

Freight Carriers

From Modal Fragmentation to Coordinated Logistics ¹

■ Executive Summary

Over the last few years, as shippers and carriers have sought to wring-out even more cost from the logistics process, a new concept has emerged in the marketplace: coordinated logistics. Coordinated logistics is the integration of distinct logistics activities, such as cross-modal coordination or the bundling of transportation and inventory control. The emergence of coordinated logistics is being driven by the growth in global trade and the rapid evolution of information technologies that permit service providers to assemble information and coordinate products that cross traditional modal and functional boundaries. Through this “bridging”, carriers are seeking to combine the inherent advantages of each mode or submode, in a coordinated logistics system, with superior efficiency and effectiveness for shippers. This trend has spawned a new type service provider, one that offers “mode-neutral” products.

Transportation providers have traditionally been organized along modal lines, with shipment size, product handling characteristics, and service quality giving birth to numerous submodes. But the rapid expansion of global and “hemispheric” (such as NAFTA) trade and rising shipper expectations have forced many carriers to abandon single-mode product offerings, and develop mode-neutral service products. The mode-neutral product is a clear attempt to exploit cross-modal advantages with coordinated logistics. The implication is that by offering the shipper a selection of time-definite services, the carrier becomes more productive.

Most carriers are reluctantly embracing coordinated logistics: non-asset providers use it as a way to improve revenue quality while maintaining low asset contribution, while asset-based carriers use it to improve utilization and network efficiency by adding density. Coordinated logistics also offers carriers a method of increasing “switching” costs to shippers, and thus improving carrier market leverage. The adoption of coordinated logistics also fundamentally changes the competitive unit from the truck or container to the “network.” It is expected that intermodal alliances of service providers will lead to the formation of international “logistics networks”, providing a broad array of services to multinational shippers.

¹ This working paper was prepared by Reebie Associates, Inc., and Cambridge Systematics, Inc., members of the Battelle Team providing research and analysis support to the Federal Highway Administration Office of Freight Management and Operations. It is one in a series of working papers providing initial analysis and discussion of the trends and issues affecting freight transportation productivity in the United States and North America. The series is available at <http://www.ops.fhwa.dot.gov/freight/adfrmwrk/index.htm>. The working papers were prepared under contract DTFH61-97-C-00010, BAT-99-020. The opinions expressed in the working papers are those of the authors, not the Federal Highway Administration. The working papers are being circulated to generate discussion about emerging freight issues and may be updated in response to feedback from public and private sector stakeholders.

Pressures on both the shipper and carrier side continue to encourage cross-modal coordination, but many challenges remain. Whereas shippers see the opportunity for better and more cost-effective service products, carriers see the high cost of information systems necessary to manage a coordinated product. But while shippers favor coordination, the present reality is that carriers are not inclined or prepared to insure product reliability across multiple operations and participants. The implications for infrastructure are uncertain. Will carrier “networks” emerge, leveraging proprietary assets to build density, or will niche providers prevent the formation of intractable alliances? There is no certainty yet.

■ Introduction

Less than thirty years ago, “logistics management” was an emerging concept that advocated a holistic approach to designing physical supply and distribution programs. Shippers, it was reasoned, could improve the efficiency and effectiveness of their networks by making internal trade-offs between faster and more reliable transportation alternatives and lower inventory levels. Over the last few years, as shippers and carriers have sought to wring-out even more cost from the logistics process, a new concept has emerged – coordinated logistics.

Coordinated logistics is the integration of disparate logistics activities, such as cross-modal coordination or the bundling of transportation and inventory control. It appears to have evolved as a result of heightened shippers’ service expectations, market pressures that have kept freight rates depressed, and the desire to improve in-transit product visibility. The enabling factor for the emergence of coordinated logistics is the rapid evolution of information technology that allows carriers to support the bridging modal boundaries. Through bridging, carriers are combining the inherent advantages of each mode or submode, in a coordinated logistics system, with superior efficiency and effectiveness for shippers.

To some extent, coordinated logistics is not a new strategy; freight carriers have sought to integrate between modes and submodes, and third parties have arranged “serial” transport for decades. What is new is the capability – through advanced information systems and the Internet – to make material improvements in coordinating service, minimizing cost, and improving in-transit visibility. This is now true whether the transport provider owns all elements of the product or not. Carriers adopting this strategy are describing their products as mode-neutral. Such carriers are able to offer varying levels of speed, capacity, commitment and on-time precision, while managing diverse and even changeable delivery modes. Though identified initially as the convergence of modes and submodes, this trend is really the advancing front of change in the organization of transport providers. As successful organizational forms are worked out, carriers have acquired some of the characteristics of third parties. Meanwhile, reacting to the need for scope, scale, and size in a market measured by competitive networks, the transport provider organizations themselves are pursuing growth, alliance, and consolidation.

