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Marilyn M. Helms

The University of Tennessee at Chattanooga

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JIT UTILIZATION: SHAPING THE FUTURE OF THE TRANSPORTATION INDUSTRY

by
Marilyn M. Helms,
The University of Tennessee at Chattanooga

Introduction

The transportation industry is making rapid changes to accommodate the Just-In-Time (JIT) quick response inventory practices that many of their customers are currently using or are implementing. These JIT production methods, made popular by the Japanese, are quite different than previous inventory and production methods.

Under JIT practices, parts and raw materials necessary to complete finished products are either produced or arrive at the assembly site just as they are needed within the production process. The system is designed to meet the precise demands of customers for various products with minimum delay and minimal inventories of raw materials, finished goods, and work in process. For JIT to operate successfully, several requirements must be met. All parts must be of a high quality with zero incoming defects. These parts must arrive where, when, and in the exact quantity needed. Also, the parts that are received must be of consistent quality, and finally, the finished product must be immediately shipped to the final consumer in order to minimize finished goods inventory and the associated holding cost.

If implemented properly, JIT can substantially increase product quality and reduce inventory, cycle time, scrap, lot sizes, floor space requirements, setup time, and down time for all JIT channel members including suppliers, manufacturers, wholesalers, and retailers. However, JIT involves more than just the changes on the factory floor. As lot sizes decrease, companies are demanding more frequent, consistent deliveries of a smaller quantity of raw materials. They also require finished products to be delivered to their customers as soon as possible. With the move toward minimizing all inventories, transportation companies are now seen as a major player in the JIT system. In the initial stages of JIT implementation, planning is less precise due to lack of data for accurate forecasting so companies still demand the more time-sensitive transportation and delivery modes. As the JIT system evolves and planning and forecasting control improves, companies begin to move to the less time-sensitive and less expensive modes of transportation.

The successful transportation companies of the future will have to expand their operations to better serve their JIT customers' changing transportation needs. Today's individual transportation segments will begin to merge together to form one-stop-shipping companies. The future of this industry will belong to these conglomerates that were once firms in a single transportation segment. These merged firms will encompass all modes of transportation including air, trucking, rail, and water delivery services.

From the shipper's locus of control and point of view, these full-service transportation companies will be a vast improvement over what is being offered today. Since the shippers will only have to deal with a single source for their transportation needs, they will no longer have to make the detailed arrangements for their many shipments with multiple transportation companies. From a competitive standpoint, these conglomerates will be providing more services and a more complete level of service; thus freeing up time and worry over shipment coordination for shippers. The sole responsibility will lie with

one transportation company to pick up all deliveries (packages, letters, boxes, cartons, containers, bulk cargo, etc.) and carry them to their final destination. The transportation supplier can combine multimodal transportation services to save the customer both time and money. This allows "peace of mind" for the shipper and will eliminate the need to have one transportation provider for air express needs, another for rail, another for truck deliveries and still another for water transportation needs.

From the transportation company's point of view, diversification will open new markets and should lead to increased transportation synergy within the firm. In addition to economies of scale, new economies of scope will provide an enhanced range of flexibility for the transportation conglomerate. This flexibility will allow the transportation provider to better serve the new market segments available with a wider range of services from a single firm. These new conglomerate firms will consist of all the delivery modes from overnight air express delivery to water transportation, as well as warehousing services, transportation and warehouse consultation, package tracking and a wide variety of other transportation-related services.

This paper will analyze this blueprint of the future transportation industry and analyze how the role of the transportation industry will change with respect to the changing needs of the JIT shipper. The paper will outline how the various modes of transportation, merged to form a one-stop-shipping company, will eventually become the industry standard, particularly if transportation companies want to sustain a competitive edge.

The Transportation Environment

The current shipping environment is strong for all the various industries providing transportation services. There has been growth in the air cargo and air express divisions as well as a significant rise in trucking volume and revenues. Operating revenues for rail traffic and water transportation is increasing with growing U.S. exports and imports from Japan, the Pacific Rim, and the European Community. Each of these transportation services and their progress toward concentric diversification will be discussed below.

Air Cargo and Air Express

The outlook for the air cargo and air express industry is promising because many national economies are expanding and there is an increased acceptance and desirability of air freight distribution methods. In addition, overnight and second-day air deliveries are becoming increasingly popular ("Shippers Choose Air...", 1989).

Deregulation in the late 1970's contributed to the high growth rate of air cargo capacity for several years, but today, though still remaining high, the number of carriers is decreasing. Continuing competition with a stable pricing environment has brought about air cargo consolidation. The consolidation and mergers between air express air cargo firms, like the one between Federal Express and Flying Tiger Lines, has formed additional marketing alliances between domestic and foreign carriers with new routes and services being created.

