one dimension or set of processes. However, there is no remotely comprehensive solution in place. There is a great deal of overlap and competition between several ventures. As usual, the rules of economic Darwinism are expected to hold, and the most effective solutions will prevail in the marketplace.

Outlook for E-Commerce

First of all, we should expect that e-commerce will quickly lose its mystique as a new business model. It is rapidly becoming an accepted and expected medium for business, just as the telephone and postal service became universally accepted forms of business media. Also, as e-commerce matures, we are likely to see consolidation in service providers. Amazon.com is willing to invest hundreds of millions of dollars in start-up costs to build an e-commerce brand name and product in anticipation of holding a competitive advantage in future e-commerce retailing. Similar investments are being made by some of the players in e-commerce supply chain services. For example, both UPS and Fedex are reported to be investing around a billion dollars a year each in information technology development, much of it focused on e-commerce solutions. The presence of information technology heavyweights such as General Electric, IBM, and Microsoft behind a number of the current e-commerce supply chain initiatives also suggests that they see this area as being worthy of considerable investment for potential long-term reward. What may these rewards be?

As noted above, there has already been considerable effort made at integrating several steps along each of the three supply chain dimensions. However, there has been very little attempt to build convergence between those dimensions—that is, to combine under an "umbrella" service the management of the flow of goods, logistics information, and financial transactions for the complete supply chain. Just as knocking down barriers within a company through the implementation of ERP systems or within an extended supply chain through supply chain integration yielded significant gains in productivity, the knocking down of barriers between the three supply chain dimensions should also bear considerable fruit in terms of raised efficiency and reduced costs.

However, the lateral convergence between the three supply chain dimensions in conjunction with end-to-end integration of the various steps in the supply chain under a single all-encompassing service provider will be no easy task. World-leading best-in-class transportation, logistics, information technology, telecommunications, and financial service skills will be required across the

board. As shown in the figure below, there are several potential players for this game, but no single organization holds all the cards. In this case, we are likely to see the current trend of alliances between organizations that have key strengths in some of the required attributes continue. E-commerce will enable these alliances to form "virtual" global supply chain management entities, managing the umbrella of services across all dimensions of the supply chain for shippers.

Global trade and transportation is a highly complex business. Yet, the very factors that have promoted the growth of e-commerce—its universality, ease of access, and relatively low cost—will promote global solutions. As Europe and the United States move to paperless forms for transacting trade and transportation, other parts of the world will find it very difficult to hold on to old bureaucratic practices that significantly undermine their positions in global trade competition.

The growth of e-commerce in the consumer sector will place significant pressure on the services that provide home deliveries. As more and more small parcels move around the world, new transport solutions will need to be found. It may well be that the current process of the shipper determining which parcel service will deliver a package to a home will be turned on its head. The customer may select the carrier to handle all of their inbound shipments as, given the increasing number and likely value of such shipments, a high level of security and integration with the customer's special delivery requirements will be required (for example, very narrow delivery windows and lockboxes for the storage of delivery items).

There are only a limited number of firms skilled in such home deliveries. This is true on a local/national level without even thinking about global capabilities. Clearly, postal services have such capabilities, as do parcel companies such as

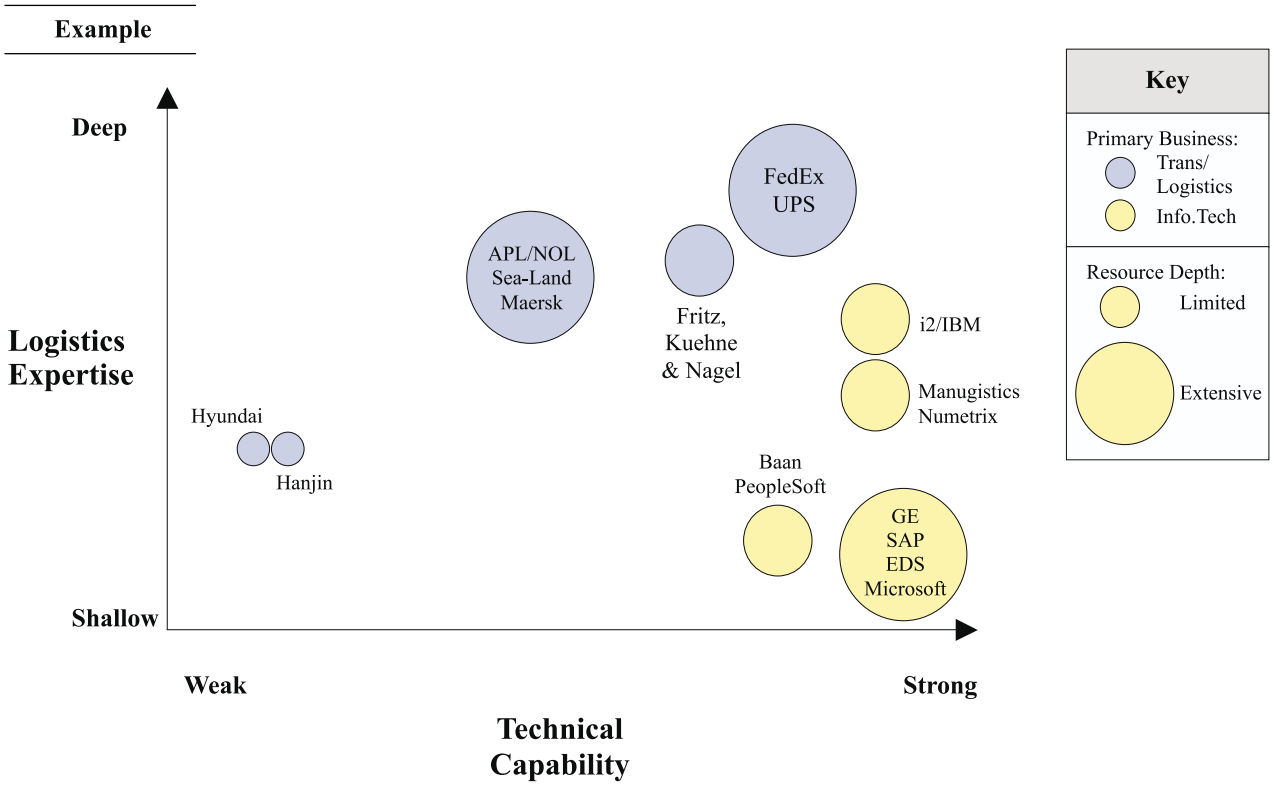


Figure 3. Strategic Positioning of Potential Electronic Supply Chain Managers

UPS and Fedex. However, there is no single entity with such expertise on a global basis.

As e-commerce grows, so will global shipments. The shipments to households in Europe or North America will be at the end of very long, relatively complex global pipelines. It is likely that the companies that control the delivery end of the pipeline will seek to control more of the pipeline that feeds the ultimate home distribution step. It will not be efficient to ship home delivery parcels as a single unit along the pipeline. Shipments will still need to be shipped in larger blocks (as they are today) before being broken down for final delivery to the consumer. However, tighter control will need to be exerted over the complete pipeline/supply chain to ensure that the right products are delivered to the consumer on a timely basis. Information is the key element in this whole process. An e-commerce based supply chain network that links all elements of the pipeline on a real-time transparent basis will help to ensure the consumer's expectations are fulfilled.

Consequently, there appear to be two sets of players well positioned from a starting point to emerge as potential parties to a global supply chain management set of umbrella services: freight integrators and information technology companies with strong supply chain expertise. These players will shape the future of e-commerce as it impacts the supply chain. Neither is likely to succeed on its own. Rather, they are likely to succeed in alliances with strong partners with complementary skills that come together to create a virtual enterprise, an electronic supply chain manager.

Certainly, there will still be a need for other transportation and logistics service companies. Ships, aircraft, trucks, trains, warehouses, and terminals will all be required to handle the continuing growth in world trade. However, the services of such companies may become increasingly "commoditized"—sold on a wholesale basis to the electronic supply chain manager who will hold the ultimate trump card, control of the customer relationship—whether that customer is an industrial firm or household.

The E-Commerce Challenge for Intermodal Transport

Companies involved in intermodal transport, whether carriers by land, ocean, and/or air, intermediaries, or the suppliers of services to the transportation principals, must ensure that they develop and execute an effective e-commerce strategy that meets two critical requirements:

- A value proposition that combines high-quality service with low cost and that is aligned with the requirements of a global electronic supply chain manager virtual enterprise
- Technological capabilities and infrastructure that will enable the intermodal company to become an integral partner of or supplier to such a virtual enterprise

There are a number of major intermodal transport companies that may be able to play a leading role in the creation of such a virtual enterprise. For example, Maersk Sealand and APL Limited appear to have the necessary global scope and depth in transportation and logistics expertise to add considerable value to any such enterprise. However, their capabilities in e-commerce, while among the best in container shipping, are still well behind those of other major transportation companies such as UPS or Fedex and potential players on the technology side, such as General Electric or i2 Technologies.

E-commerce is irrevocably changing the rules, processes, and structure of international trade and transportation as we know it. The strategic choice for many in the intermodal transport sector is a stark one: (1) be prepared to survive in a highly commoditized business where high service levels at lowest cost determine success and where your customer may no longer be the actual shipper but rather a global supply chain manager of enormous scale and market power, or (2) follow the path of value migration to become a leading participant in such a virtual enterprise, leveraging current operational expertise and market knowledge through the application of leading edge e-commerce technological solutions provided by the right strategic partner.

E-Commerce, Supply Chain Management, and Intermodality

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Roger Demkes, TNO Inro

The Emergence of E-Commerce

The development of e-commerce has been very strong in the past decade, impelled by the development of telematics and computing power. Its influence as a driving force of change in logistics and commercial processes is undeniable both within companies and within supply chains, and even in consumer markets. It is generally felt that e-commerce changes the context of business. Some authors even dare to state that it eliminates the business cycle doom, giving rise to a "new economy." Whereas the influence of e-commerce on, for instance, grocery retail and other markets for goods is the subject of many publications, its impact on markets of transport services receives relatively little attention, despite the fact that there is ample reason for doing so. E-commerce induces a completely new context for transport business, revealing two main influences on the management of logistics:

- It blurs traditional company boundaries.
- It makes completely new functions and companies appear (and others disappear).

The effect is even greater on intermodal transport management, where the need for significant information means that the influence goes to the very core of business. We may therefore say that e-commerce redefines intermodal freight business.

The objective of this paper is to explain how e-commerce and related information and communication technologies (ICT) developments offer a new context for intermodal transport. This influence takes two clearly distinguished paths (see Figure 1):

- By influencing the operation and organization of supply chains, e-commerce influences the demand for transport services.
- By offering new management tools and transparency of transport service markets, e-commerce gives rise to new forms of mediation for intermodal services.

The two paths involve very different e-commerce applications. This paper is built around this scheme.

The second section of this paper describes the indirect influence of e-commerce on intermodal transport by describing its influence on supply chain processes on the shippers' side, like production, inventorying, and ordering. The third section describes the direct influence of e-commerce on intermodal transport organization and facilitation. The fourth section describes a future for intermodal transport, in the light of the probable developments of e-commerce and other factors in the environment of the transport world.

Electronic commerce, or e-commerce, is strictly defined as the conclusion of transactions by data exchange between computers. There is another interpretation of e-commerce, however, that is not restricted to just the electronic conclusion of transactions, but rather includes

- pretransaction support (e.g., forecasts or market information),
- transaction support (narrowly defined as above), and
- post-transaction support (e.g. monitoring, tracking, and tracing)

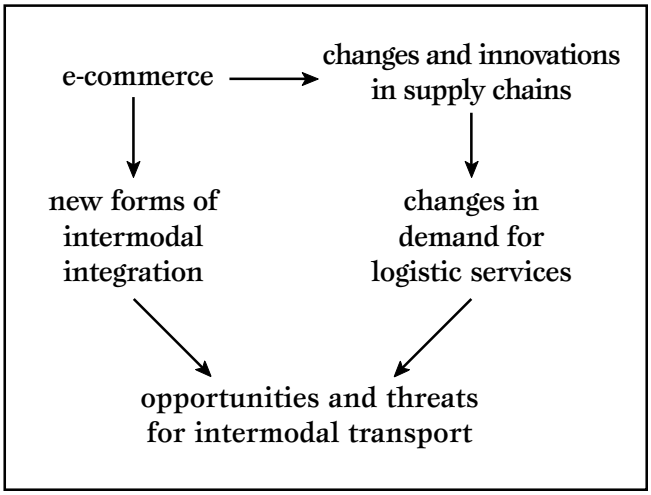


Figure 1. *Relationships Studied in This Paper*

In the following sections, a close look at the practice of e-commerce shows that the different categories are difficult to distinguish. In fact, it is the combination of applications from the three categories that really improves the interconnectivity and interoperability of transport systems to a significant degree.

E-commerce basically facilitates transactions. Transactions take place in markets, where supply and demand meet and prices are set. Different applications of e-commerce can be distinguished according to different price-setting mechanisms. These include:

- electronic order calls (within blanket contracts subsequent to bilateral negotiations),
- electronic catalogues (posted prices and simple allocation rules, such as "first come, first served"), and
- electronic auctions (simultaneous price setting and matching of supply and demand).

The prerequisite technology for electronic order calls is electronic data interchange (EDI), not necessarily connected to the Internet. To make EDI possible, the communicating computers must be linked and be able to communicate (interconnectivity), be able to understand each other, and be able to properly process the exchanged information (interoperability). The interconnectivity of computers is enhanced by advances in telematics, like Internet and broadband technologies. The interoperability of computers is facilitated by ongoing standardization of message definitions and protocols, as well as by the use of standard professional business planning software.

Before we ever spoke of e-commerce, the first wave of innovation in business-to-business communication was the development of business-to-business EDI. It had its first and foremost application in automated ordering. Two later waves of innovation have led to a reasonable penetration of such applications, namely point-of-sale scanners (delivering the data to be exchanged) and standardized enterprise resource planning (ERP) software (to process the data).

The advance and proliferation of Internet technologies in particular will give a new stimulus to e-commerce, especially to electronic catalogues, electronic auctions, market information, and tracking and tracing applications. Such applications have a large content of graphically presented information, which makes them well suited to the Internet. The focus of new developments will be on creating automated agents that are capable of finding exactly the right information. Intelligent software agents (ISA) are probably the fastest growing area of information technology. Intelligent software agents are characterized by their autonomous completion of tasks delegated to them, in interaction with their information environment.[1]

"Conventional" EDI only got through to the larger companies, who could afford investing in special-purpose interfaces or in large ERP packages. Most of the smaller and medium sized companies were reluctant to get involved in EDI, especially since it often concerned one-to-one applications, which would make them too dependent on one large customer or relation. Therefore, the investments needed to implement EDI, as well as the asset specificity of such investments, have more or less restricted the application of EDI to interaction between large industrial companies. The Internet, however, offers both cheap technology and flexible interfaces. In view of Internet becoming a common phenomenon in many households and companies, small or medium sized enterprises (SMEs) are expected to apply EDI much more in the future than they have done up to now.

Apart from integrated EDI applications like efficient consumer response (ECR), very few e-commerce ventures have been reported to be profitable. Setting up a commercial Internet site was recently calculated to cost at least US $1 million.[2] The mail order sites offer low prices but long lead times, often in impulse markets. Teleshopping is often supported by an expensive delivery system. Experts feel[3] that such applications still have to prove their value. Expectations are very high though. We can look at the Dutch situation as an example, which is representative of Europe. Recent investigations in the Netherlands

indicate that e-commerce is just beginning to be applied. In most industries, a few innovative firms are investing, but the use is not widespread and a critical mass is yet to be established (see Figure 2). Still, the amount of Dutch business purchases via Internet doubled this year to about US $1 billion, and private purchases doubled to about US $350 million.

The spread of Internet use (see the sidebar on connectivity, below) and the swift development of information infrastructures (i.e., the vast investments of governments and companies in broadband communication, GSM networks, and other telematics) lower barriers to entry. The United States is currently leading in terms of the Internet, in both perceived quality and support by company management. The experience built up in the United States, however, offers European companies valuable lessons (some 75 percent of the current e-commerce projects are said to be stillborn[4]) and might give the European companies an advantage when the expected breakthrough occurs.

Beyond the performance of single ventures, policy makers often suppose that e-commerce, and especially the penetration of Internet utilization, could be leading to higher market performance, due to higher transparency and lower transaction costs. This explicitly includes pre- and post-transaction elements of e-commerce (market information, as well as automated transaction monitoring).

However, the Internet is a medium like any other, and the benefit of higher transparency cannot be directly attributed to the Internet, for two reasons. First, as already stated, pre-Internet EDI already contributes to market performance. Second, the Internet can be used both for open communication and for closed communication (e.g., newspapers versus private mailing). New communication technologies such as XML are especially tailored to authorization and protection of data streams. In many business-to-business markets, the perception of the safety and reliability of Internet communication that potential users have will be of crucial importance for its eventual breakthrough. In short, the penetration of the Internet is not by definition equal to a higher level of market transparency; it is the organizations, institutions, and software systems making use of it that actually makes the difference.

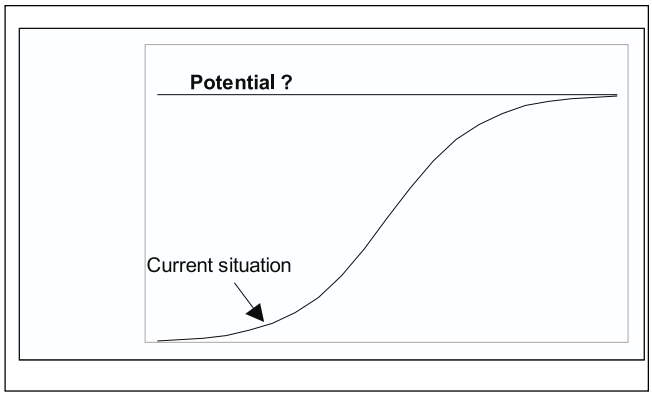


Figure 2. *E-commerce in Europe Is Taking Off*

On the other hand, the Internet is a powerful enabler of transparency. It offers flexible, standardized, and cheap technology to realize business-to-business EDI. Therefore, the Internet is the recommended platform to realize multi-user applications. Based on the expected proliferation of EDI, the Internet or its successor will be the vehicle through which companies will make data available, either to selected business partners, to government, to special network communities or the world.

Most multi-party communication will be mediated by trustworthy, special information service providers, like AC Nielsen, which provides retail outlet scanner data.