The theme of cross-modal logistics coordination is explored in this paper, first by considering the market and competitive forces at play, then by looking at the trend itself,

and finally by examining product development and the reorganization of transport providers in this new environment. This paper will outline the trends shaping the development of cross modal operations, the issues associated with cross modal operations, and the implications of cross modal operations upon both carriers and their associated modal infrastructure.²

■ Trends toward Cross Modal Operation

Freight carriers traditionally have organized along modal lines, with shipment size, product handling characteristics, and service quality giving birth to numerous submodes. In several areas, these historical boundaries are crumbling. The pressures on service and cost performance imposed by modern neurologistics systems are described in another paper in this series, “Business Logistics: From Push to Pull Logistics”. The first consequence of these pressures is that carriers are driven to the limits of their modal technology, and cross into other modes in search of better performance. The second consequence is that shippers will not be satisfied with a cross-modal service unless its coordination is seamless. The transportation products that are arising in this market are mode-neutral, in the sense that the shipper is unconcerned with the manner of operation. Instead, the shipper is focused on results: predictable time service from pickup to delivery, from door to door.

There are five trends pushing and shaping cross modal operational strategies: (1) the rapid development and adoption of information technologies for tracking shipments and managing fleets; (2) economic competition for capital; (3) carrier concentration and consolidation; (4) globalization in the economy; and (5) the evolution of networks.

Widespread Application of Information Systems

The rapid pace of changing business processes brought about by information technology development can be legitimately termed a revolution. In the transportation sector, such terminology is certainly appropriate in that information technology has been a source of significant productivity gain, and the catalyst of significant industry restructuring. A commentator in *The Economist* (9/23/00) compared information technology to previous technological revolutions, and noted that:

[One] “test of a new technology is how far it allows businesses to reorganize their production processes, and so become more efficient....Now computers and the Internet are offering the means for a sweeping reorganization of business, from online procurement of inputs to more decentralization and outsourcing.”

²The information and analysis in this paper are based on two major sources. The first, part of a scan of defense freight transportation issues in the spring of 2000, was a document review to prepare an annotated bibliography. The second source was a set of 30 interviews and discussions with officials and expert observers. The interviews, mostly in person, were relatively open-ended conversations in the spring (11 conversations), or focused discussions based on the draft issue scan and briefing slides in the fall of 2000 (19 conversations). The interviews were not for attribution in order to encourage candor.

The constellation of technologies presently available for freight transportation can be grouped into three major categories:

1. Shipment and asset tracking technologies such as mobile communications for field personnel (cellular phones, two-way radios, on-board computer systems), passive asset tracking and monitoring systems for trailers and power units (satellite and mobile tracking systems), and bar codes and radio tags on the shipment handling units (envelope, shrink-wrapped skid, container) that can be tied back to bar-coded stock keeping units (SKUs).
2. Routing and dispatch optimization models – Operations Research software that is able to manage and reconfigure routing, matching, blocking and consolidation decisions.
3. Commercial transaction management software – such as marketing software that is able to re-price and manage yields in response to differential costs and supply/demand relationships.

The increased availability of sophisticated information technology is bringing change to the way volume is managed in the operating stream, affecting the creation of fundamental economies of consolidation and densityⁱ. It alters the question of cross-modal coordination, by making it possible to monitor and even control shipments from door to door, improving handoffs and mitigating their effects. Logistics companies that lack physical operations but possess strong coordination skills become more competitive, and operating companies can consider shedding some assets in favor of management roles. Recognizing the transforming importance of information systems, the huge motor carrier United Parcel Service has stated that it is “no longer a trucking company with technology, but rather a technology company with trucking.”