Competitors within the air cargo market are the all-cargo carriers, which includes specialists in the air express delivery of heavy shipments and passenger carriers which haul cargo in the belly of passenger aircrafts. For cargo services, profits are still smaller than those of passenger service, but they are rapidly increasing. The established carriers are showing strong growth and have succeeded not only in taking business away from the passenger carriers but also in generating new demand (U.S.

Industrial Outlook, 1991). The traditional airport-to-airport service offered by passenger carriers is giving way to the much more attractive door-to-door service offered by the all-cargo and air express carriers. In order to be more competitive in this market, passenger carriers have begun to engage in new pricing and advertising strategies in order to compete with the successful all-cargo carriers. While costs to shippers are lower from the all-cargo carriers, many prefer to pay more for the reliable door-to-door service air express firms provide.

Advances in freight handling and documentation procedures are also aiding the traditional air cargo carriers. Included in this market segment is the expedited small package carriers. However, the lines between the air cargo industry and the expedited small package industry are increasingly blurred as the package weight limits of the former letter and small package lines have been increased or even eliminated (Helms, 1989). For example, Federal Express has continued to raise their maximum weight limits for packages to compete with UPS. Now they have eliminated the weight limit entirely.

The air express sector owes much of its innovations to the Federal Express Corporation who made nationwide overnight deliveries possible through their utilization of a central super hub and smaller regional hubs. United Parcel Service (UPS) once only a surface delivery firm has also expanded and brought about competition in the air express market. Being the largest shipper of packages, UPS has beefed up its second-day air service, which was started in the mid 1970's, and in 1983 entered the next-day air market to compete directly with Federal Express. UPS has begun the expansion toward a multi-modal transportation company and is currently very successful as a bi-modal organization.

Both cargo and passenger carriers have expressed a strong interest and have even succeeded in expanding their services abroad. By the end of the 1990's, it is likely that four or five major carriers will have global networks, or transportation

conglomerates merged with computer tracking capabilities with an international market and focus. The removal of Europe's restrictions on trade in 1992 as well as German unification, other changes in Eastern Europe, and bi-lateral free trade agreements with Canada and Mexico will all offer potential for further international growth. Carriers, including Federal Express, UPS, and Emery have already established European hubs, and in the near future, hubs in the Asian and Pacific Rim market will be needed to serve this fast growing transportation customer segment.

Trucking

According to *Industry Surveys* (1989), the \$120-billion-a-year regulated interstate trucking industry is divided into private and for-hire freight haulers. The for-hire group is the fastest growing segment and consists of common and contract carriers. Today, almost 90 percent of the profits generated are in the truckload (TL) division which consists of full or entire truckloads of freights and which carries cargo of 10,000 pounds or more.

Since the 1980 deregulation of the motor carrier industry, the number of ICC regulated truckers has more than doubled from 18,000 to 45,000 carriers (*Industry Surveys*, 1990). This growth has contributed to the beginning of new, primarily nonunion truckload carriers. There is relative ease of entry in this segment in all 48 contiguous states because of the minimal amount of capital required to start and the easily obtainable operating authority. Small, nonunion TL entrants also have a lower cost structure and can therefore undercut the rates charged by larger carriers. To cover the rising costs of staying in business, TL lines are differentiating themselves by offering a growing variety of value-added customer services.

The TL market is highly fragmented and due to intense competition, the small carriers operate on small profit margins. Very few major truck lines have emerged. If viewed as a single entity, for example, Landstar System, which operates Ranger

Transportation and four smaller TL carriers, is the nation's largest truck line. J.B. Hunt takes credit for being the single largest TL carrier. Among others are Schneider National and North American Van Lines, which is a division of Norfolk Southern Railroad (*Industry Surveys*, 1990). It will be advantageous for TL carriers to merge with other transportation carriers. Rail or air express firms, for example, that have already made the capital outlay for tracking technology and other customer services, would be good partners for the TL carriers. Also, shippers' practice of limiting their business to a small group of core carriers will contribute to further mergers in the trucking industry. To differentiate their service, carriers are beginning to offer shipment pick-ups with 24 hours, on-time delivery guarantees, and warehousing services. Over the next decade the number of carriers should be cut in half. "Analysts agree that to survive the anticipated shakeout (in the trucking industry), TL carriers must be well capitalized and able to finance the expensive investment in computers and satellite communication systems that will soon be necessary to compete effectively" (*Industry Surveys*, 1989, p. R41).