Connectivity

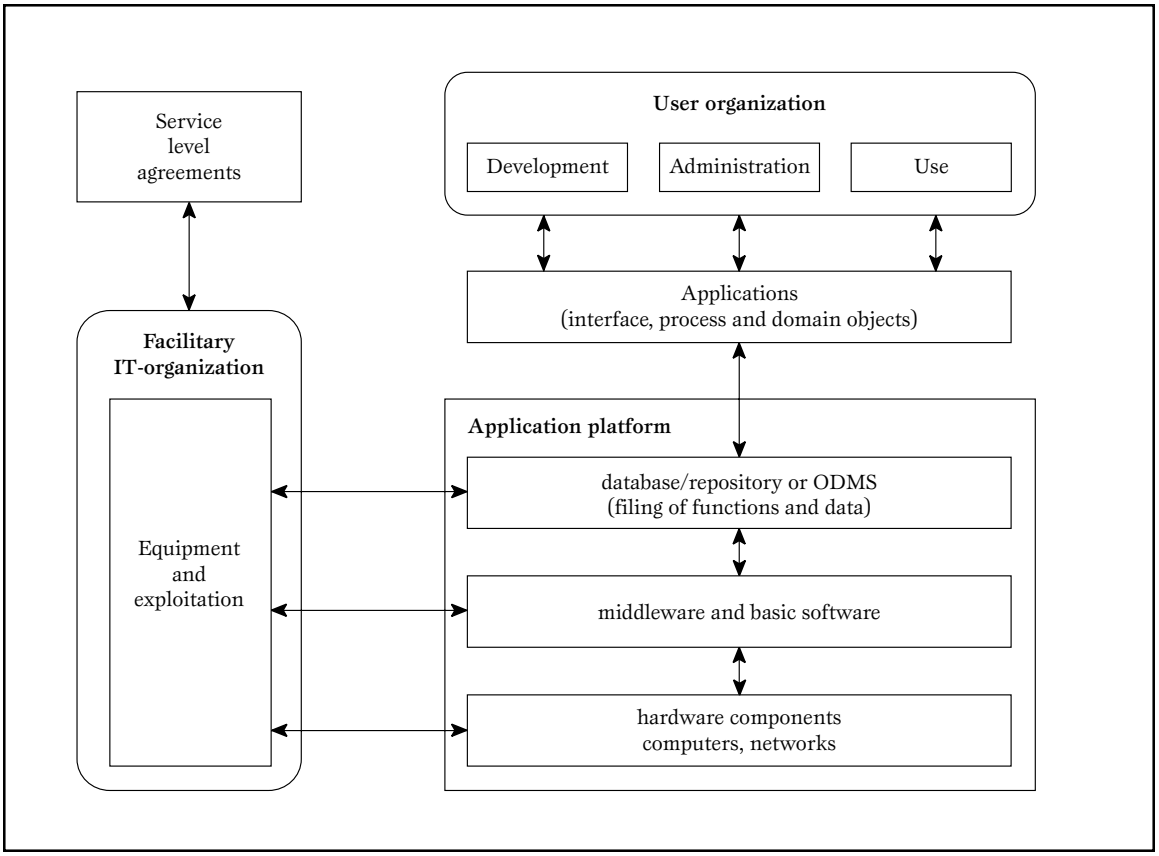
In 1998 approximately 95 million people worldwide "surfed the Internet" for at least an hour per week. About half of the Internet users live in the United States. In 1999 there will be approximately 130 million people surfing the Internet worldwide, and this number is expected to increase to 350 million in 2003.[5] Less than 50 percent of Dutch SMEs had a connection to the Internet at the beginning of 1999. By the beginning of the year 2000, the number of connections is expected to increase to approximately 66 percent.[6]

Such companies bring in the required reliability and authorization of the data transmission, as well as the knowledge and systems for processing the data properly into useful information. Many types of intermediaries can be distinguished in the information service business, some of them involved in maintaining and exploiting the infrastructure for applications, others with the applications themselves (see Figure 3). Infrastructure has to be maintained by defining and keeping records of message standards (repositories) through the provision of middleware (that is, technical software to operate the hardware) and the telematics hardware itself.

Typical examples of e-commerce can be found in many different markets, including the following:

- consumer markets
- business-to-business markets for physical goods
- business-to-business markets for transport-based services.

***Figure 3**. The Application Platform*[7]



Consumer Markets

In consumer markets, the applications focus on convenience products (payment transfer through banks, food tele-shopping), typical mail order products such as books, CDs, and videos, and electronic equipment, or information-intensive products with relatively scarce supplies (secondhand cars, antique books). Most applications concern simple order calling (bank payment transfers) or electronic catalogues (teleshopping and mail order products widely advertised on the Internet). Applications like teleshopping offer a new marketplace, where consumers are offered tailor-made "shops," personally designed to fit their lifestyles and tastes. Every action taken by the consumer on the Internet is recorded and applied to perfect the provision for the next time. Every comment and every purchase that the consumer makes is reported back into the channel. Retailers are investing heavily in such e-commerce applications like teleshopping out of fear of missing what

is essentially a new market. In the future, ICT will go further in defining the environment for consumer-producer interaction.[8] Smart refrigerators are available. They might communicate directly with the teleshop to order missing products, whereupon the teleshop service delivers the product at home, without the consumer interfering (ubiquitous computing) or even having to care about it (still computing).

Business-to-Business Goods Markets

In business-to-business markets, an even broader range of e-commerce applications can be found. As in consumer markets, business-to-business electronic sales have to compete with the existing, more traditional marketing constellations in these markets. Whereas in the United States electronic auctions (for example, eBay.com) are a big hit for all kinds of goods, in the Dutch flower trade, many attempts and vast investments in electronic auctions could not seduce wholesalers and retailers to move away from the established "physical" auctions. In the Netherlands, electronic catalogues and auctions for flowers and plants still play a modest niche role.[9] In its current state, e-commerce in business-to-business markets is heavily centralized around bilateral automated ordering.

Together with the automated exchange of pre-transaction data for mutual planning purposes, it gave rise to some important changes in business operations and relations in the last decade, especially in retail and wholesale sourcing markets.

Business-to-Business Service Markets

Transport activity is coordinated in several interconnected markets, especially in logistics services (by logistics service providers, forwarders, third parties) and transport services (offered by operators and carriers). Transactions are supported by e-commerce applications in all of these markets.

The following sections will give a structure for the influences of e-commerce on physical products markets and show some examples of this influence, as well as some examples of applications in logistics and transport services markets.

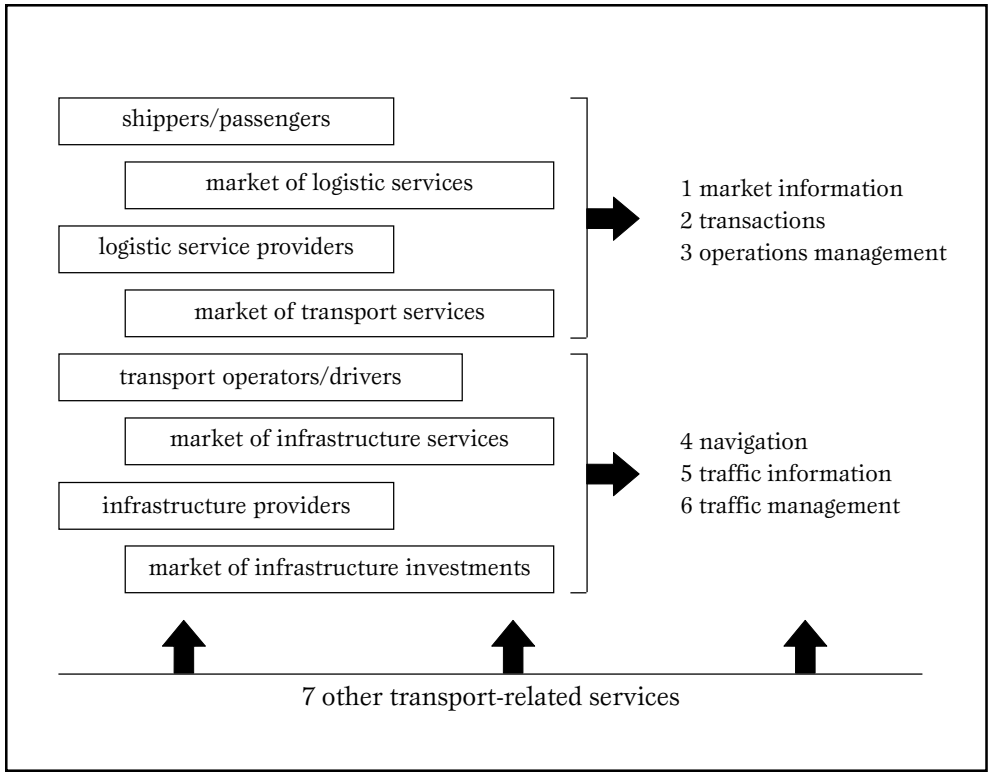


Figure 4. *An Overview of Transport-Related Markets and ICT Applications*[10]

E-Commerce Driving Changes in Supply Chain Management

As stated before, e-commerce has two main influences on supply chain management:

- vertical integration between trading partners (both shippers and logistic service providers)
- the appearance of completely new functions and companies.

Vertical integration between trading partners pertains to information sharing, common planning, and exchange of existing functions. The new functions are centered around information services. Besides functions maintaining the information infrastructure (middleware providers, repositories for messages and dictionaries), the most important new functions, especially for logistics services, are that of the infomediaries. In this section we will explain the concept, from a supply chain perspective. In the next section we shall explore its importance in the transport and logistics markets.

Vertical Integration

Supply chain integration is both supported and driven by ICT and e-commerce. The main requirement for proper coordination and management of supply chains is that partners in the chain are sufficiently informed about each other's processes, so that they can anticipate each other's needs and reach an overall optimum, instead of reacting to each other for a suboptimal result.

Technological advances in ICT support supply chain management because it improves information exchange significantly in terms of lead time, completeness, and transparency. This can take place in all stages of the supply chain. For example:

- Data sharing by means of product data interchange decreases the time-to-market for new products.
- Information transfer about sales and orders decreases safety stocks, preventing the bullwhip effect.
- Sharing production schedules and giving real-time order status information optimizes operations planning.

Supply Chain Planning via the Internet

Well-known examples of companies using the Internet to steer their supply chain are Intel, Cisco, SAP, and Dell (which all happen to be ICT-related companies). In the field of logistics, especially global express, parcel companies like UPS and DHL are actively using the Internet in combination with tracking and tracing applications to offer status information on shipments to their customers.

Key to supply chain management effectiveness is the sharing of data among supply chain partners. Clearly ICT can help, but implementing shared database systems is not easy. Lack of systems compatibility, nonintegrated organizational structures, and the loss of good local information are three key barriers to effective database implementation. Also, how does a firm share its information among external information users in a supply chain? It may dissolve beneficial information asymmetries, but it may as well serve to increase power by making partners more depen-

Data Sharing in Intermodal Transport

In the European Union's Wisdom (Waterborne Information System, Distributed to Other Modes) project the concept of data sharing has been analyzed for a number of innovation scenarios in intermodal transport. Two alternative implementation strategies were considered—namely, a central database system and a distributed database. In case of an information need, the latter system would search the databases of business partners to see whether this information is already available. Each actor in the chain can decide for himself what information is accessible to others.[11]

dent. A basis of trust seems an important precondition for a firm's willingness to cooperate.

For instance, worldwide retailers are aware of the important value of their point-of-sale data. They often "sell" this data as part of a package deal to their suppliers: information for better service, information for better prices. Under the ECR denominator, many producers and retailers succeed to reduce both inventory levels and operations. The lead time of the supply chain as a whole is also compressed by the incorporation of point-of-sale data in the producer's planning. Often the producer or transporter is given the responsibility for the planning of the retailer's inventories ("vendor managed inventories"). The better exchange of information and the interoperability of planning systems is one of the important drivers in this functional integration.

The focus of ICT investments tends to shift from internal to external flows. Although the added value of these systems for internal planning and administration is often doubted,[12] many large companies have been or are investing in ERP systems that combine internal planning with external EDI communication, especially of orders. Networks of interconnected ERP systems constitute a platform for interorganizational exchange of information. Since there is only a limited number of ERP systems providers,[13] there is a large degree of harmonization and interoperability between these systems. Whereas the external activities of ERP systems go no further than to exchange upstream information, new advanced planning systems are available from several companies, which actually produce an integrated resource plan of suppliers, distributors, and delivery fleets. To respond to customers' requests, the planner incorporates insight in the current capacities of his supply chain.[14]

Appearing and Disappearing Functions

Given that new forms of information will become available, new supply chain roles will arise and old functions will lose ground, if not disappear altogether. In information services, many new functions can be distinguished. Infrastructure must be provided, maintained, and exploited just as it is for nonelectronic highways. Traffic rules have to be set. Users have to be registered and licensed. To ensure that the information received is the same as the information sent, message modes (i.e., the vehicles carrying the data and information) have to be defined and standardized. Such standards have to be kept in repositories, they have to be accessible and up to date. Besides these hardware and middleware functions, the most interesting developments, however, can be seen on the software side and involve the companies and institutions sending and receiving the messages, and organizing and processing the information flows alongside the physical flows.[16]

ERP via the Internet[15]

The company QAD releases a new version of its ERP software MFG/PRO with a Web interface to make transactions via the Internet possible. Another feature is the possibility to link to the Federal Express Web site for status information on shipments.

A consequence of e-commerce development is that information becomes more easily available to all partners in the supply chain. This is a threat to parties in the chain who have traditionally earned a living on their access to scarce information. Many traditional functions, not only in transport and logistics, derive their added value from better access to scarce information (take agents and freight forwarders as examples). These functions are either outdated or enhanced by e-commerce. Since the market for these services faces large economies of scale, the switchover to electronic commerce may leave room for only a few of them. Closely connected to these functions is the function of forwarders, wholesalers, and retailers. A large part of their business stems from matching sup-

TNT Post and ALS in E-Commerce Projects[17]

TNT Post and the Dutch e-commerce logistics group ALS are to launch several new e-commerce operations. One of its customers is e-Quote, which will, before the end of this year and in cooperation with business magazine *Quote*, start a company selling the "good things in life," such as wine, cigars, and gastronomic products. ALS will also become the fulfillment house for the new store, selling mobile telephone products of Belcompany, part of the MacIntosh Retail Group. Toy company Light House Trading and radio station 538 will also join forces with ALS for the logistics of e-commerce.

The Overall Impact of E-Commerce on Transport Demand

The overall impact of e-commerce on transport demand is not clear. Depending on which of the two opposing forces get the upper hand, we can depict two different scenarios of future transport demand:

- e-combustion—Transport is completely subordinate to customer service; one-stop shopping changes into daily "just-for-you" shipments of small packages by mail order and teleshops; producers require perfect responsiveness of their suppliers, who must deliver twice a day instead of once a week.
- e-limination—All opportunities to reduce transport demand are exploited; consumers and customers require sustainable solutions; service requirements are modest, leaving room for transport optimization.

We can imagine a scenario for the future in which cities are occupied by small freight vans, practicing just-for-you distribution to the consumer. The vans depart from shared warehouses at the city boundaries. Traffic between production centers and shared city warehouses is often long distance and with small unit shipments, but efficiently organized by large-scale cooperation and consolidation.

ply and demand information, albeit mostly in combination with logistic functions like consolidation, forwarding, storage, picking, and marketing. These companies are facing more and more competition from electronic sales channels.

Both in transport services markets and goods markets, suppliers and actual users can access each other's information more easily, and direct trade between them is enhanced. This consequence is often described as disintermediation: certain intermediating roles in the chain may become redundant. Still, in large-scale markets like transport, the abundance of information may lead to overload—parties in the chain can neither find information they are looking for nor can they simply handle the information available. This opens up opportunities for new roles within the supply chain, often referred to as information brokers or infomediaries.

The developments depicted up to now exercise two opposing forces on the freight transport demand of shippers. First, e-commerce leads to an increase in freight transport demand. Second, ICT tools and the opportunities they create, along with environmental demands and the need to stay competitive, all result in a reduction of transport demand.

Increase in Transport Demand

Trends towards an increase in transport demand are fueled by the fact that, for many products, transport costs play a subordinate role in supply chain decisions. Apart from logistic families having low value density and large party sizes (e.g., bulk products), for most goods, modal choice is only the last argument to be considered, after location choice, market choice, product design, service levels, and inventory policies.

E-commerce, together with better planning tools and flexible production techniques, enables producers and retailers to minimize inventories and lead times (efficient consumer response) and establish responsive production, both in quantity and in design (mass customization). This leads to highly fragmented freight ship-

ments, characterized by frequent shipments of less-than-full truckloads to and from distribution centers. Supply chain processes move from efficient batch-wise processes towards responsive, semicontinuous processes.

Furthermore, the globalization of sourcing and the involvement of countries with cheap labor in many production chains is partly facilitated by e-commerce. E-commerce makes information available worldwide. Tracking and tracing facilities make it possible to manage such flows. The transaction part of the e-commerce support for consumer transactions occurs mainly through credit card billing. Distant partnerships in business to business markets enjoy the services of comparable "trusted third parties," like banks.

Decrease in Transport Demand

E-commerce contributes to a decrease in demand by redefining products, increasing outsourcing, and improving consolidation between shippers. Various trends speak in favor of the "e-limination" scenario:

- Direct Logistics—The concept of infomediation as a separate function makes it possible to optimize physical flows independent of information flows. As a result, many transport movements indeed skip intermediate storage points. Infomediaries in business-to-business trade channels quit handling all their product themselves, so that transport and grouping of materials can be freely optimized. Many new teleshopping formulas, applying mail order concepts to grocery products, offer a large opportunity for optimizing transport through direct distribution center–to–consumer logistics,[19] which may reduce urban transport by a vast amount.
- Dematerialization—A dematerialization of products could be a consequence of the increase in information. At a macro level we see an ongoing shift in demand from goods towards services. At a micro level we see a change in the form the product takes on (for example, books on the computer screen instead of on paper and video-on-demand through cable systems rather than from a videotape shop). Other products are dematerialized and distributed through the Internet. This first started with computer software, but new items, such as musical recordings, books, and brochures, are finding their way to the Internet very quickly.
- Outsourcing, consolidation, and cooperation—A historical example shows that ECR or just-in-time deliveries do not necessarily equate to soaring transport movements. Recently, three Dutch retailers entered into a program to implement ECR, together with four suppliers of perishables. They came to the conclusion that a lot could be gained by organizing transport and production

E-Commerce Success Could Be Hindered by Order Fulfilment Chaos (Part 1)[18]

Companies are figuring out how to sell goods over the Internet, but getting the goods to the customer is another story. As online orders from consumers and businesses soar past the 2 billion per year mark, Internet sellers will be faced with logistics chaos. Forrester Research predicts that the demand for order fulfilment solutions will reshape the existing landscape as logistics suppliers evolve to serve the small-package, individual-oriented needs of commerce site operators.

Order fulfilment has not been a serious e-commerce issue to date because most Internet sellers have limited the number of products offered on their sites and have executed fulfillment in-house. But as online sales move past the experimental phase, three factors—an expanded selection of products sold online, the need to move large volumes of small parcels, and rising customer expectations—will combine to put new pressures on order fulfilment systems.

planning more responsively, both in terms of money and in product quality. Part of the deal, however, was a cooperative outsourcing of transport and warehousing. Many producers who previously provided their own transport start to outsource transport to common carriers or to cooperate in dedicated transport combinations as a result of the increasing pressure on the time between arrivals of various shipments, the lead time, and the load sizes. Another Dutch retailer developed new technologies—namely, a truck with flexible compartments for nonfrozen, refrigerated, and frozen products—to bring down the number of drops at its outlets.

Reviewing all developments, e-commerce seems to lead the way to a better utilization of intermodal transport services. Namely, it indirectly contributes to establish better demand conditions for intermodal transport to compete with all-road transport:

- E-commerce in supply chain management leads to fragmentation and less-than-truck loads (just-in-time deliveries, ECR), which is a notoriously hard market for intermodal transport. This threat is, however, countered by an opportunity because it leads to cooperation between shippers and more outsourcing to professional carriers at the same time, which is often a first step to intermodal transport.
- E-commerce in supply chain management facilitates globalization, and intermodal transport is more efficient for longer distances.
- E-commerce in supply chain management detaches information flows from goods flows, thus facilitating separate, flexible optimization of transport; in the next section we show that this is one of the best opportunities for intermodal transport.

E-commerce Success Could Be Hindered by Order Fulfilment Chaos (Part 2)[20]

Although a few fulfilment vendors like Fingerhut and Valley Media are geared up to service the largest e-commerce sites, most online sellers ship less than 400 orders a day — too small to get any help. But over the next 2 years, Forrester predicts that new outsourced services will evolve to deliver end-to-end solutions to smaller online players. These companies will offer improved drop-ship services and provide a range of residential delivery options.