Yet the cost of these cutting-edge systems may still be too expensive for all but the largest of carriers, and could thus serve as a motive for consolidation and a barrier to market entry. A top truckload and logistics operator believes that information technology

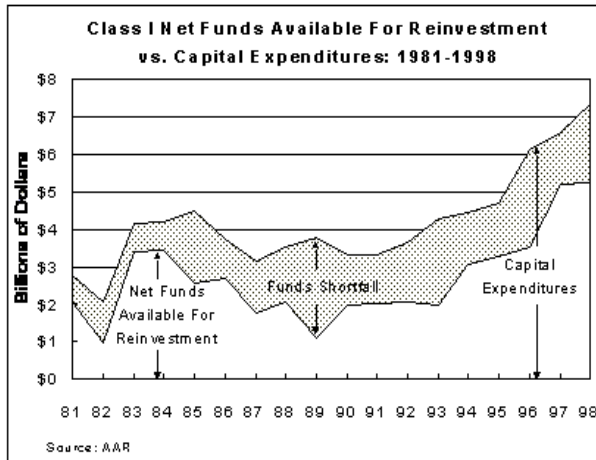
“potentially (has) a huge impact, but the big question is whether it’s going to reduce costs. It certainly improves information to the customer. ... Developing technology costs loads of money and it requires some kind of economic payoff. The winners are going to be the ones with the biggest pockets.”

Economic Competition for Capital

Transportation has historically been a capital-intensive product. The significant investment in assets such as ships, locomotives, facilities, and tractor-trailer equipment, often places transport providers at a competitive disadvantage in the capital markets to more asset efficient industries. Transport providers are finding it difficult to attract the reinvestment capital necessary to maintain service quality.

The railroad capital gap is well documented, as is shown in the accompanying Chart. Internally generated funds have fallen short of capital expenditures for years, while returns on investment have been increasingly uncompetitive. Truck lines also find their external sources of funds inadequate. In the words of the CFO of a top LTL company:

“Wall Street is not interested in companies whose market capitalization is less than \$1 billion, which exceeds the market capitalization of all but a few motor carriers. Access to capital is becoming more of a problem for many carriers, and the industry just doesn’t offer competitive opportunities versus the financial alternatives. Consequently, the cost of capital has gone up and its availability has declined.”



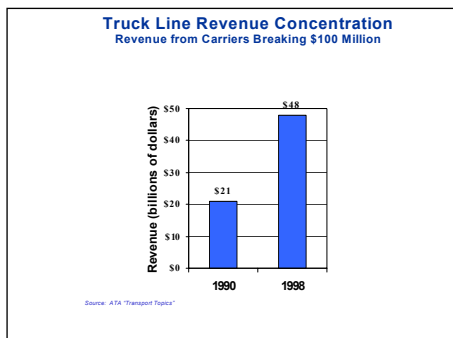
As a result, carriers have sought to reduce asset requirements while maintaining revenue levels through the expansion of products and services beyond their traditional base. Coordinated logistics offers one kind of solution. For a non-asset provider, it works to promote revenue quality while reducing the need to own assets. Coordinated logistics for an asset-based carrier provides a way to improve utilization and network efficiency through economies of density, by retaining certain volumes on-line and subcontracting others. As one trucking company stated:

“[These carriers]...establish partnerships in order to improve the density of fleet operations; for example, [they] farm out delivery in regions where they do not have very good density but some other carrier will.”

This same truck line also uses rail intermodal line-haul services to improve its own fleet productivity.

Concentration and Consolidation

The core carrier programs initiated by many shippers over the past two decades encouraged consolidation within modes by concentrating larger volumes of freight among fewer carriers; carriers gained economies and shippers gained leverage. Shippers now seek to extend this strategy and widen their influence through combinations, alliances and web exchanges. These larger shipper networks control more business by moving up (adding vendor traffic) or across (combining with similar shippers) supply chains; they retain for themselves a larger share of the volume economies available in the market, then put them out to bid from a position of considerable advantage. The result, according to one trucking executive, is:



“more consolidation of freight and volume and control on the shipper side,” and “carrier consolidation (taking) place in order to equalize the leverage.”

While the trucking industry as a whole remains fragmented, the degree of concentration among the largest lines has grown. Carriers with annual revenue over \$100 million commanded two and a

half times the business in 1998 as in 1990 (the accompanying Chart displays this.) Domestic air freight has become an industry thoroughly in the hands of a half dozen integrated carriers. U.S. flag steamship companies have merged with foreign lines. Railroads have reduced to the point that there are less than ten major systems in all of North America. In the eyes of some shippers, these changes have brought a material shift of market power that favors the carriers. Several shippers we interviewed suggested that the vertical and horizontal integration of carriers has significantly reduced their ability to share in the efficiencies these consolidations were intended to create.

Shipper programs and equalization of market leverage are hardly the only reasons for carrier consolidation, and the freedom wrought by deregulation has been a strong force from the outset. (The eighth paper in this Series explores the theme of Regulation further.) Even so, much of this trend can be seen as an attempt to capture volume economies, and coordinated logistics is a further means to this end. Most of the largest freight carriers are substantial cross-modal operators; although consolidation across modes is not yet a strong force (we discuss this further below), the use of modal coordination in developing traffic concentration is significant and appears to be growing.