Successful carriers must have satellite communication or electronic data interchange (EDI) capabilities to offer on-line shipment tracking and tracing services for their JIT customers. Shippers must know where a shipment is at all phases of the delivery process in order to track materials and expedite or de-expedite shipments as the production line demands. For shippers of time-sensitive freight (which includes anyone participating in JIT), a satellite link or EDI link can provide an early warning for potential delivery disruption. The presence of these services should capture market share at the expense of other firms which lack the package tracing capabilities.

Private carriers. Private carriers, yet another participant in the trucking industry, are carrying their own raw materials or finished goods. They account for 55 percent of all truck movements found among manufacturers, retailers, food companies, and utilities (*Industry Surveys*, 1990). Usually these

private fleets exist because firms demand more service than can be provided by independent freight carriers. In the future, as multimodal transportation services with advanced services capabilities emerge, the number of more expensive private freight carriers should decrease. This private service is limited because it only provides over-the-road delivery. Firms must still go outside the organization and purchase transportation services for other delivery modes.

Multi-modal transportation carriers can also provide a competitive edge over private trucking carriers through faster delivery times. Still other advantages are greater flexibility in scheduling, low cost and more reliable deliveries. Both are essential for manufacturers practicing JIT inventory control. The multi-modal transportation firm can specialize in all facets of transportation while allowing a service or manufacturing organization to concentrate on their core business without having to become transportation specialists. Firms can virtually eliminate their entire transportation departments and rely solely on the services of the multi-modal provider.

Contract-Carriers. Another growing trucking segments is contract carriage. In a contract carriage arrangement, trucking companies provide customized transportation distribution plans including everything from dispatching, maintenance, and billing, to regulatory filing. Most of the freight moved in this segment is TL but a growing portion of the freight is in less-than-truckload shipments. This reflects the practice of minimizing inventories through a JIT system and demanding and shipping smaller quantities. Contract carriers should continue to grow until the end of the 1990's when transportation conglomerates begin to offer these same services as well as other transportation-related services.

Less-Than-Truckload (LTL). The LTL segment has experienced an industry concentration or a contraction in the number of carriers in the past decade. Last year, the three largest companies, Yellow Freight, Consolidated Freightways, and

Roadway Express generated revenues equal to 40 percent of the LTL market. There are two reasons for increased concentration. The first of which is a steady stream of bankruptcies since deregulation, and secondly, the lack of new market entrants to replace firms that have failed. Due to the ease of entry and exit in this market, many firms have lacked the expertise and experience to be successful and profitable. Merger activity in the trucking industry today centers primarily on the fragmented regional market. The strategy seems to be to buy up small firms and create conglomerates (*Industry Surveys*, 1990).

Regional divisions using LTL shipping were ignored until it was recognized that these markets were growing faster than the long-haul businesses. An increasing percentage of this growth is due to manufacturers JIT practices. Although no figures currently exist on the percentage of businesses due to JIT practices, it is evident that more freight is being shipped shorter distances as suppliers are relocating near their major customers. Also shipments are smaller and more frequent as supplies must be brought to the companies on tighter time schedules. Companies are moving to sole sourcing of supplies and the supplier companies are moving their operations to locate near the major manufacturer. In the future, multi-modal carriers will be better able to offer LTL shipments since they will have size and scale advantages and can combine these smaller shipments, offering lower rates.

Rail Shipments

Traffic in the railroad industry is rising with the recent increase in industrial and foreign trade since the late 1980's. Though there are still challenges ahead for this ever-growing transportation segment, sixteen Class I railroads (defined as those with revenues exceeding \$91.5 million annually), are currently in operation, and of these only seven are major players (*U.S. Industrial Outlook*, 1991). Moving forward with innova-

tions in equipment, computerized tracking of freight and scheduling of trains, and market programs, the industry is directly challenging other transportation modes.

The ideas of stacking cars on piggyback and intermodal traffic, such as those with trucking, are emerging to offer different alternatives to ship cargo. Even though these increases in rail traffic are taking place, the industry still has concerns about profitability due to the increased competition between railroads and domestic motor carriers. Mergers between these two transportation providers could reduce or eliminate these concerns due to synergy and lessened competition.

Since deregulation rail services are becoming more flexible and, due to competition, there are increased incentives to improve efficiency, compete more aggressively, and restructure rates and methods of operations. Safety records have also improved along with the financial situation and the physical conditions of the industry. All of this has been done without sharp rate increases, but the real test for this industry is earning adequate profits. Shippers are striving to reduce total transportation costs. Conglomerates can help shippers to meet this goal by reducing shipping distances, transit time, and inventory holdings (Industry Surveys, 1991).