E-Commerce and Innovations in Intermodal Transport

Whereas e-commerce in supply chain management seems to establish clear opportunities for intermodal transport, it is yet to be proven whether intermodal transport will live up to those challenges. Intermodal transport has to compete with unimodal transport, which is also being enhanced by ICT tools and e-commerce. The recent developments in ICT, especially those in e-commerce, offer the best opportunities in decades for intermodal transport to lay down its dust-biting past for good and move towards a competitive head start. They do so in three ways:

1. Facilitating innovative organizational forms suited to serving the supply chain door-to-door.
2. Enhancing service levels by means of - door-to-door monitoring services, flexible transport optimization, and decreasing terminal throughput time.
3. Increasing efficiency by optimizing capacity utilization over all modes.

In this section we first sketch the competitive playground, and then consider the three contributions of e-commerce.

Service Requirements

The supply chain management trends depicted above not only offer intermodal transport opportunities to improve its performance, but they also lead to ever stricter

service requirements (frequency, reliability, lead time, information provision, risk of damage to cargo, complexity of administrative procedures, thinking along with the customer) and an increasing number of small consignments and less-than-truckloads, a market that intermodal transport has lost almost completely. If intermodal transport is to win back a part of the growing less-than-truckloads market and really take substantial volumes off the road, it will have to comply with these demands, starting by improving its image (see Table 1). It is clear that if intermodal transport is to be able to compete with unimodal road transport, it should drastically improve both its perceived and its actual service level. To this end, it needs organizational formats better suited to provision of service and information, sophisticated logistics concepts, and advanced information systems.

Table 1. Customers' Perception of Transport Modes[21]

Characteristics	Truck	Rail	Inland vessel
Reasonable prices	1.9	2.9	1.7
Reliability	1.6	2.7	2.1
Punctuality	1.7	2.5	2.5
Service	1.7	3.1	2.6
Flexibility	1.2	3.7	3.4
Speed	1.3	3.4	4.1
Total	1.6	3.1	2.7

Scale ranges from 1 (very good) to 6 (deficient)

E-Commerce Enhancing Door-to-Door Transport Service Organizations

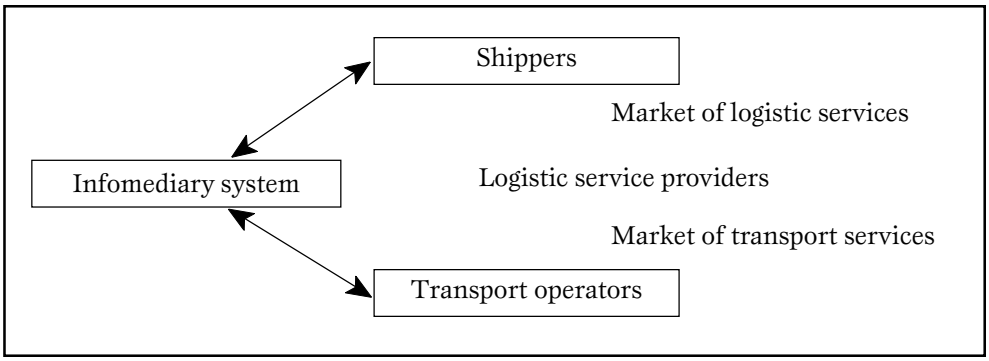
In testing different organizational structures and information systems in container transport, a recent study[22] concluded that optimal transport performance is obtained by a centralized decision structure having flexible access to all modes. This knowledge is confirmed by European studies on tracking and tracing in intermodal transport, showing that unwillingness to share data among companies has been the largest impediment to implementing such services. That implies that door-to-door tracking and tracing can only be achieved either by companies large enough to impose new technologies and data sharing (like TNT does in its intermodal forwarding) or by uninvolved, independent parties, so-called trusted third parties. In other industries, such companies have both made a good living and proved to be a vital catalyst in organizing the data sharing between the trading partners. Research companies (AC Nielsen), ICT companies (Baan), banks, consultants, and cooperatives have played such roles. In transport infomediation, we can see the emergence of information infrastructure providers and so-called fourth- or fifth party logistics service providers. Actually, these parties are often not directly involved in logistics (for instance, ICT providers, banks, or consultants).

Apparently, the business environment fitting best with the need for advanced intermodal services is made up by mode-independent and mode-neutral forwarders, as opposed to the current modally driven companies. Such forwarders are typical examples of infomediaries, processing and providing information as their core business. These new integrators, resembling intermodal marketing companies (IMCs), have the best chance of developing the skills to serve the increasing demand of high-quality logistics services. E-commerce facilitates infomediaries in different ways. Infomediation itself is often realized in the form of an electronic market. Constituting the intermodal

Sky-Eye [23]

The worldwide operating satellite provider company Sky-Eye offers not only technology and hardware for world-wide container tracking, but also information on location, movement and standing times of containers, estimated time of arrival, reefer and tank container diagnostics (temperature, pressure, etc.), and container utilization rate.

Figure 5. *The Information Shortcut through Infomediation*



Recent European Projects on Intermodal Tracking and Tracing [25]

Based on a purely rail-bound system (Trace-Rail) developed for Deutsche Bahn, Bertschi and ICF, an extended system for door-to-door tracing—TraceIntermodal—is being marketed. The system is marketed and operated by its developer, TraceCare. Currently, the system is being tested in a network of four rail terminals in Germany and the Benelux countries. Data gathered through GSM technology is stored in a central database and made accessible through the Internet. Test results are expected in the spring of 2000.

The Greece-based intermodal INFOLOG system integrates EDI and the automated equipment identification systems of shippers, carriers, and terminal operators. In a demonstrator version, tools and interfaces are provided to all parties to monitor and control the cargo door-to-door. The integration of all systems in a transport chain management system allows constant tracking of cargo by all actors. The TRACAR system focuses on monitoring the conditions and positions in and about reefer containers. It has been set up by a consortium of participants in the whole supply chain for these products.

Other comparable projects are FITE, UK-based and focused on door-to-door tracing in the Manchester-Milan rail corridor, and CESAR, German-based and focused on exchanging tracking and tracing data between railroad companies.

infomediaries on the basis of an integrating information system implies direct information connection between shippers and transport operators without the interference of a third logistics party (see Figure 5). Several examples of such systems are available in transport, like Europe-based Téléroute for truck load balancing, which operates on Minitel, a predecessor of the Internet. These systems not only make it possible to pass over the traditional intermediaries, they also establish completely new markets.

E-Commerce Enhancing Intermodal Services

To date, virtually no progress has been made in establishing efficient systems for the door-to-door tracking, tracing, and monitoring of intermodal flows, despite past experiments made in this field. Whereas the road transport sector continues to introduce real-time information systems that can report on the status of any consignment being shipped to clients, intermodal transport has virtually nothing comparable to offer.[24] There are a number of reasons for this. In Europe, nonroad carriers invest relatively little in information technology. Furthermore, the organizational structure of intermodal transport is not suited to processing the information needs connected to intermodal transport. Information simply is not the core business of traditional forwarders. Currently, several attempts are made to establish infomediaries for intermodal tracking and tracing (see the sidebar on European tracking and tracing projects). In 1992 the European Union's promising Combicom

initiative did not work out due to high technology costs and low penetration of the supply chain optimization concept; today, several products are being tested on the market in Europe for container tracking in intermodal transport.

Most of these recent projects benefit from technological advances (like GSM technology) and from supply chain initiatives by shippers, which more or less force carriers to cooperate. In the implementation, problems do still typically arise in the division of costs and benefits. This calls for an integrated supply chain perspective when implementing intermodal, door-to-door monitoring systems.

E-Commerce Enhancing Intermodal Efficiency

Examples of e-commerce applications can be categorized along the different links in the intermodal transport chain (see Figure 6). We distinguish systems facilitating the following:

- collection and distribution transport (e.g., Téléroute)
- terminal operations (consolidation, inventory and transshipment, customs)—e.g., smart cards
- access to unimodal services
- mode integration (combinations of the above systems, overall optimization, and tracking and tracing)

Particularly eye-catching is the activity of hubs (port authorities, airports, container terminals) in innovative information systems. Many of these organizations have complete, multi-functional virtual hubs or "data hubs" parallel to their physical hubs.

The unimodal e-commerce systems achieve consolidation, optimizing capacity utilization and total distances over sometimes hundreds of operators and thousands of loads per day. Such systems are both a threat and a blessing for intermodal transport. They directly increase the competitiveness of unimodal transport. But they make it possible for the intermodal service provider to outperform the single-mode operators. That is, where before only single-mode operators were able to schedule such that their mode was efficiently used, which gave rise to significant economies of scale, now even small intermodal operators, without a significant position in any single mode, can achieve comparable efficiency as a result of the market transparency and access provided by the single mode systems. The distinction between single-mode transport and intermodal transport gradually disappears.

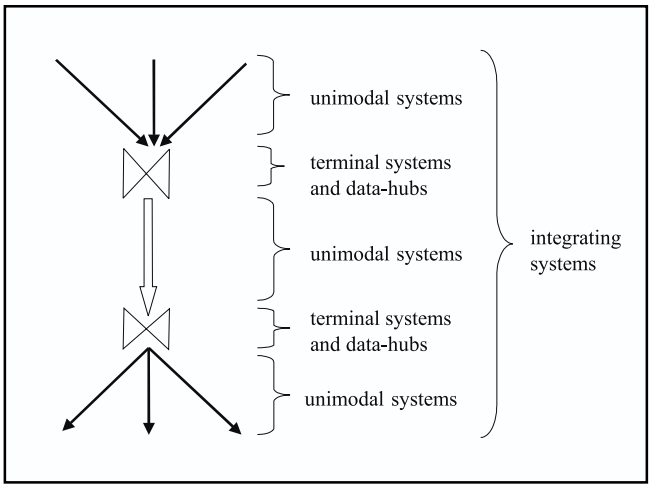


***Figure 6**. Different Types of E-Commerce Applications in Intermodal Transport*

US and Europe's Leading Internet Applications in Freight Transport [26]

As an Internet application, shipment tracking is the top freight transport application both in North America and in Europe (responsible for, respectively, 21.7 percent and 20 percent of all Internet applications available). In North America, quote request is second (14.7 percent of applications), and services showing load and equipment availability for tender purposes together make up 18.7 percent. The second type of application in Europe is interactive scheduling (6.5 percent). Electronic transaction support and EDI-like applications show about the same percentages in Europe and in North America (approximately 6 percent).

Even more interesting is the dispersion of applications over providers. North America–based companies have more than twice as many applications as their European counterparts.

Single mode systems may be used as a part of an intermodal optimization algorithm, as intended by den Hengst,[27] to reduce empty capacity and mileages on collection and distribution transport of intermodal trips. As such, they are a crucial part of the toolkit of any intermodal service provider trying to keep pace with the all-road competitors.

To face the threats, as well as to seize the opportunities, posed by e-commerce, we may conclude that there is a need for intermodal integrators able to access all unimodal markets, to optimize over these markets, and to deliver optimal value and service to the shippers.

Future Trends and Expectations

Reviewing the considerations and examples of the previous sections, several conclusions can be drawn. The progress of ICT technology and e-commerce interferes with markets of both physical products and transport services. It leads to completely new organization forms, and it has a strong impact on the nature of physical good flows. It is unclear if e-combustion or e-limination will prevail. The odds are in favor of the latter. More outsourcing, better cooperation and consolidation between shippers, more substantial flows over longer distances, and a more flexible organization of transport will also create more opportunities for inter-modal transport.

Although e-commerce offers goods opportunities, the challenges facing intermodal transport in Europe are multifaceted, and some structural changes are necessary for the transport world to live up to them. Better service and reliability and better efficiency must be achieved, and it can be done by a change of organization and coordination structures. Service applications, like tracking and tracing, and efficiency optimization over the entire intermodal network (see Figure 6) imply gathering and analysis of data from all firms in the network. Data sharing among transport and logistics firms, involved in a strong competition, had proved difficult if not impossible to bring about.

It gives rise to expectations that there is a special role for independent specialized infomediaries. There have been some successful examples. Not only are these firms necessary to realize e-commerce on a broad basis in intermodal transport, but e-commerce tools and technology are a *sine qua non* to these infomediaries. Some of them will essentially be just an e-commerce tool (for instance, an electronic marketplace for loads and capacity, supported by a supposedly neutral ICT firm). Others will be fourth-party service companies, again neutral, stemming from banks or consultants, perhaps even from trusted parties in transport. Both the infomediary systems and the fourth-party service providers will rely heavily upon electronic data transmission to and from their clients and suppliers, upon electronic transaction support and tracing applications, and upon electronic subtools like the unimodal infomediary companies. Recent research has revealed[29] that such neutral infomediaries

Planning and Routing Intermodal System (Paris—Intermodal Transport) [28]

The Paris information system is operated by its developer, Cairo Systems, an information technology provider. The system is used by several shippers and deep-sea container carriers like SeaLand, which uses the system in Felixstowe. Paris plans the hinterland transport of containers to and from ports. The main objective of the system is to minimize empty mileage and to reduce transport costs within the rules and preferences indicated by the various shippers. The cooperation that is established between the shippers and deep-sea carriers leads to an increase in efficiency that is not achieved by individual logistics service providers. Furthermore, it creates flexibility since shippers can use a larger scope of transport operators and each transport operator is free to determine what capacity he puts in and what orders he accepts. Monitoring of operations by means of tracking and tracing services is not available.

- directly mediating between shippers and carriers,
- supported by a comprehensive battery of electronic tools and interfaces,
- flexibly optimizing over a number of different transport solutions, and
- offering reliable door-to-door services

will be able to deploy the possible gains from intermodal transport.

Besides data sharing, one other hindrance to applying e-commerce had been the technology cost. Technological progress makes better techniques available at lower costs, and this at a still increasing pace. Tracking and tracing technologies and data transmission technologies are becoming increasingly cheaper, and with Internet penetration, anyone can interface with the world. We may expect that developments in cargo transport will follow the developments in the transport of high-value goods, like passengers and express delivery packages. It may therefore be expected that, in the coming years, common carriers will deploy complex electronic booking devices, such as airlines have done. That door-to-door tracing, which is common in express delivery (UPS, FedEx), will be commonplace in container and other transport chains as well.

Looking to the development of European intermodal transport as compared to the North American situation, short-sea and inland waterway transport is well developed and is adapting swiftly to ICT developments. The expectation is that e-commerce will offer the best opportunity for the European railroad cargo transport to follow the US example. Germany is responsible for the majority of rail cargo in Europe. The Benelux countries, with their central position in European cargo transport, are miraculously lagging behind. The market seems ready; due to increasing congestion on the roads, attempts are being made to transport even perishables like fresh-cut flowers by train. Many large Dutch shippers are constantly stressing the need to organize rail services to important export destinations. Research has shown that even without additional infrastructure projects, there is enough capacity to accommodate at least part of the flow. With current transport demand and existing capacity, only information and organization structure have to be changed in order for the trains to start moving. And this is, as we have seen, the largest contributor of e-commerce in intermodal transport.

The future is bright for European intermodal transport. Growth can be predicted because of the ongoing liberalization and increase of scale on the supplier side, the ongoing standardization across boundaries, the investments in technology and "brainports," and the efforts of several European institutions. E-commerce and infomediaries will, however, be the most important driver, especially in the next 5 years.

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The Self-Sufficiency of U.S. Ports and the Role of State Subsidies

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Preface

This paper is in response to a discussion at the second intermodal forum, which revealed there to be policies within the European Community and the United States that seek greater transparency and consistency in port finance.

Heightening the transparency of US port financial practices is certainly honorable enough an objective for conducting research leading to a paper. But if, as stated, one is looking for opportunities for coordinated action, then it would seem useful to take the analysis further than identification and classification. As dismal and complex as this subject may be, it is nevertheless fundamental that we come to grips with the role that subsidies take over time, within the political/financial environment of ports. Thus, in this paper we will attempt to place subsidies within a historic trend traced by US ports toward more or less self-sufficiency. Questions to be asked and hopefully answered in this paper include the following:

- Is the trend of US ports toward greater or lesser profitability?
- What impact do subsidies have on this trend?
- What is the trend of return on port assets, and do subsidies have an impact?
- Do either of the above trends differ significantly by size of port?
- Is success in the US port sector associated with megasize and megasubsidies?
- What about the future—will U.S. ports require more or less subsidies?

This paper is divided into five parts. The first part summarizes the conclusions of the paper. The second part defines terms key to the understanding of the analysis. The third part summarizes the results of a key study on the profitability of ports in the US. The fourth part reports on the results of four case studies specially conducted for this paper. These case studies are designed to update the results of those reported on in section two. Finally, part five, in the interests of transparency, reviews reports covering port subsidy programs found in the US.

Summary of Conclusions

The US Department of Transportation's Maritime Administration (MARAD) study covering the period 1985 to 1994 found a steady decline in the self-sufficiency of US ports.[1] It also found a consistent increase in the average operating ratio, a decrease in the average operating margin, and a steady decline in the net return (before direct subsidies) on the net investment in plant, property, and equipment. Its general conclusion was that competitive factors "may require the future growth of most ports to be funded through taxes and sources other than port revenues."

The case studies carried out as an extension of the MARAD study tend to support the above conclusion, but with some fundamental differences. The most outstanding impression given by these case studies is the tendency toward diminishing returns on investment. Ports are under duress to invest heavily in new facilities, but to do so in a context of burgeoning costs, stagnating productivity, and reductions in subsidies from all sources. This conclusion holds true irrespective of the size of port—in fact, the larger the port, the more representative its behavior is.

The size of investment required for new container terminals is skyrocketing. Most of today's costs were not even present a few years ago, with from 50 percent to 60 percent of the total accounted for by land reclamation and environmental mitigation. Furthermore, the demand for terminals is usually from new amalgams of old tenants, i.e., alliances and mergers. Typically the demand from these quarters is for terminals sometimes twice the acreage of the sum of the partners' previous facilities. With rare exceptions the new terminals do

not exhibit significant increases in productivity. The best productivity levels in US terminals run about 3500 lifts per acre and have remained in this vicinity for the 5 years covered by this study. So demand for new megaterminals remains strong, accompanied by minimal productivity increases.

Certainly no one can report on increases in the prices ports can charge their clients. In fact, the prices appear to be going down. Ports seem to have nearly lost control of the pricing of their terminals. Major international shipping lines have learned how to leverage ports downward not by aggressive competitive pressures, but through political pressure. Never before in the United States have we gone through a period in which public port agencies have had their prices so manipulated by private companies using political pressure. Of course the political pressure is rationalized by stressing the losses in jobs and taxes if the shipping line were to pull its service out and go elsewhere.

Parallel with the growth in costs and reduction in prices has come a reduction in subsidies available. Most state and local governments follow the lead of the federal government and at least pay heavy-duty lip service against "corporate welfare" and for "tax reduction." Most port managements are under heavy pressure to reduce such dependency, where it exists.

Unless ways are found to relatively reduce terminal investment and to increase productivity and pricing, the conclusions of this paper must support those of MARAD—namely, that "future growth of most ports will have to be funded through taxes and sources other than port revenues."

Definition of Terms

Self-Sufficiency—For the purposes of this paper *self-sufficiency* and *profitable* are used interchangeably. A port is defined as profitable if it has a positive net income, not including direct or indirect subsidies. Thus, a port is deemed self-sufficient if it generates sufficient operating income to cover its operations, maintenance, security, sales, administrative, and depreciation expenses without reliance on subsidies.

Direct Subsidies—Direct subsidies include income from balance sheet items such as tax levies, contributions, grants, donations, economic development programs, and cross-subsidies. The latter is considered a subsidy only if significant sums are shifted from one port authority department to the other consistently over a series of years, for the express purpose of achieving a breakeven performance (for instance, if accounts indicate that regularly monies are shifted from the airport department to the marine department). It should be noted that port-published financial statements tend to obscure such shifts. Payments out of port income rendered to city or state owners and not in response to services received are considered to be a form of *negative subsidy*.