Emerging Global Economyⁱⁱ

The availability of globally produced goods in most major consumer markets is enormous. The spillover benefit of this trend has been a rise in transport as producer and consumer sub-economies trade around the globe. Most international transportation touching the United States is characterized by coordinated logistics, either because the operation is intrinsically intermodal (as with overseas shipping), or because border regulations and equipment standards require interchange (as with NAFTA shipping). Cabotage and immigration provisions impose further restrictions, so that the only international freight networks with real freedom of movement are coordinated networks.

The increased transport opportunities available in the world economy have also spawned an increasingly competitive environment for transportation services. As shippers seek to establish product advantage and use their logistics chains as tools to the purpose, carriers are forced to reduce the costly transfers of intermodal service, and have begun to look for opportunities to integrate operations forward and backward for commercial advantage and cost reduction. Some small package carriers have been building global capabilities to satisfy this new demand, NVOCC operations have become relatively common in LTL, and at least one truckload operator is allied with a proposed high-speed container line.

Nevertheless, the globalization of freight transportation is in its infancy. Apart from air and marine companies who expressly serve an international market, freight carriage in the U.S. and elsewhere is predominantly regional or continental. Though many carriers have attempted some measure of expansion beyond borders, synergies with domestic operations have been few. International containers, for example, normally are an inferior good for U.S. domestic transportation and do not contribute to equipment balance. A railroad-based transportation conglomerate with facilities on three continents finds *"...precious few synergies in being a global carrier"*. And, while large shippers commonly conduct manufacturing and retail operations in multiple countries, this carrier reports that *"dealing with customers globally does not offer any particular advantage yet."* ⁱⁱⁱ Where there are efficiencies, they come from the coordination of compatible networks, such as the

rail-marine interface and the run-through trailers between U.S. and Mexican truck lines, and the logistics information networks third party operators and others are working to construct.

Evolution of Transportation Networks

Freight operators have grown through core carrier programs, but also have been forced to grow, and to make fixed capacity commitments in their networks. Coordinated logistics initiatives are one way to manage these commitments, and to make meeting them less costly. Coordination takes place through simple purchase of service, through partnership or sharing of a portion of capacity, through management by information technology, or through control of another modal operator by acquisition. A newer form of coordination is the web-based carrier exchanges. Among other things, these are aimed at more efficient matching of supply and demand in a virtual carrier network - but in effect they thereby seek to control a larger share of the available volume economies (and counter-balance the advantage of shippers).

Cross-modal coordination in many networks is a fundamental requirement. Air freight typically supplies a highly reliable door-to-door product, but its first and last miles are accomplished by truck, usually in a tightly controlled, company owned operation. Railroads have merged for the sake of network economies, but also have dropped route miles and have seen industrial development take place far away from trackside. Progressively, trucks on the streets of cities and industrial parks have performed railroad pickup and delivery.

Infrastructure management and carrier operating performance are bound up with each other (as railroads attest), and both affect the efficiency of supply chains. One consequence is that facility complexes are being designed for cross-modal coordination. Freight villages and inland ports are an example of this, where the staging, transfer and control of goods is supported by a local network of information systems and modal infrastructure, often with a major shipper or carrier center at its heart. More traditional infrastructure providers like seaports and airports are deploying information technology, establishing links to distant facilities, and working in consort with groundside carriers to assure the continuous flow of goods.

Increasingly, for both the shipper and carrier communities, networks are becoming the unit of competition. The performance of supply chains is vital to shippers, not only for the sake of bringing goods to market, but because logistics itself has become a source of market advantage. For carriers, the size and strength of networks will be the key determinants of market power, according to the chairman of fast-expanding Deutsche Post - now a significant player in the U.S. market: ^{iv}

“In the future, the large international customers will need logistics providers with large international networks. They don’t want 150 logistics suppliers... they want about 10. And to be one of the 10 when there is a bidding, you have to have a strong international network. The one with the strongest international network will be the winner.”