The regulatory environment of the railroads, as it relates to pricing, service, and financial structure, has been shaped by the Staggers Rail Act of 1980. Through this act, industry flexibility has increased so that carriers could compete more aggressively for traffic. Railroads have also become more sensitive to shippers' demands by adjusting their own operations and capital plans to reduce cost and redirect expenditures to maintenance and service. The restructuring of the railroad industry is still continuing. "Others agree that although the pace of mergers between major railroads has slowed, restructuring continues through the purchase or transfer of smaller portions

of rail systems and acquisitions of, or coordination with, carriers in such other modes as trucking and barge transportation" (U.S. Industrial Outlook, 1989, p.52-12).

Since 1979, there have been several major rail consolidations, and in 1984, the first major rail-barge merger occurred between CSX Corporation and American Commercial Lines, a subsidiary of American Commercial Barge Lines. In 1985, Norfolk Southern Railroad, which was the merger of Norfolk, Western, and Southern railroads, acquired North American Van Lines, Inc., a household goods and general freight trucking company. In 1987, Union Pacific Corporation's acquisition of Overnite Transportation Company (a trucking firm) was approved by the Interstate Commerce Commission (U.S. Industrial Outlook, 1991).

Union Pacific reported improvements in operating income net income, and earnings in rail operations due to an increase in carloadings. Major gains were in intermodal traffic. Union Pacific Corporation is continuing its emphasis on cost cutting and productivity improvements ("Income Stronger at Union Pacific, 1990").

Rail intermodal volume is growing. Intermodal transportation contributed 14 percent of Burlington Northern's revenues in 1989 and they are continuing to combine highway trailer and rail shipment movement. Another rail company, Kansas City Southern Lines, has invested in facilities and equipment to advance the efficient rail movement of shipments. Their container/trailer system can transport products by rail, air, sea, or highway combinations. CSX rail, with Sea-Land Logistics, is designing and providing customized multimodal, integrated transportation packages as well.

The primary source of rail traffic traditionally has been from bulk commodities. Barge carriers have been the major competitors of railroads for these bulk shipments. However, as JIT experience and forecasting improves, rail transportation will become a more viable transportation alternative for other shipments too.

Water Shipments

The U.S. Water Transportation industry consists of International sea and domestic transportation (including passenger ship), Great Lakes - St. Lawrence Seaway Carriage, Inland Waterway Movements, and Local Waterborne Cargo Shipments (U.S. Industrial Outlook, 1989). Deep Sea and domestic water transportation includes general cargo, dry bulk, and liquid bulk. General cargo operations include the movement of finished goods by regularly scheduled liner-type vessels operating as common carriers. Liquid cargos are handled by tankers and tank barge fleets and are transported as contract or proprietary shipments. While water carriage is not a primary mode of transportation for the beginning JIT shipper, customers that have moved along the JIT experience curve can begin to use less time-sensitive delivery services like water transportation. This long-term movement to slower and more reasonable transportation forms will benefit both shippers and final customers as evidenced by reduced shipping costs and price savings.

The future of foreign water transportation also depends on continued growth of U.S. exports. International expansion and the expected growth of exports will mean profitable growth for deep sea operations. For example, Miller Transporters Inc. a bulk tank carrier with 30 U.S. terminals recently formed a partnership with Wim Vos, a tank container operator based in Holland. The joint venture gives customers of both firms the capacity to ship products in bulk tanks anywhere in the world. Ocean transportation is provided by the parent company of Wim Vos and the company has depots in the United Kingdom,

the Netherlands, Sweden, Denmark, Spain, France, Germany, and Italy. Their JIT customers include food manufacturers and soap companies as well as chemical manufacturers. Miller felt their customers would be shipping more products overseas so they established the relation with this European Firm (White, 1990). Another intermodal container firm, American President Companies Ltd., provides distribution and transportation services within and between Asia and North America through an organizational structure that combines ocean, rail, and truck transportation ("American President...", 1990).

It is assumed that as companies continue to expand internationally and export products abroad, domestic water shipping operations will become a more important source of freight movement. In addition, as JIT penetration increases, JIT planning and forecasting improves, and as organizations locate on inland waterways and port cities to take advantage of the reduced transportation costs, water shipping will increase. As delivery time needs become subordinated, the primary factor influencing the JIT customer's choice of transportation carrier will be price.

Conduct Within Transportation Industry

The economic markets in today's environment are blurring and a worldwide global economy is emerging. Many businesses are in the process of changing to an international industry structure. At the same time, many of these companies are moving to a JIT inventory system to eliminate inventory holding costs and streamline their production and service operations. While no exact figures exist on the number of firms using JIT inventory control procedures the growth of the current literature on JIT and its related partner of total quality management (TQM) suggest its pervasive popularity. JIT is changing the mode of transportation service that the industries have traditionally used as well as their internal transportation practices.