Indirect Subsidies—Income from sources not shown on the balance sheet constitutes indirect subsidies. They include navigation expenditures by the US Army Corps of Engineers (its cost share) for maintenance dredging and channel deepening projects. It also includes expenditures by city, state, or federal government for infrastructure explicitly intended, at least in part, to improve access to the port. A third category of subsidy is that extended by the federal government to public infrastructure development agencies throughout the United States (not just ports) in the form of low-interest, tax-free revenue bonds. These bonds typically allow port authorities to obtain loans for public-purpose projects at interest rates two or more percentage points below the prime rate.

Operating Ratio—The operating ratio is a self-sufficiency performance measure determined by dividing the total operating expenses by gross operating revenues. In this paper it is calculated with and without the inclusion of direct subsidies.

Operating Margin—The operating margin is an additional measure of port financial performance and is calculated by dividing net operating income by gross operating revenues.

Net Investment—Net investment covers investment in plant, property, and equipment and includes the cost of land, buildings, equipment, and other improvements, minus their accumulated depreciation.

Net Return on Net Investment—Net return on net investment in plant, property, and equipment is calculated by dividing the net income, with or without direct subsidies, by the net investment in plant, property, and equipment.

Total Subsidies Ratios—Several ratios have been crafted to measure the impact of the sum of both direct and indirect subsidies. They include (a) subsidy/gross income and (b) subsidy/net income.

Note on Data Confidentiality, Availability, and Credibility

The Eno Transportation Foundation requested that case studies be conducted especially for this paper. The relatively short time available to conduct these studies has in itself limited their number to four. Timing was also a key factor in determining which port chief financial officer was available on relatively short notice. In all cases, however, ports allowed themselves to be subjects for a publicly available paper only if anonymity was guaranteed by the author. This is the reason why the cases studied are referred to only as number one, two, three, or four. A reliable and exhaustive coverage of indirect subsidies would require an effort beyond the scope of this paper. For the purposes of this review, reliance has been placed on interviews of authorities in the position to know. Reliability and certainly exhaustiveness cannot be guaranteed.

The 1997 Analysis of US Public Port Profitability (1985–1994)[2]

In June of 1997 MARAD published an analysis of trends in port profitability covering the 10-year period from 1985 to 1994. The case studies carried out for this paper were designed to extend these trends from 1994 to 1998.

With few exceptions the MARAD study found a steady decline in the average number of profitable ports during the 10-year period. It also found a consistent increase in the average operating ratio, a decrease in the average operating margin, and a steady decline in the net return (before direct subsidies) on the net investment in plant, property, and equipment. The general conclusion was that competitive factors "may require the future growth of most ports to be funded through taxes and sources other than port revenues."[3] Specific findings in each of six major categories were as follows.

Port Region

The MARAD study found that irrespective of port region,[4] US ports did not increase their self-sufficiency over the 10 years from 1985 to 1994 (that is, net income before direct subsidies declined in all regions). It also found that ports in all regions exhibited a generally low rate of return on net investment. Thus the study concluded (in 1994) that such a performance would not support the high cost of constructing port improvements and equipment.

Port Size Based on Gross Operating Revenue

Size of port in terms of gross operating revenues was found to be the only characteristic of significance, and that only relatively so. Increases were found in only the two highest gross operating income categories[5] (that is, for ports with gross incomes either between $40 million and $75 million or in excess of $75 million).

The study also observed that the operating ratios for all revenue categories show an increase over the 10-year period, with operating margins showing a corresponding decrease. Of course, the opposite movement in these two indicators signifies general deterioration of financial performance.

Ports with an average gross operating revenue of less than $10 million (50 per-

cent of the ports studied) exhibited a negative average operating margin from 1990 onwards.

The average net return on net assets in plant, property, and equipment on all of the revenue categories show a steady decline during the 10- year study period. Ports in the smallest revenue categories had an average negative return for the last 5 years of the study period.

The study also revealed that direct subsidies to ports were sufficient to eliminate negative returns on investment in the lower revenue categories.

Port Size Based on Net Investment in Plant, Property, and Equipment

Conclusions on port profitability in relationship to net investment and port size paralleled those based on operating revenue. During the 10 years observed, an increase in profitable ports was found only in the largest net investment category[6] of ports, with net investment in plant, property, and equipment in excess of $250 million.

Operating ratios for all investment categories showed an increase over the study period, with the exception of ports with a net investment in plant, property, and equipment in excess of $500 million.

In 1994 all of the categories with a net investment of less than $250 million showed an average negative net return. In that year, direct subsidies were sufficient to eliminate the negative net returns for all investment categories except for the $100 million to $250 million category.

Type of Operation

The 1997 MARAD study also looked at profitability from the standpoint of type of operation.[7] Interestingly, enough the study found the number of profitable nonoperating ports to have been consistently greater than the number of ports not profitable in each year of the study period. The nonoperating category of ports was also the only group that did not show a declining trend in profitability for the 10-year period. The other two categories, operating and limited-operating, showed a declining trend in the number of profitable ports.

Operating ratios for all categories generally increased over the study period, with average operating margins showing a corresponding decrease. The average net return for all of the revenue categories declined steadily during the 10-year period. Limited-operating ports had an average negative net return in 3 of the 5 years analyzed, including 1994. In 1994, operating ports had a net return of only 0.7 percent.

Direct subsidies were sufficient to eliminate the negative return on investment for the nonoperating and limited-operating ports.

The MARAD study also investigated port profitability relative to the type of government department, agency, or authority, and by the extent to which the port administration had a strong commitment to long-range planning. The study found the case of the former to be of little consequence and of the latter to be of "significance."

Port Self-Sufficiency Case Studies 1994 to 1998

As noted earlier, the case studies done for this paper were designed as an extension of the earlier analysis carried out by MARAD. Because of the observed significant relationship between port revenue size and self-sufficiency, the ports to be examined were chosen solely on the basis of size. A comparison between the size categories used in both studies is shown below (Table 1). Note, for the purposes of this study, a larger category was created. The information for the case studies was obtained from interviews carried out on site by the author in August 1999.

Case Study Number 1—Hub Port

Case study number one represents one of the largest ports in the United States, with gross operating revenues in excess of $100 million in each of the 5 years studied. Table 2 presents for 1994 through 1998

Table 1. *Characteristics of Ports Included in MARAD Study and Ports Included in Case Studies*

Port Size ($ million)	MARAD Study ($ million)	Case Study
> 100		Case No. 1
75 to 100	> 75	Case No. 2
40 to 75	40 to 75	Case No. 3
20 to 40	20 to 40	Case No. 4
10 to 20	10 to 20	
< 10	< 10	

Table 2.
US Port Financial Self-Sufficiency Analysis 1994-1998, Case Study 1
Gross Operating Revenue in Excess of $100 million

	US$ (thousands)				
	1998	**1997**	**1996**	**1995**	**1994**
Operating Income					
Income from Operations	188,578	177,230	218,650	151,512	128,817
Nonoperating Income	0	0	0	0	0
Operating Income without Subsidies	188,578	177,230	218,650	151,512	128,817
Operating Income with Subsidies	188,578	177,230	218,650	151,512	128,817
Operating Expense					
Operating Expense	38,238	38,053	52,479	34,786	30,378
Depreciation & Amortization	45,582	34,703	37,528	26,039	25,234
Total Operating Expense	83,820	72,756	90,007	60,825	55,612
Nonoperating Expense	42,319	19,975	36,660	36,671	10,578
Net Income					
Net Income without Subsidies	62,439	84,499	91,983	54,016	62,627
Net Income with Subsidies	62,439	84,499	91,983	54,016	62,627
Net Investment					
Investment, Accumulated	1,533,041	1,264,079	1,264,079	855,948	855,948
Depreciation, Accumulated	289,408	277,466	277,466	229,136	229,136
Net Investment	1,243,633	986,613	986,613	626,812	626,812
Operating Ratio					
Ops Ratio without Subsidies	0.67	0.52	0.58	0.64	0.51
Ops Ratio with Subsidies	0.67	0.52	0.58	0.64	0.51
Operating Margin					
Ops Margin without Subsidies	0.33	0.48	0.42	0.36	0.49
Ops Margin with Subsidies	0.33	0.48	0.42	0.36	0.49
Net Return On Investment					
Net Return without Subsidies	0.05	0.09	0.09	0.09	0.10
New Return with Subsidies	0.05	0.09	0.09	0.09	0.10

the port's financial performance with and without direct subsidies. It covers the following accounts:

- Operating income, with and without direct subsidies;
- Operating expense, both operating and nonoperating;
- Net income, with and without direct subsidies;
- Net investment;
- Operating ratio, with and without direct subsidies;
- Operating margin, with and without direct subsidies; and
- Net return on investment, with and without direct subsidies.

Operating Income—Operating income grew throughout the period at a 7 percent compound annual growth rate (CAGR) During the same period, the port's main revenue cargo—containers—grew at a rate of 8 percent. As noted, the port received *no* nonoperating income (i.e., direct subsidies).

Operating Expense—Operating plus nonoperating expense exploded relative to income, growing at 23 percent CAGR over the 5 years.

Net Income—It is not surprising that the port's net income exhibits a nearly stagnant growth; in fact, it is slightly negative.

Net Investment—Net investment grows at a rate of nearly 17 percent (CAGR).

Operating Ratio—The nearly 6 percent growth in the operating ratio underlines the port's less than positive financial performance.

Operating Margin—This performance indicator further reinforces the picture of a relatively dismal financial performance.

Net Return on Investment—The negative 13 percent growth in return on investment over the 5 years indicates a shift from the previous time period where the MARAD

Table 3.
US Port Financial Self-Sufficiency Analysis
Case Study 1

Evaluation of Direct and Indirect Subsidies

	1998	1997	1996	1995	1994
Income and Investment US$ (thousands)					
Gross Operating Income	97,689	177,230	218,650	151,512	128,817
Net Income	62,439	84,499	91,983	54,016	62,627
Investment	0	257,020	0	359,801	0
Subsidies US$ (thousands)					
Direct					
Tax Income	0	0	0	0	0
Appropriations	-6,244	-8,450	-9,198	-5,402	-6,263
Dredging					
Maintenance	0	0	0	0	0
New Channels	0	0	0	0	0
Access	0	0	0	0	0
Cross-Subsidies	0	0	0	0	0
Bond "I" Rate Diff.	17,137	10,350	13,786	9,735	6,955
Total Subsidy	10,893	1,900	4,588	4,333	692
Ratios					
Subsidy/Gross Income	11%	1%	2%	3%	1%
Subsidy/Net Income	17%	2%	5%	8%	1%

report found that ports of this size maintained a positive growth in return on investment. Diminishing returns to scale are exhibited.

Table 3 sheds further light on the performance of the port in case study number one. Here the impact of total subsidies (direct and indirect) is examined. Two items stand out. First, the port's performance is restrained by the payments made annually to its owner. These "negative subsidies" average 10 percent of the port's net income. The only other subsidy identified is that labeled bond "i"(interest) rate differential, which estimates the value of federal government subsidies extended to all state and local level entities in the form of tax-free bonding capability. The amount of this indirect subsidy obviously grows at nearly the same rate as the port's investments. It accounts for the negative growth in the relationship of total subsidies to gross income and to net income.

Table 4.
U.S. Port Financial Self-Sufficiency Analysis 1994-1998, Case Study 2
Gross Operating Revenue Between $75 to $100 million

	US$ (thousands)				
	1998	**1997**	**1996**	**1995**	**1994**
Operating Income					
Income from Operations	80,965	71,024	62,254	55,278	45,584
Nonoperating Income	0	0	0	0	0
Operating Income without Subsidies	80,965	71,024	62,254	55,278	45,584
Operating Income with Subsidies	80,965	71,024	62,254	55,278	45,584
Operating Expense					
Operating Expense	46,366	42,881	41,301	37,434	31,816
Depreciation & Amortization	15,773	15,086	14,671	12,234	11,742
Total Operating Expense	62,139	57,967	55,972	49,668	43,558
Nonoperating Expense	110	-2,112	-2,755	617	317
Net Income					
Net Income without Subsidies	18,716	15,169	9,037	4,993	1,709
Net Income with Subsidies	18,716	15,169	9,037	4,993	1,709
Net Investment					
Investment, Accumulated	531,777	496,851	468,509	458,923	436,162
Depreciation, Accumulated	180,556	165,277	151,385	138,396	128,046
Net Investment	351,221	331,574	317,124	320,527	308,116
Operating Ratio					
Ops Ratio without Subsidies	0.77	0.79	0.85	0.91	0.96
Ops Ratio with Subsidies	0.77	0.79	0.85	0.91	0.96
Operating Margin					
Ops Margin without Subsidies	0.23	0.21	0.15	0.09	0.04
Ops Margin with Subsidies	0.23	0.21	0.15	0.09	0.04
Net Return On Investment					
Net Return without Subsidies	0.05	0.05	0.03	0.02	0.01
New Return with Subsidies	0.05	0.05	0.03	0.02	0.01

Overall Performance of Case Number One

The performance of case number one is important because it represents a class of the largest ports in the United States. The overall impression is one of deteriorating economic performance, mainly because of apparent diminishing returns on investment. There are two likely causes: lack of growth in the productivity in the use of the terminal's revenue-earning facilities (lifts per acre), or lack of the growth in facility pricing commensurate with investment costs. In the case of this port, it is doubtful that bottlenecks in the inland access can be the cause of stagnant productivity increases. Whichever the case, while indirect subsidies do exist, they do little to mitigate the deterioration. Perhaps most important, the picture obtained from these most recent 5 years indicates a shift downward from the previous 10 years in self-sufficiency of the country's largest ports.

Finally, in spite of definite 5-year negative trends, this port is currently quite profitable and will remain so for some time without the benefit of direct subsidies.

Case Study Number Two—Major Port

Case study two is a major port, ranking among the top ten in the United States, with gross operating revenues in excess of $75 million in 1998. Table 4 presents for 1994 through 1998 the port's financial performance with and without direct subsidies. It covers the following accounts:

- Operating income, with and without direct subsidies;
- Operating expense, both operating and nonoperating;
- Net income, with and without direct subsidies;
- Net investment;

Table 5.
US Port Financial Self-Sufficiency Analysis
Case Study 2

Evaluation of Direct and Indirect Subsidies

	1998	1997	1996	1995	1994
Income and Investment US$ (thousands)					
Gross Operating Income	80,965	71,024	62,254	55,278	45,584
Net Income	18,716	15,169	9,037	4,993	1,709
Investment	0	19,647	14,450	-3,403	12,411
Subsidies US$ (thousands)					
Direct					
Tax Income	0	0	0	0	0
Appropriations	0	0	0	0	0
Dredging					
Maintenance	1,100	0	1,100	0	1,100
New Channels	0	0	0	0	0
Access	0	0	0	0	0
Cross-Subsidies	0	0	0	0	0
Bond "I" Rate Diff.	1,442	1,519	1,577	388	39
Total Subsidy	2,542	1,519	2,677	388	1,139
Ratios					
Subsidy/Gross Income	3%	2%	4%	1%	2%
Subsidy/Net Income	14%	10%	30%	8%	67%

- Operating ratio, with and without direct subsidies;
- Operating margin, with and without direct subsidies; and
- Net return on investment, with and without direct subsidies.

Operating Income—Operating income grew throughout the period at a rapid rate of 12 percent CAGR. During the same period, the port's main revenue cargo—containers—grew at a rate of 7 percent. As noted, the port received *no* nonoperating income (i.e., direct subsidies).

Operating Expense—Operating plus nonoperating expenses were held in pace with income at a 7 percent CAGR. Net income exhibits a remarkable growth of over 60 percent CAGR.

Net Investment—The key to this port's stellar performance can be found in its minimal investment over the 5-year period.

Operating Ratio—A negative growth of 4 percent clearly reflects this port's positive financial performance.

Operating Margin—This performance indicator further reinforces the picture of a relatively positive performance.

Net Return on Investment—It is no surprise that in a context of rapid increases in income, low levels of operating expense, and little or no investment, the port's return on investment grew over the period at nearly 40 percent CAGR.

Table 5 sheds further light on the performance of case study two. Here the impact of total subsidies (direct and indirect) is examined. Two items stand out. First, the port has received indirect subsidies in the form of expenditures for maintenance of channel depth. This is the cost accounted for by US Army Corps of Engineers. The only other subsidy identified is that labeled bond "i"(interest) rate differential, which estimates the value of federal government subsidies extended to all state and local level entities in the form of tax-free bonding capability. The amount of this indirect subsidy obviously is minimal. This port's outstanding profitability was minimally affected by the receipt of subsidies.

Overall Performance of Case Two—Major Port

The performance of case study two is important not so much because the port is big, but because of the way the port is operated. Unlike the other cases examined, the second case is an operating port. Clearly the port had its hands well on levers of financial power during the 5 years. The conclusion that operating ports have done better than nonoperating ports conflicts with the trends developed in the MARAD report. Statistics fail to reveal the difficult future facing this port. Living well within its means has meant that investments in its future have come strictly from its earned revenue, leaving little on current account to cover major expansion projects. Success for this port has brought it face-on with its future, necessitating the development of a major expansion project. The port knows significant price increases to be highly unlikely, so it has little alternative but to seek an investment grant from its owner. Today's antisubsidy fiscal climate makes this alternative difficult to achieve. Perhaps the conclusion regarding case study two is that it has merely postponed a deterioration in its profitability. Certainly subsidies have played little or no role in this port's past, but they may do so in the future.

Case Study Number Three—Medium Sized Port

Case study number three is perhaps the most representative of the ports studied. It represents one of the many US ports in the $40- to $75-million gross income class. Table 6 presents for 1994 through 1998 the port's financial performance with and without direct subsidies. It covers the following accounts:

- Operating income, with and without direct subsidies;

- Operating expense, both operating and nonoperating;
- Net income, with and without direct subsidies;
- Net investment;
- Operating margin, with and without direct subsidies;
- Net return on investment, with and without direct subsidies; and
- Operating ratio, with and without direct subsidies.

Operating Income—Operating income increased throughout the period at a little over 2 percent CAGR. During the same period, the port's main revenue cargo—containers—grew at a rate of 3 percent. About 10 percent of the port's operating income is received from its owner's tax base.

Operating Expense—Operating plus nonoperating expense grew at 3 percent CAGR over the 5 years.

Table 6.
U.S. Port Financial Self-Sufficiency Analysis, Case Study 3.
Gross Operating Revenue Between $40 and $75 million

	US$ (thousands)				
	1998	**1997**	**1996**	**1995**	**1994**
Operating Income					
Income from Operations	55,557	57,789	53,265	51,737	49,330
Nonoperating Income[1]	6,300	5,899	5,897	6,098	6,088
Operating Income without Subsidies	55,557	57,789	53,265	51,737	49,330
Operating Income with Subsidies	61,857	63,688	59,162	57,835	55,418
Operating Expense					
Operating Expense	33,009	33,533	31,195	31,121	30,129
Depreciation & Amortization	14,098	13,068	12,230	11,228	10,845
Total Operating Expense	47,107	46,601	43,425	42,349	40,974
Nonoperating Expense	-2,992	-2,397	-2,333	-2,455	-2,121
Net Income					
Net Income without Subsidies	11,442	13,585	12,173	11,843	10,477
Net Income with Subsidies	17,742	19,484	18,070	17,941	16,565
Net Investment					
Investment, Accumulated	549,664	476,776	455,507	447,228	422,441
Depreciation, Accumulated	176,597	162,738	149,731	137,721	403,419
Net Investment	373,067	314,038	305,776	309,507	116,788
Operating Ratio					
Ops Ratio without Subsidies	0.79	0.76	0.77	0.77	0.79
Ops Ratio with Subsidies	0.71	0.69	0.69	0.69	0.70
Operating Margin					
Ops Margin without Subsidies	0.18	0.21	0.21	0.20	0.19
Ops Margin with Subsidies	0.29	0.31	0.31	0.31	0.30
Net Return On Investment					
Net Return without Subsidies	0.03	0.04	0.04	0.04	0.09
New Return with Subsidies	0.05	0.06	0.06	0.06	0.14

[1] Revenue from ad valorem taxes.