In terms of logistics, no longer do traffic managers want to deal with ten or twelve different transportation firms to send a variety of shipments domestically and internationally; they are demanding to deal with fewer and fewer transportation parties (just like they do with their own JIT suppliers) with the ultimate goal of working with only one, fully-integrated, multi-modal transportation provider. The shipping customer's demand for one-stop-shipping is rapidly changing the transportation industry by having all shipments move from one door (manufacturer) to another door (destination) by one party, perhaps over a variety of transportation modes. To accommodate the changing market, many transportation companies are growing and adapting to meet these needs.

Some transportation providers are moving toward the multi-modal industry structure already. For example, United Parcel Service (UPS) began with an extensive ground fleet, and augmented ground delivery by expanding their air fleet to meet the company's needs. They currently service every address in the United States and Puerto Rico and more than 100 foreign countries in which they operate in the door-to-door freight market.

Federal Express increased their market penetration with the purchase of Flying Tiger Lines, an international air carrier with bulk shipment capabilities. This purchase provided Federal Express with a larger market share while simultaneously giving them additional international routes. In the trucking arena, Consolidate Freightways Inc. purchased Emery Air Freight Corporation to expand their services to air delivery and to provide customers additional transportation choices. In another example, Santa Fe Railway and J.B. Hunt Transport Services recently established intermodal freight transportation with Santa Fe providing the line-haul service and J.B. Hunt coordinating shipment pickup and delivery (Bowersox, 1990). While these mergers have not yet resulted in profits, these strategic alliances have growth potential to be profitable in the future.

As can be seen by these mergers, the transportation industry is beginning the consolidation needed to form the transportation conglomerates. Another way JIT is changing the transportation industry is in the frequency and size of shipments. With continuing adaptations, transportation carriers can become one-stop-shipping companies for both small and large shipment quantities. In a recent study by Lieb and Miller (1988), the biggest transportation beneficiary of JIT was the contract truck carrier because their schedules were tailored to the customers' needs. Air transportation also increased considerably in both inbound and outbound operations due to the implementation of the JIT system. The experiences of large corporations including Northern Telecom Canada Ltd., Chrysler Corp. and Kodak Inc. show that judicious use of air freight can lead to significant distribution benefits even though air transport is a premium service, the demand for emergency service often occurs with little advance notice. The pressures of JIT manufacturing are intense and in some cases parts must be flown to the assembly line to keep the line running. Airfreight has always been the preferred mode for handling JIT emergencies. It also can offer enhanced customer service (Tausz, 1989), and it is this value-added service of time utility that is the basis for the profit of the airfreight segment of the transportation industry.

These air and trucking modes are utilized more heavily in the introduction stage of JIT, but it would naturally follow that as firms move along the JIT learning and experience curve they should move to slower and more inexpensive modes of transportation as their ability to forecast demand and schedule production flows improve (See Figure 1). Emergencies should be less frequent and coordination should improve thus eliminating the need for relying solely on the more expensive and more time-critical shipment modes.

When JIT customers were asked about carrier selection and what factors were important to them, their responses included on-time performance along with responsiveness to short-term

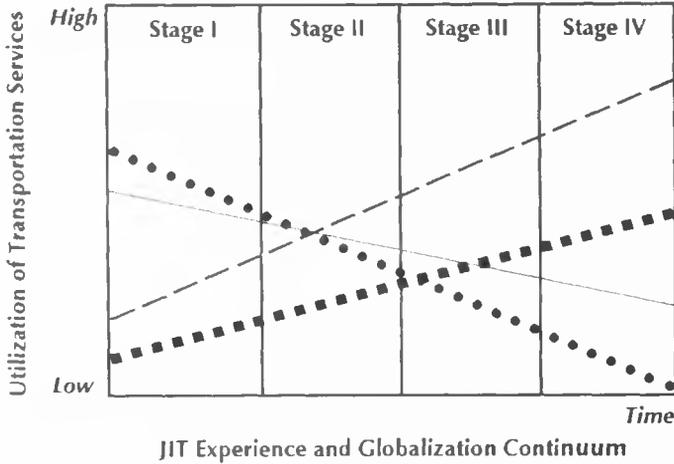
needs. Both of these characteristics are very important to the JIT system. Other important factors were tracking capability, which will become more important as schedules become tighter and tighter (Lieb and Miller, 1988.)

Another change occurring in the transportation industry is in customer service. Many carriers are no longer playing pricing games to get a short-term contract but just like JIT principles, they are establishing long-term relationships with their domestic and international customers. An example of this can be seen in the relationship between GM and Robin Transport. Robin holds a three-year contract that covers 15 loads each day. Robin did not receive the GM contract on price alone, but sold them on all aspects of their delivery system including equipment, on-time delivery, and flexibility. The long-term contract helps the transportation firm and their customers to better plan for the future and allows the transportation company the time and scheduling flexibility (due to the security of the long-term relationship and level of communication) to provide better service. Another company benefiting from long term relationships is Roadway Express. With long-term, secure contracts Roadway has purchased almost two thousand new trailers and has begun calling itself "America's just-in-time-carrier" ("Transportation Changes..." 1984). Roadway adopted this marketing strategy for differentiation as well as for targeting the needs of the growing number of JIT customers.

The transportation industry is combining various modes to better serve their international customers as well. One example is the assembly of the Cadillac Allante, an expensive (\$50,000+) two-seat sports car designed by Cadillac to compete directly with BMW and Mercedes Benz. The chassis is built in Detroit and flown to Italy in specially designed Boeing 747F jet freighters. In Italy, the bodies are assembled with the chassis for a perfect fit, and then they are flown back to Detroit for final assembly. The merger of global assembly and air freight sounds

Figure 1

The JIT/Transportation Stages And Usage Level



air ● ● ● ● ●
 truck — — — — —
 rail - - - - -
 barge ■ ■ ■ ■ ■

<u>Stage I*</u>	<u>Stage II</u>	<u>Stage III</u>	<u>Stage IV</u>
air	truck	truck	rail
truck	air	rail	barge
rail	rail	air	truck
barge	barge	barge	air

*Carriers are listed in order of their usage at each stage, from highest to lowest usage

somewhat less than practical for automobile production, but, when the reduction in transportation time, theft, and damage are taken into account, this operation becomes feasible. It also saves time and money, and the cars can be tailored by experts in each stage of the JIT operation (Kaufman, 1989). Operations such as this are becoming more commonplace in today's transportation industry as it adapts to the new JIT-induced trends.

According to Bowersox (1990), these examples illustrate logistics alliances. These alliances are becoming more prevalent as manufacturers and transportation firms combine to lower distribution and storage costs and at the same time improve the quality of service.

Electronic-Data-Interchange(EDI)

The transportation industry is also changing by adopting advanced computerized electronic data interchange. EDI allows transportation shippers to perform a myriad of services including electronic billing, calculation of rate charges, scheduling pickup and delivery, tracing shipments, and creating customized databases using a customer's traffic history. The catalysts for EDI growth are high interest rates, (which speed the adoption of the JIT inventory system) and the sharp drop in computer costs (which puts personal computers on almost every business desk). Shippers practicing JIT inventory control techniques demand EDI for timely and accurate information about the status of their shipments. The benefits for shippers and carriers who use EDI are: (1) reduced clerical costs, (2) less paper handling, (3) faster transaction processing time, and (4) fewer mistakes (*Industry Surveys*, 1991).

American Airlines (AMR Corporation) is testing their own fully automated, bar-coded tracking system for their air cargo. The system will enable American to track each air cargo

shipment as well as to simplify operations. Through their AMR Information Services American Airlines has created a computerized reservation system for Europe's railroads, working with the French National Railway System to coordinate and schedule international shipments.

United Parcel Service (UPS) has implemented internal computer systems integrated into their shipping business. They have replaced the microcomputer with local area networks to reduce clerical time and to help UPS keep track of packages more economically (Eskow, 1989).

At Federal Express, EDI is used in all aspects of the business. When a courier picks up a package it is scanned and automatically put into the beginning of the system. As the package travels from point to point, it is scanned to allow continuous tracking. If any information is needed about the package, it can be retrieved and analyzed. This helps Federal Express experts to see if they have any steps in their operations that could be corrected to better serve the customer. In addition, their EDI can be accessed by their customers at any time.

Roadway Package System (RPS) offers customers scanning technologies. With their automated hubs, they offer the customers less package handling, more efficient distribution, and the elimination of sorting errors. Technology has also allowed RPS to offer a wide range of services with package tracing and itemized billing, specialized pricing programs, voice encoding, and image processing.

Roadway Express trucking company has a personal-computer software system to allow customers to create and print bills of lading and express documents directly to a Roadway terminal. With their system they can also receive shipment status information, manifests, claims, and communicate via computer with the customer.

Consolidated Rail Corporation has merged all their customer service functions into a single corporate unit. This has added simplified pricing and billing systems and has added the capability for the electronic filing of rates. Customers can access this information from their remote computer terminals.

As more participants in the transportation industry continue to use EDI and computer tracking, additional customer services can be offered. Another service that will become available is inventory and transportation consultation.