Net Income—It is not surprising that the port's net income exhibits only a slight upwards growth trend (1 percent).

Net Investment—The port has, however, invested heavily in its future, with net investment growing at nearly 26 percent CAGR.

Operating Ratio—The port exhibits nearly no movement in the operating ratio over the 5 years, with or without subsidies.

Operating Margin—This performance indicator further reinforces the picture of a relatively level financial performance.

Net Return on Investment—Returns on this medium sized port's investment have fallen by about two-thirds. This indicates a similar issue of price or productivity as faced by case study number one.

Table 7 sheds further light on the performance of case study three. Here the impact of total subsidies (direct and indirect) is examined. Three items stand out. The port's performance is enhanced by annual tax receipts. Another subsidy identified is that labeled bond "i"(interest) rate differential, which estimates the value of federal government subsidies extended to all state and local level entities in the form of tax-free bonding capability. It will also be noted that the port has been the beneficiary of off-site highway expansion, and the port's cost share has been estimated as shown. Subsidies as a percentage of net income increase at a rate of a percentage point a year, hitting 45 percent by 1998. Obviously, subsidies play a major role in the profitability of this port.

Overall Performance of Case Three

The performance of case study three is important because it represents a large class of US ports. The overall impression is one of level economic performance. The port is profitable with or without subsidies. Be-

Table 7.
US Port Financial Self-Sufficiency Analysis
Case Study 3

Evaluation of Direct and Indirect Subsidies	**1998**	**1997**	**1996**	**1995**	**1994**
Income and Investment US$ (thousands)					
Gross Operating Income	61,857	63,688	59,162	57,835	55,418
Net Income	17,742	19,484	18,070	17,941	16,565
Investment	83,000	59,029	8,262	-3,731	192,719
Subsidies US$ (thousands)					
Direct					
Tax Income	6,300	5,899	5,897	6,098	6,088
Appropriations	0	0	0	0	0
Dredging					
Maintenance	0	0	0	0	0
New Channels	0	0	0	0	0
Access	50	50	50	50	50
Cross-Subsidies	0	0	0	0	0
Bond "I" Rate Diff.	1,677	1,638	1,071	1,212	655
Total Subsidy	8,027	7,587	7,018	7,360	6,793
Ratios					
Subsidy/Gross Income	13%	12%	12%	13%	12%
Subsidy/Net Income	45%	39%	39%	41%	41%

sides the port's receipt of subsidies, its heavy investment coupled with deteriorating return on investment are its two most interesting features. This port has focused its investment specifically on intermodal facilities aimed at minimizing terminal dwell time and hence land use productivity of its assets. It is expected that in the future the fruits of this investment policy will be felt in terms of increased return on investment, with direct and indirect subsidies included.

Case Study Number Four—Medium to Small Sized Port

Case study number four is the first port where subsidies really make the difference between a negative or positive net income. It represents one of the many US ports in the $20- to $40-million gross income class. Table 8 presents for 1994 through 1998 the port's financial performance with and without direct subsidies. It covers the following accounts:

Table 8.
US Port Financial Self-Sufficiency Analysis 1994-1998, Case Study 4
Gross Operating Revenue Between $20 and $40 million

	US$ (thousands)				
	1998	**1997**	**1996**	**1995**	**1994**
Operating Income					
Income from Operations	36,508	37,369	37,942	35,311	32,196
Nonoperating Income	5,850	4,574	23,616	18,605	40,227
Operating Income without Subsidies	36,508	37,369	37,942	35,311	32,196
Operating Income with Subsidies	42,358	41,943	61,558	53,916	72,423
Operating Expense					
Operating Expense	24,741	24,741	24,880	23,820	23,728
Depreciation & Amortization	11,400	12,290	11,125	10,800	10,500
Total Operating Expense	36,141	37,031	36,005	34,620	34,228
Nonoperating Expense	968	968	1,380	5,985	1,579
Net Income					
Net Income without Subsidies	-601	-630	557	-5,294	-3,611
Net Income with Subsidies	5,249	3,944	24,173	13,311	36,616
Net Investment					
Investment, Accumulated	223,946	223,165	183,600	182,000	189,600
Depreciation, Accumulated	11,460	11,232	10,107	9,983	10,254
Net Investment	212,486	211,933	173,493	172,017	179,346
Operating Ratio					
Ops Ratio without Subsidies	1.02	1.02	0.99	1.15	1.11
Ops Ratio with Subsidies	0.88	0.91	0.61	0.75	0.49
Operating Margin					
Ops Margin without Subsidies	-0.01	-0.02	0.01	-0.10	-0.05
Ops Margin with Subsidies	0.12	0.09	0.39	0.25	0.51
Net Return On Investment					
Net Return without Subsidies	0.00	0.00	0.00	-0.03	-0.02
New Return with Subsidies	0.02	0.02	0.14	0.08	0.20

- Operating income, with and without direct subsidies;
- Operating expense, both operating and nonoperating;
- Net income, with and without direct subsidies;
- Net investment;
- Operating margin, with and without direct subsidies;
- Net return on investment, with and without direct subsidies; and
- Operating ratio, with and without direct subsidies.

Operating Income—Operating income without direct subsidies grew throughout the period at a little over 2.5 percent CAGR. Counting subsidies, its revenues actually decreased owing to a major reduction in the level of grants and appropriations.

Operating Expense—Operating plus nonoperating expenses were held fairly level over the 5-year period.

Net Income—As the MARAD report showed, ports of this size cannot be self-sufficient without subsidies. With subsidies, they can be. What is most important to note, however, is the major effort management has made to pull the port out of the red. It has literally cut its losses sixfold.

Net Investment—While improving its bottom line, the port has paid for investment mainly from retained earnings and, to a lesser extent, from subsidies. The port's net investment has grown over the 5 years at a rate of 3.5 percent CAGR.

Operating Ratio—An operating ratio above one is bad, but in 1999 the port will break even.

Operating Margin—This performance indicator further reinforces the picture of an improving financial performance.

Net Return on Investment—Net return on investment shows little improvement. This reflects an increase in investment unaccompanied by increases in traffic and by severely constrained prices.

Table 9 sheds further light on case study four's performance. Here the impact of total subsidies (direct and indirect) is examined. Four items stand out. The port's performance is enhanced by annual tax receipts. Appropriations from a number of state programs are received. The port receives a major indirect subsidy in the form of channel maintenance dredging. The fourth area of subsidy is identified as bond "i"(interest) rate differential, which estimates the value of federal government subsidies extended to all state and local level entities in form of tax-free bonding capability. Direct plus indirect subsidies play a large but diminishing role as a percentage of gross income. Just the opposite must be said for net income.

Overall Performance of Case Four

The performance of case study four is important because it also represents a large class of US ports. From the MARAD report, one expects and finds a high level of subsidies coupled with profitability depending on subsidy. What is difficult to reveal in statistics is the effort that the management of this port has extended to reduce its receipts from this source, a sevenfold reduction in 5 years. Also during this period it has held its expenses steady while simultaneously increasing investment solely from retained earnings. The port now foresees the need for a major expansion, which it understands can only come from retained earnings. Both port management and those of its owner disclaim dependence on subsidies in the future.

State Programs for Financing Port Development

The Lyndon B. Johnson School of Public Affairs, University of Texas at Austin, has published a remarkable series of documents on state-sponsored port subsidy programs available in the United States. These reports include:

- *The Texas Seaport and Inland Waterway System*, Policy Research Project No. 114, 1994-95

Table 9.
US Port Financial Self-Sufficiency Analysis
Case Study 4

Evaluation of Subsidies

	1998	1997	1996	1995	1994
Income and Investment US$ (thousands)					
Gross Operating Income	42,358	41,943	61,558	53,916	72,423
Net Income	5,249	3,944	24,173	13,311	36,616
Investment	0	553	38,440	1,476	-7,329
Subsidies US$ (thousands)					
Direct					
Tax Income	500	500	500	500	500
Appropriations	5,350	4,074	23,116	18,105	39,727
Dredging					
Maintenance	7,710	14,983	8,658	4,676	7,253
New Channels	0	0	0	0	0
Access	0	0	0	0	0
Cross-Subsidies	0	0	0	0	0
Bond "I" Rate Diff.	140	189	241	306	368
Total Subsidy	13,700	19,746	32,515	23,587	47,848
Ratios					
Subsidy/Gross Income	32%	47%	53%	44%	66%
Subsidy/Net Income	261%	501%	135%	177%	131%

- *Port-Related State Programs and Federal Legislative Issues*, Policy Research Project No. 117, 1995-96
- *State Programs for Financing Port Development*, 1997

The last document reviews in detail port subsidy programs for the States of Wisconsin, Minnesota, Oregon, Louisiana, Florida, and California. Those interested in a major effort toward providing transparency to this subject should study these documents.

Endnotes

[1] U.S. Department of Transportation, Maritime Administration, *An Analysis of U.S. Port Profitability and Self-Sufficiency* (1985-1994), Washington, D.C., June 1997.

[2] U.S. Department of Transportation, *Ibid*.

[3] U.S. Department of Transportation, *Ibid*, page 2.

[4] U.S. Port Regions included: North Atlantic ports, South Atlantic ports, Gulf ports, North Pacific ports, South Pacific ports, and Great Lakes ports.

[5] Port size was classified in terms of annual gross operating revenue as follows: 1) in excess of $75 million 2) between $40 million and $75 million, 3) between $20 million and $40 million, 4) between $10 million and $20 million, and 5) under $10 million.

[6] In the MARAD 1997 study, net investment in plant, property and equipment was classified into the following categories: 1) in excess of $250 million, 2) from $100 million to $250 million, 3) from $50 million to $100 million, 4) from $25 million to $50 million, 5) 12.5 to 25 million, and 6) less than $12.5 million.

[7] The type of port operations studied were as follows: (a) nonoperating ports, (b) operating ports, and (c) limited operating ports.

The Future Development of Infrastructure for Intermodal Transport in Europe

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State-of-the-Art European Intermodal Infrastructure

The use of intermodal transport in Europe is fairly modest. Despite the fact that governments go to great lengths to stimulate intermodal transport, there is still no major shift from road transport to the use of alternative modes of transport by shippers and transport companies. Although there is a slight growth in the use of rail transport in Europe, the market share of intermodal rail transport was in 1994 the same as it was in 1985, namely 5.5 percent. There is a constant decrease in the number of containers transported in Europe by rail. The number of 20-foot containers went from 1,286,000 in 1997 to 1,249,000 in 1998. The transport of swap bodies, on the other hand, rose 9 percent between 1996 and 1997. Fortunately, there are more hopeful perspectives for intermodal transport (for instance, the considerable increase in transport by inland barge and the growing interest in short-sea transport. But on the whole the situation does not look very promising for the future of intermodal transport.

A number of bottlenecks and barriers prevent a widespread implementation of intermodal transport. The most important bottlenecks/barriers to intermodal transport are as follows:

- The *cost level*, which is often too high in comparison with the tariffs used in conventional road transport.
- The additional *time and costs*, which are caused by the necessity of *pre- and endhaulage* at the first and final legs of the intermodal logistics chain.
- The *involvement of (too) many actors* in the intermodal chain, which leads to a lot of problems in the fields of *organization and communication* and which also leads to higher costs and the loss of efficiency.
- The *lead times* in intermodal transport, which are typically longer than those in traditional road transport (partly due to the former two points).
- *Punctuality and reliability,* especially of rail transport, are poor when compared with road transport.
- The *limited applicability* of intermodal transport. The mode is not suitable for all types of goods, especially small and time-critical shipments of high-value goods.
- The European *intermodal transport market is still very fragmented*. There are big differences in the rail gauge, and the companies operating in this market are still very much nationally oriented. Another problem is the dominance of state-owned companies in intermodal transport, which prevents international strategies and improvements in flexibility and efficiency.
- The European *intermodal infrastructure network still is far from complete*. Important links are missing, and some regions are not opened up at all.

An overview of the European intermodal infrastructure network will be presented in this article. Some maps are included to give a clear picture of the state-of-the-art of the existing routes for the different intermodal modes—namely, rail, inland barge, and short-sea transport—as well as an up-to-date overview of the present terminal network. Some conclusions will then be drawn for each of the modes.

Several major conclusions can be stated on the present European rail infrastructure network:

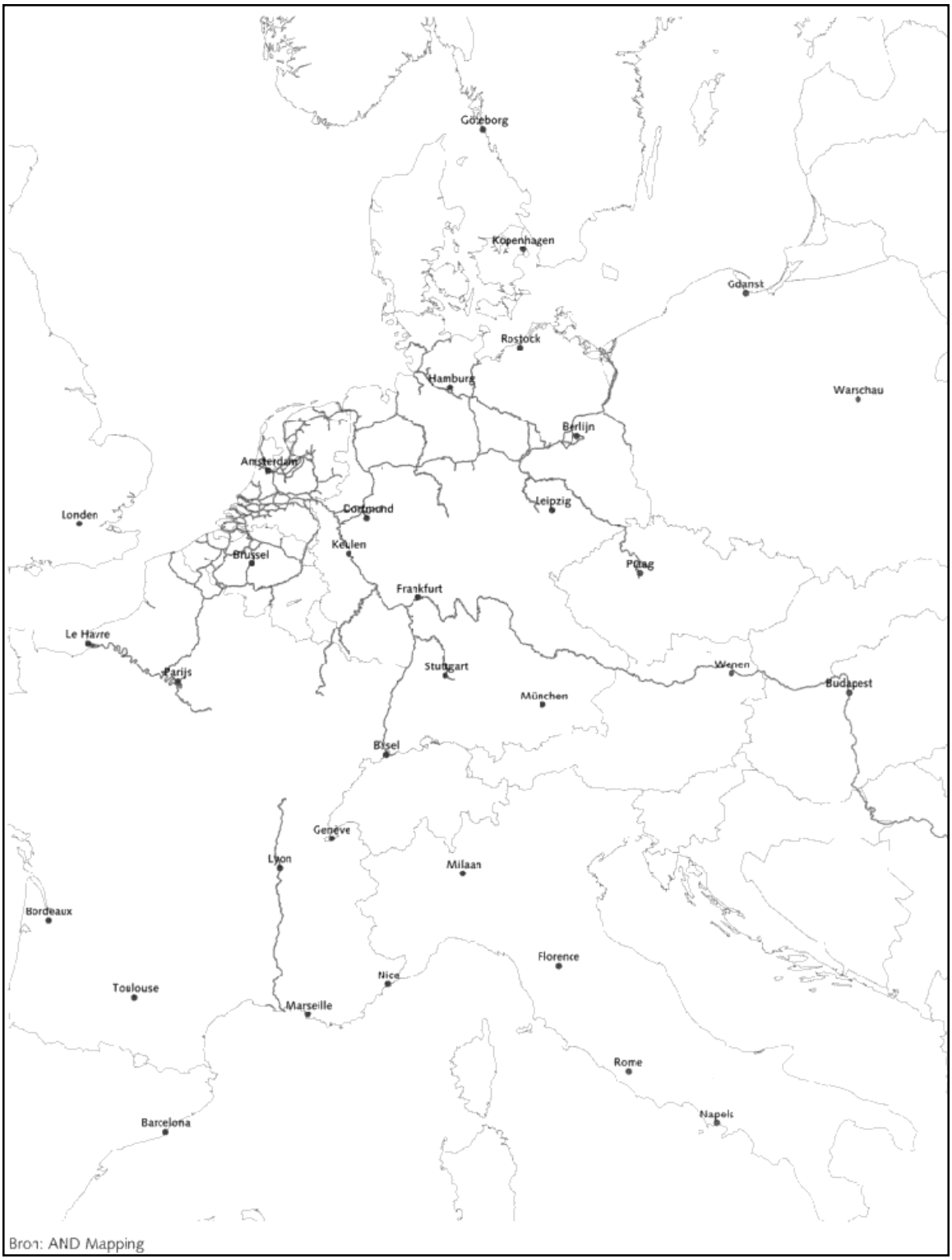
- The present network of rail connections is rather dense. In particular, Germany, the Benelux countries, England, and the northern part of France are well connected.
- Most of the connections between the main economic centers are dedicated to both passenger transport and goods transport. There are few main lines that are designated for freight transport only.
- There are big differences in, for instance, rail gauge between the various countries.

Figure 1. Overview of the present rail infrastructure network in Europe

- The rail networks are still nationally oriented and operated. The plans for the Transeuropean Transport Networks, as well as the upcoming liberalization, both instigated by the European Union, will change this situation drastically in the coming years.

The most important conclusions on the inland waterways network are as follows:

- Because the inland waterway infrastructure largely depends on the presence, situation, direction, and depth of natural waterways, the suitable net-



work is fairly limited. Only Germany, the Benelux countries, and the northern part of France are fit for a large-scale use of inland barge transport.

- Sometimes main economic poles cannot be served by inland barge transport, simply because these centers are not located near waterways.
- Extension of the natural network, by constructing artificial connections, is

Figure 2. Overview of the present inland waterways infrastructure network in Europe.

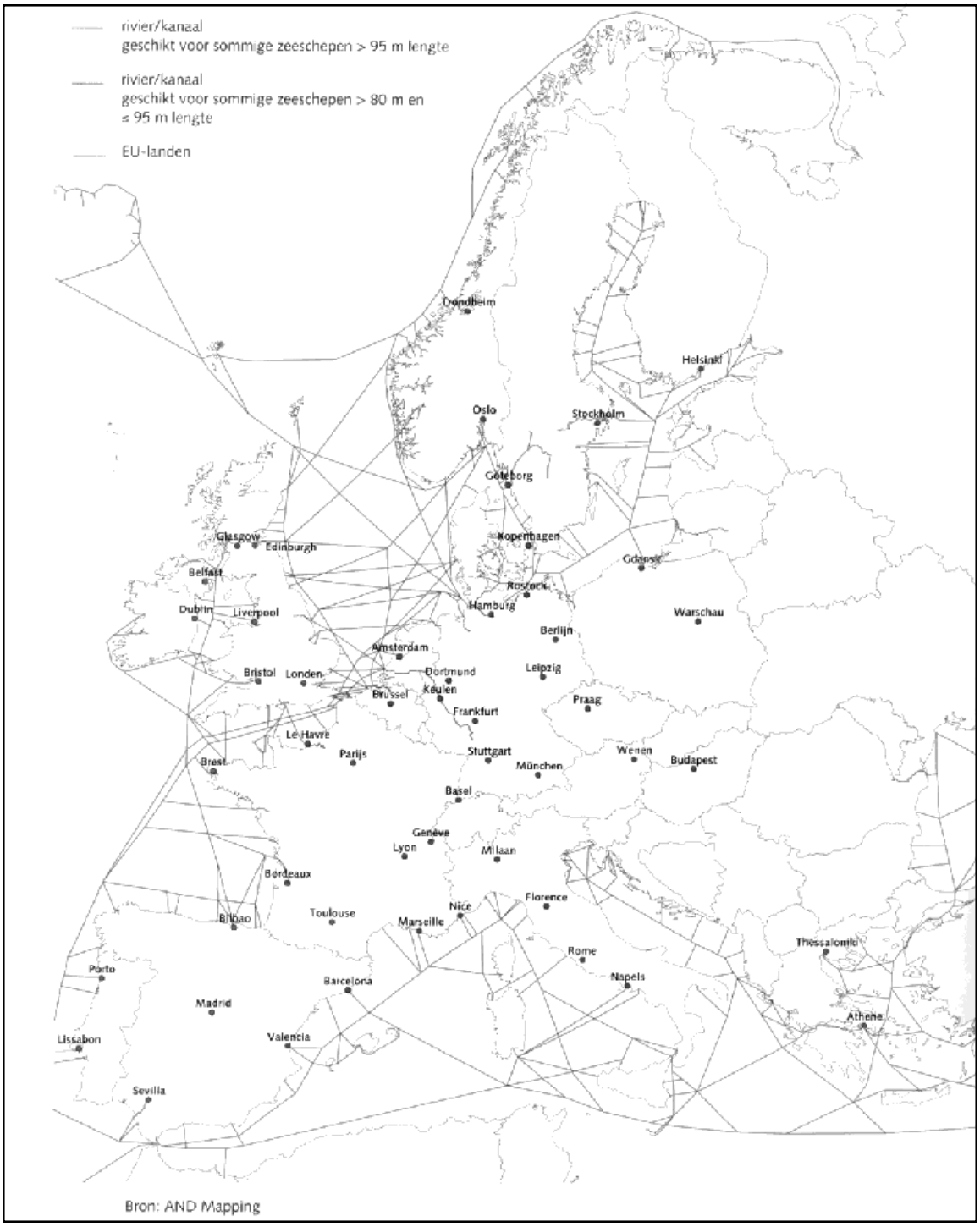


Figure 3. Overview of the present short-sea route network in Europe

very expensive and nowadays also hindered by environmental groups who object to the the construction of new canals because of their impact on the landscape.