Consulting Services

With the use of portable personal computers, a transportation sales specialist in carrier sales can quickly show a customer a variety of transportation shipment scenarios and the current rates for each alternative transportation mode. When the customer places an order, it can be sent by telephone and automatically entered. All of the shipment instructions will automatically be sent to the proper locations and a hard copy can be printed for the customer immediately. The salesperson can also track existing shipments if customers have questions about a current shipment location. This consulting service is even more advantageous to the shipper if the transportation company has multiple modes under one umbrella. They can simulate numerous combinations of rail, water, truck and air delivery to determine the optimal balance that best meets the customer's specific needs.

Transportation conglomerates have added these consulting services to expand their range of customer service offerings. Burlington Northern Inc. railroad view transportation services as an extension of their customer's businesses and have developed a software package that enables customers to evaluate all relevant logistical factors and costs when selecting among the various transportation options.

Federal Express established a corporate division to address the custom logistics needs of customers, giving Federal Express the opportunity to assume primary responsibility for the customer's inventory management needs. As more firms in the transportation industry move toward the conglomerate organization structure, the consulting services will be a vital department. JIT customers are requesting help coordinating and scheduling all their transportation needs. Proactive transportation providers will address these consulting needs.

Warehousing

Another trend in the transportation industry is the use of third party distribution. This service is rapidly gaining acceptance, especially in the manufacturing environment as customers demand dedicated and consolidated distribution operations. One firm implementing this distribution system is Federal Express. Their "Parts Bank" combines a storage facility with an expedited-delivery system that can dispatch medical equipment, electronic components, and other critical parts to users around the country on the next available plane (Quinn, 1985). All storage, warehousing, and insurance concerns are handled by Federal Express.

To capture business that combined rail, warehousing and truck delivery, CSX railroad has begun a network of bulk intermodal distribution centers and has formed Total Distribution Services Inc. Shipments are transferred by rail to the distribution centers and are stored and scheduled for local or just in time delivery by truck.

Many manufacturers are using similar warehousing services instead of setting up and maintaining their own multiple regional warehouses. The warehousing services keep their customers' equipment and products in working order because the immediate shipment of a part can minimize machine and

production downtime and save everyone both time and money. Warehouse services are growing as U.S. companies reevaluate how they maintain inventories and move their materials. To meet JIT inventory needs, more companies will eliminate their own warehouses and purchase warehouse inventory systems as well as their transportation services from outside in order to better maintain their production schedules. Firms who are considering exporting their goods or who want to rapidly enter the global market will also consider using warehousing services.

Leaseway, a \$1.4 billion transportation company has "assembled a group of services targeted at manufacturers ranging from public warehousing, sub-assembly of finished goods and consolidation of shipments of warehouse management systems and, of course, distribution of goods. Since its conception, Leaseway has established 30 distribution and consolidation centers throughout the country and serves more than 150 clients, many major manufacturers" (Davisson, 1986, p. 69). These examples have been possible due to the deregulation of the trucking and airline industries and lessening of anti-trust lawsuits, and both have capitalized on the JIT environment. Other transportation firms should add warehousing services as they make the commitment to developing and providing totally integrated distribution systems.

JIT and the Transportation Industry

The primary reason transportation companies must merge to combine the various forms of service is due to the JIT experience continuum. As shown in Figure 1, firms implementing JIT procedures are less experienced with the production and inventory control concepts. Therefore, they experience more problems that demand expedited shipment. Planning, forecasting, and demand levels are not as accurate, causing firms to primarily use air express services and time-sensitive truck delivery. There is very limited rail and barge use at this initial level of JIT experience. Truck delivery replaces air

shipments as firms better plan lead times and schedule production runs. In the mature stages of JIT, fewer and fewer production changes occur and there are minimal scheduling problems. Lead times expand from several days to several weeks or more. Usually at these JIT stages, companies have added international operations and can rely on the less expensive forms of rail and barge transportation. Throughout the various levels however, on-line tracking services as well as consulting services remain important.

Transportation firms, like the customers they serve, must become just-in-time shippers in order to remain competitive. The improvements brought about by JIT will benefit all firms adopting the improvement principles. As customer needs change, the transportation companies must have all transportation modes and services at their disposal. As shippers demand full-service transportation providers, the providers must have these services available. Thus JIT is the stimulus behind the changing future of the transportation industry.

Industry Performance

The goal of all the emerging multi-modal carriers is to provide shippers with high-quality, flexible transportation services over one mode or over several transportation modes. By combining transportation forms synergy in profitability, performance, and service is possible.