The main conclusions on the short-sea route network are as follows:

- Because of its characteristics (transport over sea), short-sea transport is only suitable for the coastal regions in Europe.
- For the rest of the regions, long-distance pre- and end-haulage transport is needed, which makes this mode of transport less attractive.

Some conclusions, which can be drawn from the map on the terminal network, are:

- At this moment there are more than a thousand terminals for intermodal transport in Europe. The following sub-division can be made:

Rail-road terminals:	452
Road-sea terminals:	247
Rail-road-sea terminals:	245
Rail-road-sea-barge terminals:	38
Rail-road-barge terminals:	32
Barge-road terminals:	24
Barge-road-sea terminals:	12

Figure 4. *Overview of the present terminal network in Europe*

The absolute number of terminals is the highest in Germany (166), Italy (124), the United Kingdom (110), and France (94). All figures used refer to the year 1997.

- There are, of course, big differences between these terminals in quality, tariff structure, ownership, and so forth, Almost all European terminals are equipped to tranship containers, 60 percent are capable of handling swap bodies, and half of the terminals are fit for the transhipment of trailers.
- The terminal density (number of terminals per 10,000 square kilometers) is the highest in the Benelux countries of the Netherlands (15) and Belgium (13). France and Spain have a relatively low terminal density (2).
- In Europe there is still no increase of scale in the terminal network leading to a concentration of terminals into a number of hub terminals. In the United States the number of rail terminals has been reduced from 1,500 in 1977 to 160 in 1994.

Figure 5 presents an overview of the complete European intermodal infrastructure network.

Bottlenecks in the Infrastructure

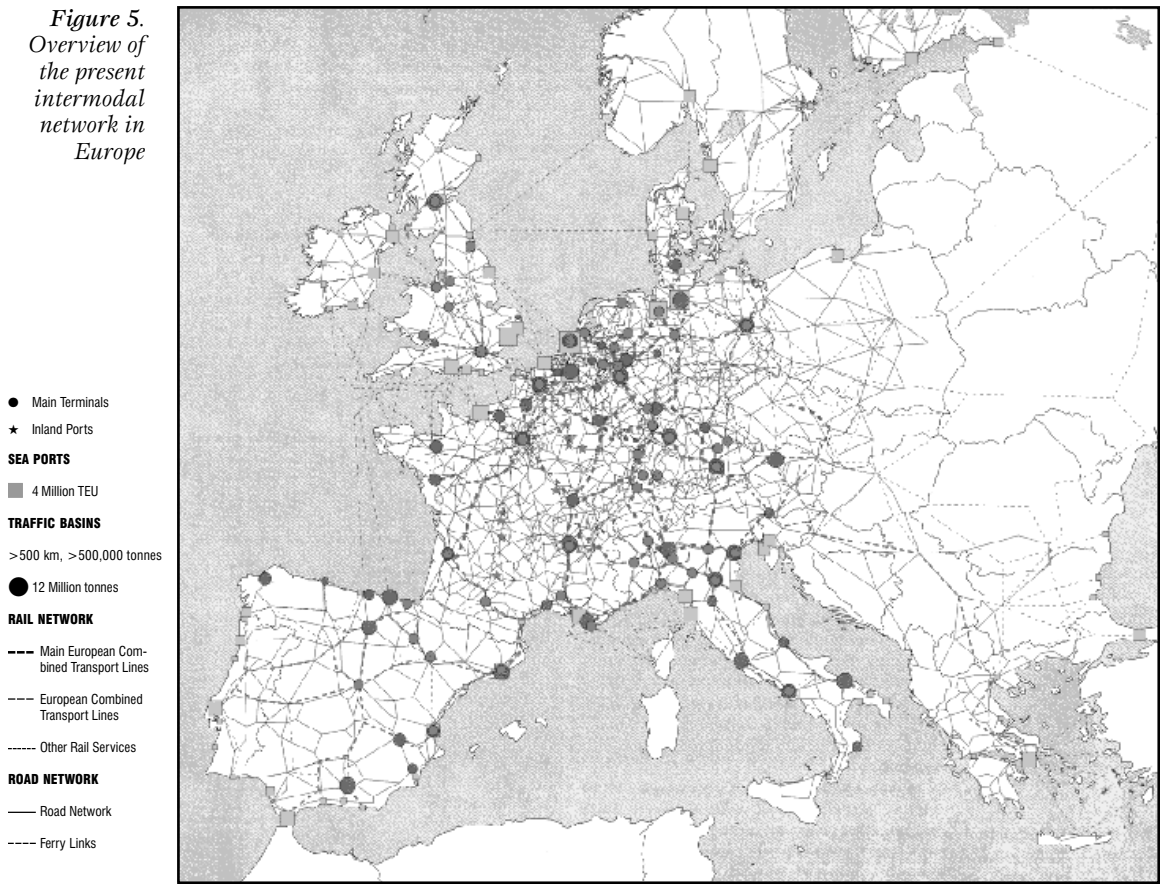
Figures 1-5 show that there is quite an extensive intermodal infrastructure network in Europe. However, there are bottlenecks, which prevent an unlimited use of the network and hinder the extension of the network. These bottlenecks can be divided into four categories:

- Diversity
- Capacity
- Location
- Organization

Diversity

Unfortunately the intermodal infrastructure

Figure 5. Overview of the present intermodal network in Europe



network is far from uniform. There are huge differences between the various countries in technical systems, loading units, and transhipment techniques. The majority of EU member states have double-track operations for most of the rail lines. Some countries, however, have a relatively high proportion of single-track intermodal transport operations. For instance, over half of the lines in Spain are single track, and these lines are subject to a speed limitation of 60 km/h. Finland also has a lot of single-track lines. As far as loading gauges are concerned, most of the EU member states have a loading gauge of UIC B level or larger. Exceptions are Italy and the United Kingdom, where the majority of the lines are below this level. There are also big differences between the countries regarding minimum speed. Germany seems to have the highest possible operating speed for intermodal transport trains (140–200 km/h). Austria, Denmark, Finland, Italy, Luxembourg, and Portugal have a comparable speed level. Other countries have totally different maximum speeds; for instance the Netherlands and Belgium have a limit of 90 km/h, the United Kingdom has limits between 70 and 100 km/h, Ireland's limit is 80 km/h, and Spain's ranges from 50 to 60 km/h. Apart form these differences in rail lines, there are also differences between the EU member states as regards maximum authorized lengths and weights of trains, the maximum authorized axle weight of wagons, operating speed, and so forth.

Besides these technical differences, there are also dissimilarities between the various countries in the policies towards intermodal transport formulated by their ministries of transport. Some countries—for instance Sweden, the United Kingdom, and the Netherlands—strongly encourage a policy focused on liberalization of the rail and inland barge sectors. Other countries, such as France and Spain, support a more modest development towards a complete liberalized market and try to maintain some state influence on the parties operating on the intermodal market. For both potential users of intermodal transport and intermodal companies that want to operate on an international level, this discrepancy in policies can cause a lack of clarity, as well as operational problems.

Capacity

The intermodal infrastructure nowadays sometimes suffers from an insufficient capacity. This lack of capacity is caused by a number of developments. One of them is the increase in freight transport in the past couple of years. Because of the growing economies in most of the EU member states, the flow of goods to be transported via the infrastructure network will probably continue to rise sharply over the next years, as will the demands on the infrastructure. As the capacity of the infrastructure network is already limited at the moment, it can be expected that problems will only increase in the years to come.

Another complicating factor in this respect is the age of the infrastructure network. A lot of the existing rail infrastructure was constructed quite some time ago; hence, the infrastructure is not, in many places, what we would call the state of the art, not only from a technical point of view, but also with respect to location. Fortunately, the recent construction of high-speed rail connections, as well as the (planned) realization of dedicated freight lines, somewhat makes up for this neglect.

Besides this lack of capacity in absolute terms, there is also the problem of inadequate use of the capacity that is available, largely because too many actors want to operate on the same routes. With the upcoming liberalization, new parties will enter the rail market and will be looking to transport goods over a limited number of lines (probably those which connect the main economic centers), for which capacity is already limited or even insufficient.

Finally, the above-mentioned problems (too limited infrastructure and too many actors) are aggravated by the fact that the use of rail infrastructure for passenger transport has increased over the past decade. In particular, the rise of high-speed rail transport as a substitute for air transport has led to a sharp increase in the frequency of trains on connections between economic centers. Generally speaking, governments favor passenger transport. In the infrastructure plans of the various ministries of transport of several EU member states, passenger transport has a priority over freight transport.

The problem of insufficient capacity of the existing infrastructure is worsened by the difficulties faced when trying to extend the network. Not only is the creation of new infrastructure suitable for intermodal transport very costly, it is also time-consuming. Governments trying to realize new rail connections or waterways are increasingly facing objections of environmental pressure groups and people living in the regions to be intersected by this new infrastructure. In response to these objections, authorities are often forced to introduce long-lasting procedures and to grant expensive alterations to the infrastructure planned. An additional problem is the fact that the limited resources available for the creation of new infrastructure will be largely used for infrastructure that will handle passenger transport. Another complicating aspect is the lack of a central planning agency for the creation of new infrastructure. Infrastructure for intermodal transport will often consist of long rail tracks between economic centers in different countries. Up until now it has been difficult to coordinate the realization of new infrastructure at an international level. The TEN program of the European Commission is the first example of a changing attitude towards this subject. Finally, the creation of new infrastructure is, as mentioned before, a costly business. Governments would therefore appreciate the involvement of private parties in order to facilitate this process. Unfortunately, private companies have so far shown only limited interest in participating in the construction of new infrastructure.

Location

The third problem related to infrastructure is "location." As the infrastructure for intermodal transport (rail lines, canals, terminals) was basically constructed decades ago (sometimes even more than a hundred years ago), the location of the infrastructure is no longer adequate. Industrial estates, along which rail lines have been built, are no longer in use, factories are dismantled or have been relocated, economic centers have moved, etc. This outdated location of the infrastructure causes a lot of problems. Not only are rail lines, canals, and terminals located where there are no longer any (major) economic activities, but the infrastructure (for instance, terminals) is also not very accessible. Trucks have to drive through residential areas or even into city centers to reach the transhipment points, where they unload or pick up their freight. This also causes a lot of environmental and societal problems, such as noise in the early mornings or late evenings or even at night when containers are handled or trains are passing by. An additional problem is the transport of dangerous goods. Communities object to the transport of these goods, and the strict regulations that must be followed hamper freight transport. Because of these poorly situated locations, it is also very difficult to expand the facilities. Often, the locations are enclosed by already occupied zones or even by residential areas, which makes it very difficult to double a rail line or to enlarge a terminal facility, especially when a lot of space is needed.

The same applies for waterways, particularly natural waterways. Natural waterways are ideal connections for the transport of freight, but because they are not manmade they sometimes run from nowhere to nowhere, ignoring the situation of important economic centers. Finally, the infrastructure has been realized from a national point of view, so a lot of seemingly logical connections, linking economic core regions across the border, are missing.

Organization

The final problem related to infrastructure is the organizational aspect. It is often difficult to realize new infrastructure and to exploit and maintain existing rail lines or waterways, because a lot of actors are involved. The involvement of many and different types of actors makes it hard to organize the assignment of capacity (existing infrastructure) and the division of costs for realization (new infrastructure). This problem also plays an even bigger role at an international level. In this respect there are also, as mentioned before, the problems

of costly and time-consuming realization procedures and the environmental pressure, which makes it more difficult to realize thing in an effective way.

Trends and Developments with Impacts on Intermodal Transport

There are several trends that have an impact on the future development of intermodal transport and, in an indirect way, have consequences for the infrastructure. To start with, there are both trends that have a negative impact on the use of intermodal transport and its infrastructure and there are trends that have the opposite result. First, the trends that favor intermodal transport will be touched on.

Trends that *support* the use of intermodal transport and its infrastructure:

- *A growing awareness of the environment*. The public and policy makers are supportive of the idea that intermodal transport can help to reduce the negative impacts of the increase of the transport of goods. Nowadays, the reduction of road transport by shifting freight to other modes, such as rail transport and inland barge transport, is part of the transport policies of most of the EU member states.
- *A development towards "green" logistics.* Because of the growing awareness of the public and of policy makers for the environment, shippers are more and more inclined to carry out their manufacturing and logistics activities in an environmental-friendly way. The use of intermodal transport is an important aspect in this respect. They are also forcing their logistic services providers to offer them possibilities for the use of all modes, including intermodal transport.
- *A decreasing reliability of road transport*. The continuing growth of the economy leads to a corresponding use of road transport, which results in an increase in congestion and traffic jams. Therefore, the accessibility of the mode road transport has diminished considerably over the past couple of years, which makes it attractive for both shippers and logistic services providers to switch to alternative modes such as intermodal transport.
- *A trend towards more hinterland depots of shipping lines*. Shipping lines, responsible for a huge amount of container shipments throughout Europe, tend to store their containers more and more at locations in the hinterland instead of ports. This in a way encourages the use of intermodal transport at the routes from ports to hinterland depots.
- *A further liberalization*, especially of the rail transport market. The liberalization of the transport markets in the EU will probably lead, as it did in the United States, to a further growth in the use of intermodal transport. The developments in inland barge transport already show a hopeful perspective.
- *The arrival of new professional intermodal players*. As a result of the ongoing liberalization of the intermodal markets in Europe, new players will enter the markets and old ones will merge or change their policies and strategies. Thus a new generation of professional intermodal players will emerge, offering shippers more possibilities to use intermodal transport in an efficient way;
- *An increase in long-distance transports*. Because of the increase in scale in most industries, there is a clear development towards international and even global operating companies. By concentrating specific manufacturing processes in certain plants (concentration into megafactories), the average length of the transport movements between these plants will increase. It is a well-known fact that intermodal transport is especially interesting for transports at long distances.
- *A centralization of stocks in distribution centers*. The above mentioned development of an increase in scale, internationalization, and mergers and acquisitions leads also to a concentration trend in logistics. Recently, there has been a trend toward the concentration of stocks in central distribution centers, sometimes even at a European scale. This also

facilitates the use of intermodal transport, since larger volumes are more easily shifted to intermodal transport than small volumes.

- *An increasing bundling of flows*. Shippers and haulers are trying to reduce the amount of trips between their plants, distribution centers, and other points of transhipments. To reach this goal, shipments are increasingly being combined and flows of goods are being bundled, even through cooperative agreements between companies. This bundling of flows also enlarges the possibilities for intermodal transport.

There are also a number of trends that are *not stimulating* the use of intermodal transport and its infrastructure:

- *A growing opposition to the construction of new infrastructure*. As previously mentioned, there is growing resistance to new, big infrastructure works. Environmental groups are stimulating these protests, which often lead to a withdrawal of the plans or drastic adaptations of the original plans. New rail lines and canals are especially facing growing opposition.
- *A trend towards the subcontracting of logistics activities*. More and more shippers are following the trend of "back-to-the-core-business" and are thus subcontracting their logistics activities. In some cases only a part of the logistics activities are subcontracted to a logistic services provider (for instance, transport activities), in other cases the complete supply chain management is subcontracted. This could be positive for the use of intermodal transport, but it is probably not because most of the logistic services providers are strongly oriented to road transport and are not inclined to use intermodal transport. This may change in the future, considering the above mentioned positive trends.
- *The rise of the Mediterranean ports*. Besides the concentration of flows of goods in a number of main ports (Rotterdam, Antwerp, Hamburg), there is also a trend towards more traffic in smaller ports (for instance, in the Mediterranean). If this trend continues it will mean that goods that used to arrive in ports in northwestern Europe will now go through ports in southern Europe. This means a breaking up of big flows into smaller ones, which makes the use of intermodal transport more difficult.
- *Trucks are becoming increasingly environmental minded*. One of the main arguments for using intermodal transport is its relatively positive position compared with road transport when it comes to effects on the environment. However, technical developments in the car industry have led to considerable improvements in the effects on the environment of trucks. The relative advantages of intermodal transport in this respect have thus decreased.
- *A lack of interest of investors for freight transport*. The wishful expansion of the infrastructure for intermodal transport is hindered by the lack of budgets of governments. Extra financing could be provided by private investors. Unfortunately, up until now investors have shown small interest in the development of facilities and infrastructure for intermodal transport.

An Outlook to the Future: An Agenda for Action

There is a well-developed infrastructure network for intermodal transport in Europe, especially when it comes to rail transport and terminals. There are, however, bottlenecks that prevent a huge increase of the use intermodal transport. The fact that a large part of the infrastructure is outdated and located on the wrong site, the lack of a central planning when it comes to maintaining the present infrastructure and creating new facilities, the high costs of constructing new infrastructure, the long procedures for the realization of infrastructure, and the lack of interest of financiers for private financing of new infrastructure all are barriers for the expansions needed.

To further stimulate intermodal transport, new ground has to be broken, innovative solutions have to be invented, and unconventional measures have to be taken. Some ideas will be outlined here. One of

them will be elaborated briefly. The following points could offer new perspectives for intermodal transport and the realization of new infrastructure required:

- *The realization of one uniform and liberalized network*. The present policy of the European Union to integrate the various infrastructure networks and to stimulate a further liberalization of the transport markets is one of the most important necessary developments for a creation of new market perspectives for a further growth of intermodal transport.
- *The use of new transport modes such as underground transport and zeppelins*. Two of the main problems with intermodal transport are the poor location of the infrastructure (for instance, terminals) and the (expensive) pre- and end-haulage. These problems can partly be tackled by using new innovative infrastructure and transport concepts. For instance, the use of underground transport can offer possibilities, especially when it comes to deliveries in city centers. In the Netherlands, some pilot projects have proven the utility of underground infrastructure. The costs are, however, still considerably high. Another option being considered at the moment is the use of zeppelins. This concept, infamous for the disaster involving the German Hindenburg airship, is being rediscovered and will be probably used not only for leisure trips but also for freight transport.
- *The bundling of flows of goods in corridors between economic poles*. One of the main reasons for using intermodal transport is the combination of flows of goods into larger quantities. This is often difficult to accomplish, however, as shippers are very reluctant to combine their goods with the products of their (potential) competitors. However, in the light of the growing congestion it could become necessary in the future to force companies to combine their flows of goods. The most efficient way to do this would be to create a number of corridors along which the freight flows can be transported. These corridors, which probably will be the main routes between the economic centers, could also have a positive impact on budgets for new infrastructure for (intermodal) freight transport since the investments could be concentrated in these corridors.
- *The creation of rail lines dedicated for freight transport (intermodal freeways)*. The above-mentioned idea of bundling could even be elaborated into the creation of specific infrastructure for (intermodal) freight transport. All goods would be transported along these main rail lines. The European Commission has already taken some steps towards this idea by creating so-called intermodal freeways. Also in some EU member states new infrastructure is being created specifically for freight transport (for instance, the Betuwe line in the Netherlands).
- *A radical improvement of information flows*. One of the main obstacles to the efficient use of intermodal transport is the lack of information and the poor communication between the different actors in the logistical multimodal chain. As analyzed in some European projects, an improvement of the communication between the various links of the chain is crucial for an improvement of the intermodal product. This can be realized in a very basic way (structural meetings of actors) or in a more advanced way—for instance, by introducing information technology systems.
- *The combination of (new) terminals and infrastructure for intermodal transport with industrial and logistic sites*. Another crucial element for the attractiveness of intermodal transport is the distance to terminals and other infrastructure facilities. When this distance is too large, the extra costs of pre- and end-haulage will make the intermodal chain unattractive. The realization of new intermodal infrastructure at locations where (logistics and manufacturing) companies are concentrated could offer possibilities for an increasing use of intermodal transport.
- *The compulsory concentration of (newly built) companies on selected industrial sites with multimodal facilities*. Inter-

modal transport is especially suitable when large quantities of goods can be transported over long distances. Often it is hard for one company to use intermodal transport because its flows are too small. In order to create large flows, it is necessary to combine the freight flows of several companies. One of the solutions in this respect could be to encourage or even force companies to locate their facilities at one location. Regional or other governments could select certain sites for the location of new industries. These sites should dispose of intermodal facilities in order to enable the companies located there to use intermodal transport for the transport of their products.

- *The use of innovative financing models*. As the budgets for infrastructure construction of governments are rather limited, the involvement of other, private parties would be welcome.

One of the possibilities for involving private-market parties in the financing of new infrastructure for (intermodal) transport is the public-private partnership (PPP), in which governmental bodies and privately owned companies cooperate and contribute to a faster realization of more and better infrastructure projects. In contrast to a traditional public tender, the PPP approach aims for a maximum utilization of the available knowledge, creativity, and efficiency of the market parties involved.

Public-private partnerships are based on three basic assumptions. First, the costs, as well as the power and risks, of developing new infrastructure have to be divided between the parties. Second, the project must have both social and commercial objectives. Third, the cooperation should not be free of obligations. A contractual commitment forces the parties to take the matter seriously and to put time and money into the project.

Earlier experiences in the United Kingdom (private finance initiative, or PFI) have proven that the PPP-concept does offer advantages to both governmental bodies and private investors. A higher efficiency and a so-called life-cycle approach (construction and operation) can offer savings up to 25 percent. Another benefit is the improved quality of projects caused by the contribution of experience and knowledge of private parties in projects, which used to be carried out exclusively by public authorities. However, although the cooperation and joint investments of public and private parties in a PPP do have their advantages, they should not be considered as a magic tool.

When PPPs are used for the realization of new infrastructure projects, the following considerations should be taken into account. First of all, most infrastructure projects are not cost-effective. No giant profits can be made through the construction and use of infrastructure. Both public authorities and private parties should bear this in mind. Another consideration is that because an infrastructure project can never be really profitable, public investments will always be necessary. The fact that the project as a whole probably is not profitable does not have to mean that private parties are not interested. Still, parts of the project can be lucrative, so a strict division of obligations and gains has to be made between the participating parties. Finally, the involvement of private parties can offer a solution to the budget problems facing governments.

What should a PPP look like when it comes to investments in infrastructure? There are two major conditions that have to be fulfilled. First, the infrastructure to be developed should generate a cash flow. This means that revenues should be generated, for instance, by imposing a levy on the use of the infrastructure or by collecting a toll. Second, a scope optimization should be aimed for. The development of the (nonprofitable) infrastructure should preferably be combined with lucrative projects or developments—for instance, with new industrial or logistics sites or other kinds of real-estate development.

Two possible PPP models for new infrastructure are the concession contract and the joint venture. The concession model is based on the assumption that the infrastructure to be realized is publicly put out for tender. Maintenance and operations, not just design and construction, need to also to be part of this tender procedure. The consortium of market parties,

cooperating in a so-called special-purpose company, offering the best price and highest quality wins the tender procedure and acquires the rights to carry out the work and operate the project for a certain period (for instance, 20 years). The costs and risks of developing the project are the responsibility of the market parties. Investments made in this phase of the project can be recovered during the operating period. This cash flow can be generated by levying a toll on the users of the newly constructed infrastructure or by collecting a reimbursement from the public authorities for the achievement made. In the concession model the government thus does not buy a product (infrastructure), but a service that is being offered by one or more market parties for a certain period (the availability of infrastructure of a high-quality level). The integration of design, construction, maintenance, and operations can provide considerable efficiency advantages, leading to lower investment and maintenance costs.

The joint venture model is based on a new company, to be established jointly by public and private parties. This model is to a large extent comparable with the special-purpose company, the main difference being the fact that the government has to invest risk-capital in the company. The parties involved are sharing costs and risks and pro rata decision power and revenues. In contrast to that of a concession, the lifetime of a PPP can be infinite. However, the joint venture can be constituted in such a way that the participating parties can sell their shares (for instance, after a certain period which they have agreed upon). If the public parties sell their share this could be called privatization. Just like in a concession model, the joint venture offers a horizontal integration of efficiency advantages.

To give an idea of the possibilities and limitations of PPP constructions for new intermodal infrastructure, some examples are listed below.

Rail Infrastructure

- The ownership of the infrastructure. When private parties cofinance the development of new infrastructure, the question arises as to how to deal with the future ownership of the infrastructure facilities. Up until now, most of the existing infrastructure is publicly owned, although there are exceptions (for instance, parts of the rail infrastructure in the United Kingdom and Germany). If private parties partly finance (parts of) the infrastructure, the possibility of an independent private infrastructure provider comes to mind.
- A contribution of users. As mentioned before, in order to generate revenues, contributions from infrastructure users have to collected, either via taxes or via the (electronic) levying of tolls.

Inland Waterways or Canals

- A contribution of users. The same applies here as for rail infrastructure; in order to generate revenues, contributions must be collected from infrastructure users, either via taxes or via electronic tolls.
- A possible combination with port and site development. In order to make the total infrastructure project more profitable, more lucrative developments could be added to the project. For instance the (re-)development of ports, harbors, or dock areas, as well as the development of logistics or industrial sites, could be added to the infrastructure project.

Terminals

- A possible combination with site development. The same applies here as mentioned above. To make the total infrastructure project more profitable, more lucrative developments could be added to the project. In the case of terminals, the development of logistics or industrial sites could be especially promising additions.
- The generation of cash flows. In the case of new terminal infrastructure, contributions from users can be taken care of in a "natural" way, namely by generating revenues from the terminal realized by a profitable exploitation.

Third-Party Logistics Providers in the European Union

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Introduction

Evolution of Third Party Logistics Service Providers

Third-party logistics (3PLs) can be defined as activities carried out by a logistics service provider on behalf of a shipper and consisting of at least management and execution of transportation and warehousing.[1] An increasing number of contracts now also include services like inventory management, information exchange, and tracking and tracing, as well as value-added activities, such as secondary assembly or even supply chain management.

The creation of the European Single Market and the Monetary Union of Europe have confronted companies with new challenges. Where most European companies were mainly focused on their domestic markets, they now have to cope with a pan-European environment. The result is that many multinational corporations are reconfiguring their logistics organization from decentralized to centralized production and distribution.

The growing competition in the European market forced many manufacturers and retailers to reduce costs by outsourcing noncore activities. A high demand for logistics providers who have the assets to act internationally and the competence to offer dedicated logistics services emerged.

Overview

Third-party logistics services are a growing market in Europe, as well as in the United States. It is expected that the 3PLs industry will grow by 19 percent annually for the next 5 years.[2] This market is already a billion dollar industry.

In 1997 the total market for contract logistics services in the United States had a turnover of $34.2 billion.[3] In Europe, US$31.6 billion are contracted out.[4]

Currently, 80 percent of transportation services in Europe and 70 percent in the

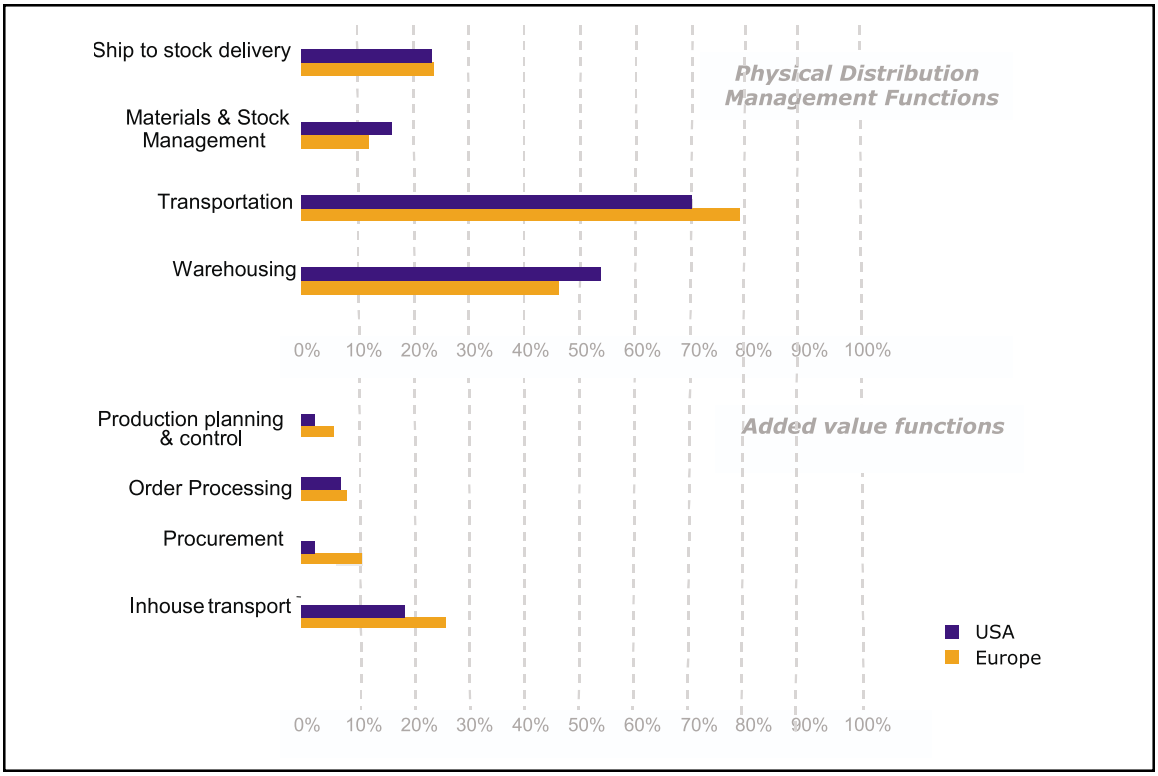


Figure 1. *Physical Distribution Management Functions*

US are outsourced, followed by warehousing (45 percent in Europe versus 53 percent in the US). The share of outsourced added-value functions, such as production planning and control or order processing, does not exceed 10 percent. Furthermore figures show that in comparison with western Europe, the value-added 3PLs market in the US is less developed. The rates of outsourced value-added services show striking differences (see Figure 1).

The decision to outsource is very often triggered by a discrete event. Nearly three-quarters of manufacturers indicate that outsourcing was a result of corporate restructuring, of a change in top management, or of a benchmarking exercise.[5] It is evident that the actual wave of mergers and acquisitions in many different sectors will enhance the demand for 3PLs services.

Despite the growing market share of 3PLs in the European market, several problems remain. Two of the most important ones are the following:

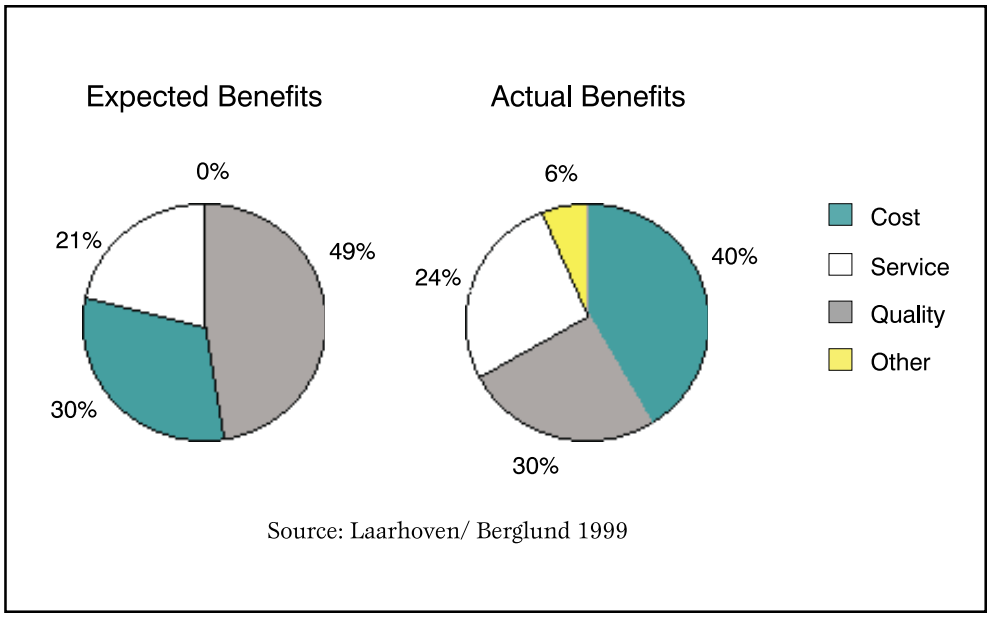
- Fifty-five percent of 3PLs partnerships fail within 5 years.[6] The driving force for shippers to outsource logistics activities is primarily cost reduction. In a recent study, 49 percent of the interviewees responded that they expected cost reductions, but only 40 percent achieved this aim. Breakups are the result. Shippers who decide to outsource logistics activities should take account of other benefits as well, such as service or quality improvements (see Figure 2).
- The start of a partnership is often characterized by concerns and reservations. Shippers fear a loss of control and lack trust in the service provider's competencies. Logistics managers especially feel threatened by the outsourcing process.

Despite these drawbacks, 3PLs are growing in importance, and many shippers consider that their aims are reached. More than 50 percent even called their relationship "highly successful."[7]

Development of 3PLs

At first, outsourcing was mainly limited to transportation and warehousing. At present, transportation is still the most important market segment of 3PLs, but the shares of outsourced added-value activities is increasing in all tiers of the logistics chain.[8] Concretely, 85 percent of European manufacturers have outsourced their external transport, and it is expected that this market segment will not grow much in the years to come, while that of value-added logistics will thrive.

To give some examples: 34 percent of European manufacturers have already outsourced transport organization, and an



Source: Laarhoven/ Berglund 1999

Figure 2. Expected and Actual Benefits in 1998.

overall increase of 6 percent is expected by 2005. The demand for packaging and labeling will grow to 24 percent from 20 percent, whereas logistics consulting shows an even higher potential. The latter indicates that in the future, 3PLs will overtake management and consulting functions rather than physical services such as transport (see Figure 3).

The European 3PLs Market

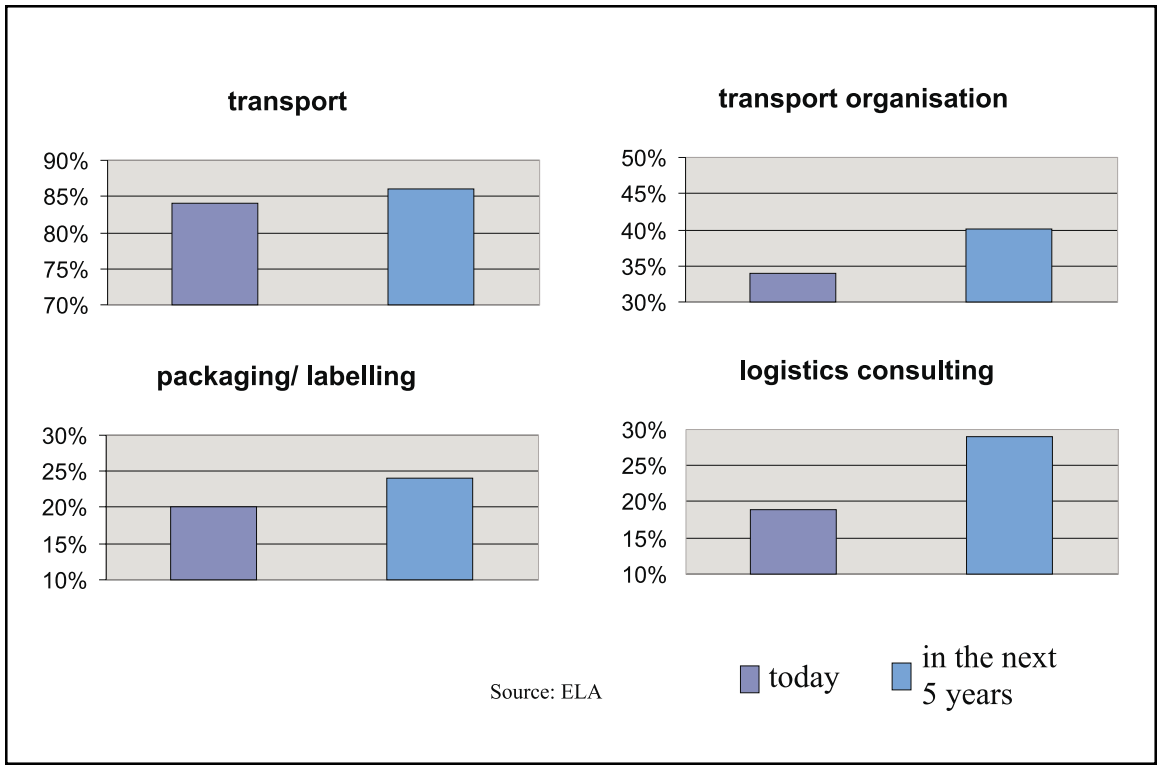
Recent Market Trends

The most striking characteristic of the European 3PLs market is the drive for mergers, acquisitions, and alliances. In the past decade, 50 different 3PLs companies have merged in 16 pan-European groups or alliances.

A good example is the Deutsche Post group,[9] which has acquired Danzas, Nedlloyd Transport, ASG, DHL, etc. Deutsche Post Group has already invested $10 billion in mergers and acquisitions and plans to expand further. With its new US subsidiaries, Global Mail and Yellow Stone, Deutsche Post has become an international player.

In the coming years, the competition in the European 3PLs market will be intensified by the entry of new service providers coming mainly from the information technology (IT) sector. Companies such as IBM or Microsoft have recognized the importance of the logistics and supply chain management markets and are developing powerful applications. Furthermore, national railway companies are also trying to offer a wider service array. Typical is the recent merger of the German DB Cargo and Dutch NS Cargo in Rail Cargo Europe to provide customized services that include value-added services, such as tracking and tracing. Express carriers are a third example of possible new entrants in the 3PLs market.