One company on the leading edge of multi-modal transportation is CSX Corporation. Based in Richmond, Va., CSX is an international, multimodal transportation company with interests in rail, ocean container shipping, intermodal, trucking, warehousing and distribution. They have the largest railroad in the United States (as measured by operating revenue and track-miles), a container-shipping company, and an inland barge line. In the 1990's CSX's business plans call for continued emphasis on improving profitability by controlling costs, particular in rail

and ocean shipping, while expanding services in key growth markets for rail, container shipping, barging, intermodal and other transportation related activities. Since 1985, their revenues have grown from \$5.3 billion to over \$7.7 billion, and CSX executives see room for continued expansion. The only area that CSX has not yet ventured into is the air express segment of the transportation industry (CSX Annual Report, 1989). Similar performance levels are possible for other multi-modal transportation providers.

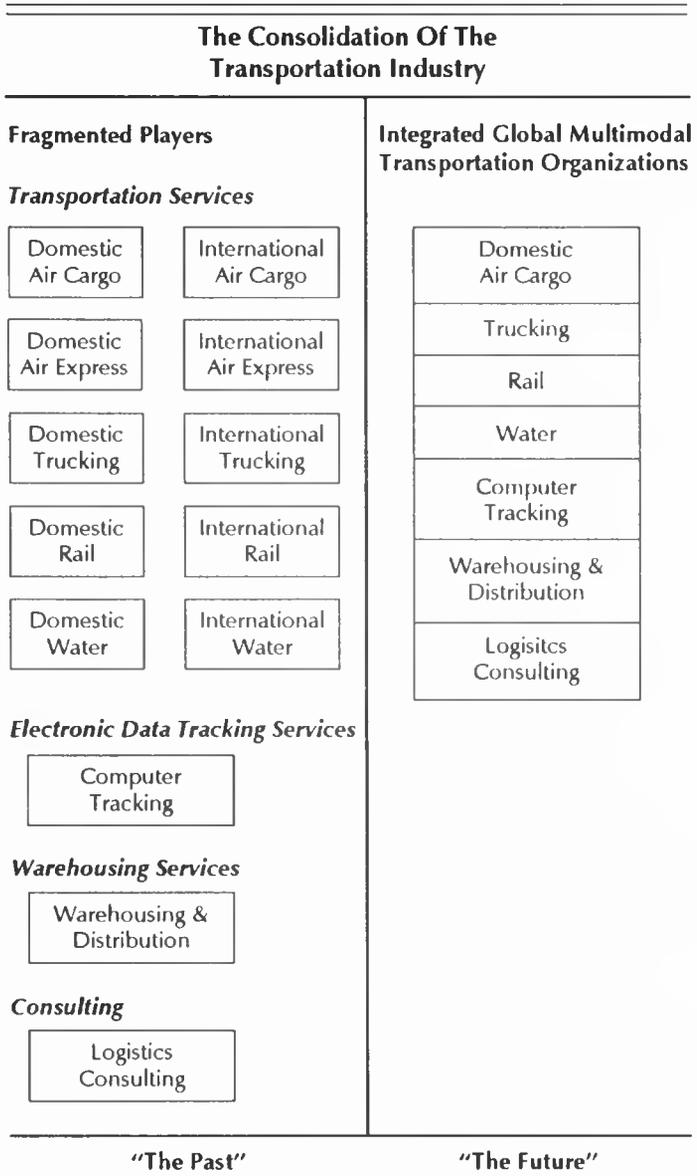
Multi-Modal Transportation: The Future

Since the deregulation of the 1980's, the largely artificial boundaries among transportation modes (LTL, TL, air freight, railroads, and barges) have been vanishing. Without the arbitrary restrictions imposed by regulatory systems, the market is becoming less specialized and as shown in Figure 2, additional transportation services are merging.

Many examples in the transportation industry signal this movement. For example, UPS ground package delivery has added air express services and tracking to the services they offer. Federal Express has moved from air transportation of small packages to the international air cargo market with their purchase of Flying Tiger Lines and has added tracking, consulting, and warehousing services. CSX Corporation has rail, barge, and surface modes under one company. CF trucking has combined with Emery Air Freight and gained air and international markets. Two railroads now have merged with trucking firms to gain synergy in piggy-back services--Union Pacific Railroad is now combined with overnight trucking and Norfolk Southern Railroads is part of North American Van Lines Trucking and the list of multi-modal examples continues to increase.

In fact, largely as a result of just-in-time inventory, transportation customers are increasingly oriented toward a total, integrated logistics operation (including inventory management, handling, and warehousing) rather than simply purchasing transportation services alone. Regulatory rigidities once obstructed the provision of reliable, fine-tuned, custom-tailored transport service. Today these multi-modal, enhanced combinations are both feasible and necessary. In the recent future the transportation industry should see these changes rapidly increase due to the increasing customer emphasis on JIT. Successful transportation companies will be the ones that have the ability to meet their customer's one-stop JIT shipping needs.

Figure 2



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