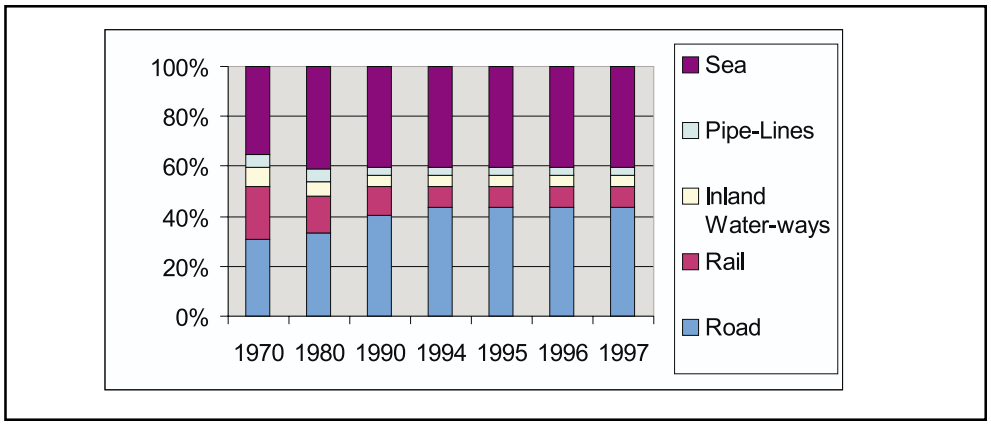
Further market segmentation is also expected to emerge. The market will be divided into dedicated 3PLs with customer-tailored solutions for smaller shippers or for one type of supply chain and big pan-Europan outfits with standardized services. The future of small and medium sized 3PLs is uncertain. The availability of value-added services and especially IT solutions will become determinant factors for success.



Source: ELA

Figure 3. Outsourcing Trends

Figure 4.
Modal Split for EU 15
Source: DG VII / Eurostat



European 3PLs and Transport Services

Looking at the transport split in Europe, the steady decline of rail freight is striking (from 21 percent in 1970 to 9 percent in 1997).The share of road transport increased from 30 percent in 1970 to 43 percent in 1997 (see Figure 4).

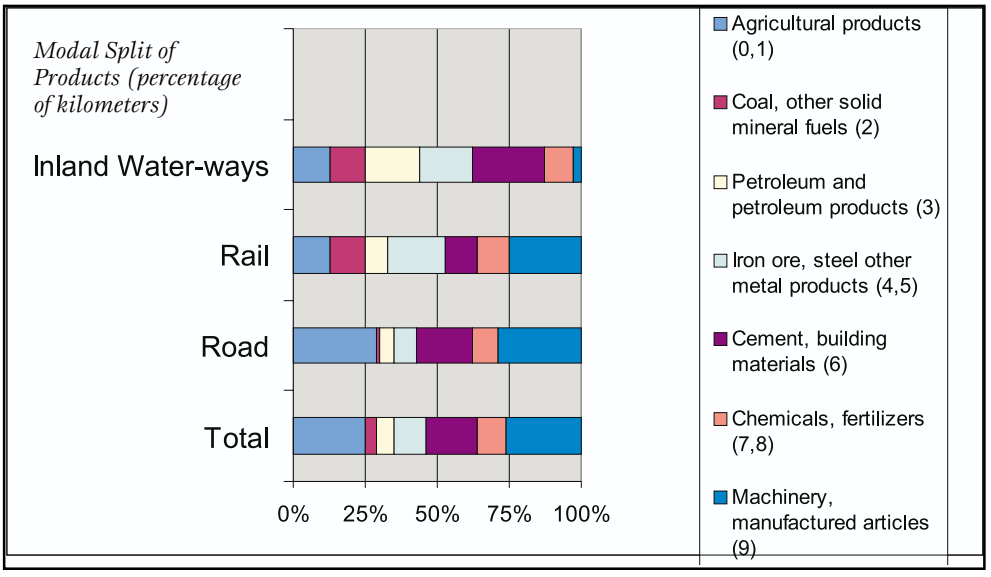
To understand this development, we have to take into consideration that by tradition rail is mainly used for bulk transport (see Figure 5). However, especially in the recent decades, the high value market has boomed, and rail was unable to capture a substantial part of this market segment.

Second, in Europe transport distances are low, and rail transport is only cost-effective for transport hauls longer than 400 km. More than 80 percent of the transport volume is moved on distances shorter than 150 km where rail transport, or intermodal transport in general, is not a cost-effective alternative (see Table 1).

Third, in the EU most railway companies are national monopolies, missing the required market incentives to innovate. In contrast, road transport was deregulated at an early stage, which resulted in fierce competition. In order to survive, trucking operators were obliged to produce inexpensive, efficient, and customer-tailored services.

Low profit margins were the reason that many of the big trucking operators started to look into new markets and ventured into the area of logistics services. As a result, many European 3PLs own road assets and have a road knowledge base. It is only re-

Figure 5.
Groups of Goods Transported by the Different Modes.
Source: DG VII / Eurostat



(NSTR classification groups in brackets)
**Data refer to EU 12, 1992 and 3 modes road, rail and inland waterways.*

Table 1.
Distances in National Transport.

Share of Transports (percentage)		
Km	tons	tkm
0-49	60	10
50-149	22	20
150-499	15	45
500-	3	25

Source: DG VII / Eurostat

cently that they have started to examine the area of freight intermodalism.

Polarization of European Logistics

In the EU 75 percent of international freight traffic is concentrated in about 200 main corridors. The rest is dispersed throughout several thousand smaller links.[10] In the past few years awareness has grown that nodes of logistics competence have developed along several of the high-density corridors. These nodes are particularly appealing for shippers looking for value-added services and for manufacturers aiming to outsource noncore activities. As a result, more cargo is attracted to these nodes, to the detriment of less-developed logistics corridors. This phenomenon has been coined logistics polarization. It is assumed that 3PLs have and are developing more rapidly in certain nodes along these corridors than in other parts of Europe.

A typical example is the different corridors originating in the Benelux countries. The Benelux countries are a favored location for centralized logistics in Europe. A great number of foreign manufacturers, such as 3M, Apple, Adidas-Salomon, Coca-Cola Company, Microsoft, Nike, Polaroid, The Gap, and Timberland, to name only a few, have built distribution centers in the Benelux countries to serve the European market (see Figure 6).

In addition, many manufacturers have outsourced their logistics. The emerging demand attracted many 3PLs, and the Benelux companies became a pool of logistics knowledge. The infrastructure is also well developed with good networks of road, rail, and inland waterways. However, not unlike the rest of the EU, the Benelux logistics industry is characterized by a high level of fragmentation. Very few companies have the knowledge and the assets to provide pan-European integrated supply chain solutions.

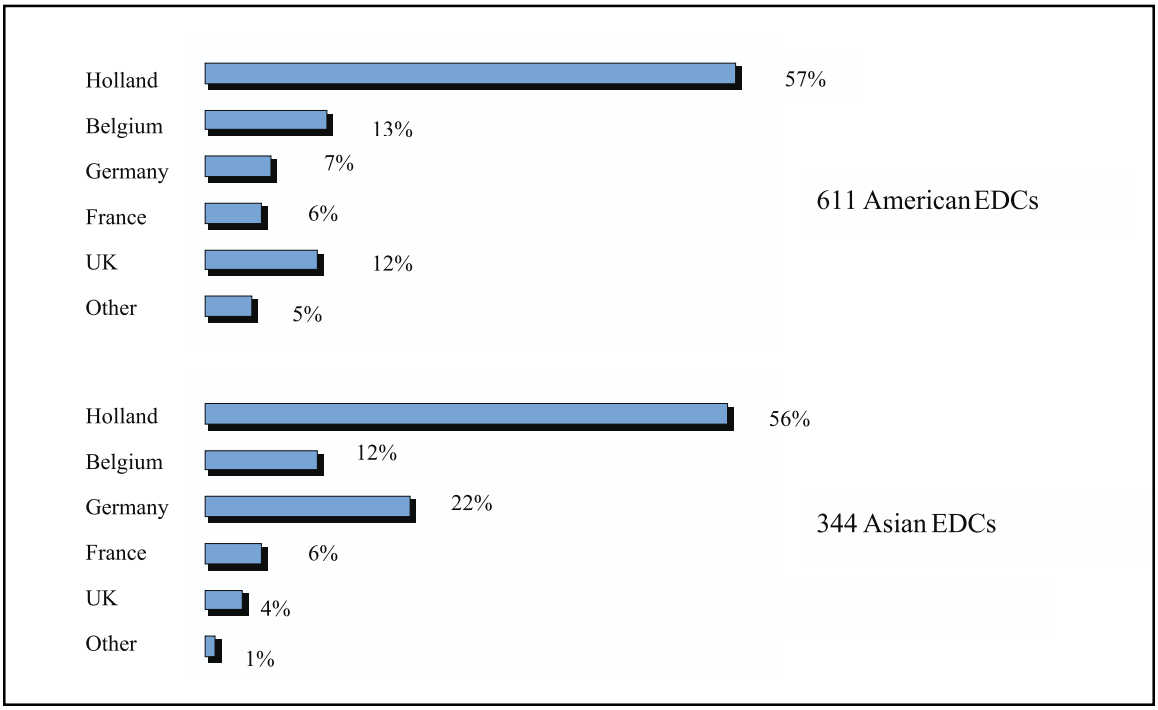


Figure 6. *Percentage Share of European Distribution Centers (EDCs) per Country. Source: BCI/ HIDC 1997*

Good examples of intermodal transport are to be found in the ports of Antwerp and Rotterdam. Several daily rail shuttles run between Antwerp or Rotterdam and France, Austria, Germany, Italy, Poland, Spain, etc. Barging has also acquired a substantial part of hinterland traffic (see Figure 7).

Brief Summary of Main Market Characteristics

In general, the European 3PLs market shows two striking characteristics:

- A trend towards value-added services
- The absence of pan-European 3PLs

In Europe, the 3PL market is still growing. Providers originally focusing on transportation and warehousing now offer services such as shipment consolidation and volume optimization, warehouse management, inventory, and even claims management. As a result, the 3PLs contracts have a longer time span and have become a matter requiring senior management involvement.

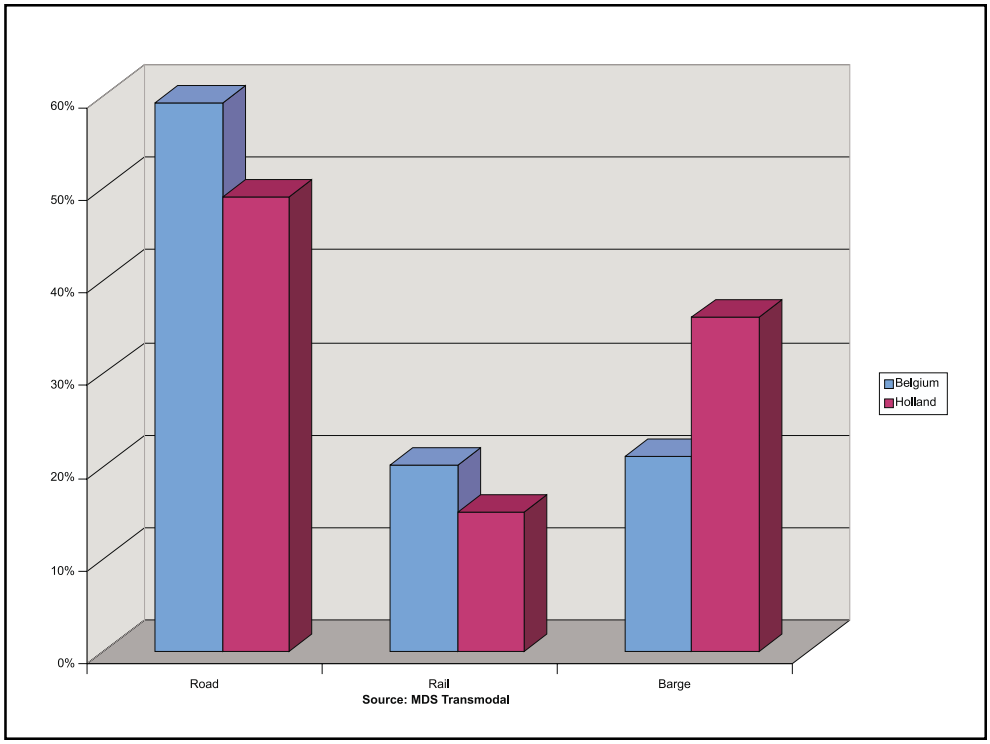
At the moment dedicated service providers dominate the market. But there is an obvious trend toward the big polyvalent 3PLs created by mergers and acquisitions. The result of this trend will probably be the development of true pan-European players and an enhanced market segmentation.

The Role of 3PLs in Transport

Fragmentation of the Transport Market

The transport market in Europe is highly fragmented. The major 3PLs have a market share of only 8.4 percent in 1997 (see Figure 8). In countries where logistics services and supply chain concepts are relatively new, the market is still dominated by small service providers that almost exclusively focus on transport and warehousing. Focusing on road transport, 444,000 haulage companies are active in the EU. Spain alone accounts for 133,000 companies, followed by Italy with 110,000, the United Kingdom with more than 39,000, and France with more than 35,000.

Figure 7. Port Hinterland Container Traffic in the Netherlands and Belgium.



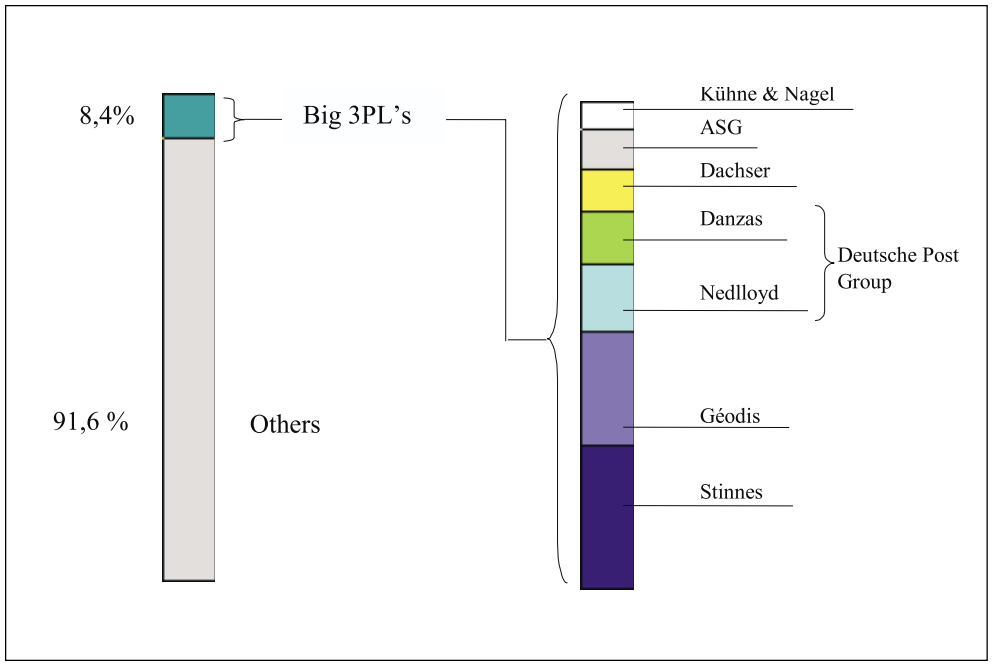


Figure 8. Land Transport in Europe

Revitalization of Rail

Most national rail companies have not yet adapted sufficiently to the changes of transport demand: they still focus on long-distance, low-value transportation. To overcome the poor quality of rail services, many 3PLs aim to run their own trains.

This in turn, puts pressure on railways to improve services. Developments in Germany are a perfect illustration. It is expected that in Germany intermodal freight volumes will hardly have increased by 2010. Instead of the 90 million tons aimed at by the government, the demand will not exceed 30 million tons.[11] Even the successful transalpine routes are hampered by insufficient rail reliability and capacity. At the moment, approximately 200,000 truck loads are transported across the Alps with road-rail-road combinations. The rolling motorway transports 100,000 truck loads.

Kombiverkehr, the German company specializing in road-rail intermodal transport, has announced the establishment of service stations to inform their customers about delays. They demand a higher level of competition on rail routes. Similar to other European 3PLs, they intend to run their own railway network. At the moment, Kombiverkehr is in the process of acquiring route rights.

DB Cargo (the subsidiary of German rail dealing with freight transport) still exerts a monopoly on certain routes. Nevertheless, under pressure of inter alia Kombiverkehr, DB Cargo has been obliged to take steps towards more "added value" services and a customer focus. In 2000, DB Cargo will launch a new service package for the chemical industry and plans to run special trains between different sites of the chemical industry. The service will provide for tracking and tracing and will be supported by an office specializing in the transportation of dangerous goods.

In July 1999, DB Cargo took over the European management of Shell Chemicals' rail fleet for solvents. By outsourcing management, Shell Chemicals hopes for a reduction of runs, a better loading factor, and thus a cost reduction. This move of DB Cargo is clearly reactive. They want to meet head-on the competition of 3PLs, as well as of shippers, such as BASF running its own trains between their plants in Ludwigshafen (Germany) and Antwerp (Belgium).

Recent developments show clearly that growing competition between 3PLs service providers will be the engine for intermodal transport development in Germany, as well as in the other EU countries.

3PLs in the 21st Century

The thrust for supply chain management will impact substantially on the 3PLs market. The holistic and cross-functional approach of supply chain management optimizes the use of transport resources. It provides also scope for a more environmental friendly freight transport system.[12]

Another innovation that will influence the transport sector and 3PLs study is e-commerce. Direct ordering will require full transport flexibility and an innovative approach. Opinions are divided on the effects of e-commerce on freight transport. In any case, supply chain management and e-commerce will force 3PLs service providers to a more enhanced customization.

Competence in information management will also become a critical success factor. This service will be provided by a new kind of logistics service companies, 4PLs. In essence, a 4PL provider is a supply chain integrator assembling and managing resources, capabilities, and technology of its own organization with those of complementary service providers to deliver a comprehensive supply chain solution.[13]

The 4PLs will help manufacturers to focus on core competencies, much more than is the case today. It is expected that they will be new entrants coming from sectors such as banking, consultancy, and information and communication technologies.

Endnotes

[1] Laarhoven, Berlund, 1999.

[2] Gerard Klauer Mattison & Co. Inc., 1999.

[3] Armstrong & Associates, "Who is Who in Logistics?" ,1997

[4] MarketLine,1997.

[5] Randall and Lieb, 1997

[6] New York-based Outsourcing Institute

[7] Van Laarhoven, Berglund, 1999.

[8] "Towards the 21st Century," Berlin, European Logistics Association (ELA), conducted by ZLU and TU, 1997.

[9] Turnover $8.9 billion.

[10] See also Spatial Patterns of Transportation, The Hague, 1997.

[11] Hacon Consultants.

[12] The European Commission (DGVII) is currently examining the environmental benefits of supply chain management in a study on the greening of supply chains (conducted by FAV, ZLU, TU Berlin).

[13] Bauknight, Bade 1999.

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Acronyms and Abbreviations

3PLs	third-party logistics
CAGR	compound annual growth rate
COFC	container on flatcar
e-commerce	electronic commerce (i.e., conducted over the Internet)
ECR	efficient consumer response
EDC	European distribution center
EDI	electronic data interchange
ERP	enterprise resource planning (software)
EU	European Union
GSM	Global System for Mobile Communications
ICT	information and communication technologies
IMC	intermodal marketing companies
ISA	intelligent software agents
ISO/TC104	International Organization for Standardization's Technical Committee 104 (Freight Containers)
NAFTA	North American Free Trade Agreement
PPP	public-private partnership
SCM	supply chain management
SITS	Simple Intermodal Tracking and Tracing
SME	small or medium sized enterprise
TEN	Transeuropean Transport Networks
TOFC	trailer on flatcar
UIC	International Union of Railways
WISDOM	Waterborne Information System, Distributed to Other Modes
XML	subset of SGML, designed for easy implementation in commercial and web environments