These comments apply equally well to domestic systems. Operating networks represent sustained investments in client relationships, construction of volume economies, and service management, quite apart from mentioning technology and infrastructure. If scale in a network matters – and in some ways it certainly does – then market entry becomes an open question. Will the formation of expansive logistics networks – by their sheer size and complexity – preclude new entrants from developing competing products? But concentration within a network also matters – the ratio of dynamic capacity (force) to geography (space). A major U.S. motor carrier reports that “smaller fleets are effective in the Fortune 500 market in niches,” and this is corroborated by one of its capacity-hungry Fortune 500 customers. The smaller carrier competes because its network is dense, and its limited scope supports a high level of performance. The risks for the smaller fleets may come from information technology, where competing in sophistication may never be cheap, and from larger operators capturing logistics coordination franchises across broad sections of market, leaving less efficient segments for other players, or relegating them to the role of commodity providers.

■ Implications for Products & Organizations

The transportation marketplace over the past two decades has seen an explosion of intermodalism. The freight industry’s operational and commercial channels that have historically been split along modal lines are increasingly being repackaged into customer, industry, and product segments. Shippers outsource single and multiple mode coordination responsibilities to asset and non-asset-based carriers, and service providers have formed units around the needs of single shippers or industry sectors. The result is that the service products from multiple modes are being assembled both operationally and commercially to provide combined services, and are giving rise to new organizational forms. There are three basic models currently in use:

1. Cross-modal service alliances (e.g. truckload carriers utilizing rail intermodal as line-haul substitution).
2. Coordinators and integrators, such as third- and fourth-party logistics companies integrating multiple mode products within a common commercial and operational framework (e.g. APL’s coordinated service package for DuPont covering TL and LTL services). Sequential transport managed by a forwarder or intermodal marketing company is an earlier and still active version of this model.
3. Cross-modal mergers and acquisitions (e.g. FedEx’s acquisition of RPS, Roberts Express and American Freightways combining air freight, parcel, express truckload and LTL services).

Purchasing Practices

As shippers have sought to reduce in-house transportation expenses, eliminate inventory in favor of rapid replenishment, and simultaneously replace traffic expertise lost to attrition and organizational decisions, they have aggregated traffic volumes to selected carriers, matching capabilities and quality to corporate objectives. In addition, shippers

have selected several new models for purchasing of transportation services that expand on the concept of these programs and include several outsourcing alternatives:

1. Single mode outsourcing, transferring transport coordination to a single carrier within a mode (e.g. various catalogue shippers to UPS).
2. Multiple-mode outsourcing, transferring the coordination of several traditional modes to a single coordinator – normally to a logistics company, whether asset or non-asset based.
3. All mode outsourcing, transferring the coordination of all modal alternatives to a single integrator or fourth-party provider.

Logistics outsourcing has altered the way transportation services are purchased. Carriers often market services not only to shippers, but also to brokers, logistics providers and even other carriers. The coordinators – with the support of the shippers – further bundle traffic through the use of consolidation and de-consolidation centers; milk-run pick-up and delivery services; and the assembly of traffic volumes from multiple shippers into full-load quantities. These efforts, intended to reduce transportation cost through the substitution of less-expensive line-haul transport, have facilitated the expansion of coordination services among both asset-based and non-asset-based providers. Essentially, these are all manifestations of a shift in logistics roles: just as intermodal marketing companies are created when line-haul operators withdraw from, or never accept a retail role, so the coordinators are created when shippers withdraw from, or never undertake management of their logistics function. When coordinators take on the business of multiple shippers and are able to combine their activities, they become yet another competitor for control of the market's volume economies.

Not surprisingly, shippers have reported that the trend to coordinated logistics has created better and more cost-effective service products. They have noted that the evolution in the industry towards fewer, larger service providers had been a positive outcome of deregulation where barriers to entry are comparatively low. The shippers we interviewed believed that deregulation in the motor carrier industry had resulted in several large high-quality providers^v, while deregulation, but more importantly, consolidation in the rail industry, had lowered quality^{vi} in the near term and reduced alternatives significantly.

From the carriers' perspective, coordinated logistics has yielded a mixed result. Some carriers express difficulty in financing the investments in information systems necessary to manage a coordinated product. Some also express frustration in their attempts to capture the synergies believed to exist in cross-modal coordination. With the limitations of current infrastructure, systems and business practices have thwarted their ability to coordinate the disparate products successfully.

Product Offerings

The central questions in coordinated logistics concern the types of products offered, and the forms of organization required to supply them. On the product side, time definite and mode indefinite characteristics are on the rise – even for bulk commodities -- and a primary issue is the product integrity maintained door to door. On the organizational side, new models of transportation providers are being established in some sectors (and

not at all in others), and are expressions of new business strategy. Neither set of developments is mature, and novel solutions to the central questions are still to come.

The mode-neutral product is a clear attempt to exploit cross-modal advantages with coordinated logistics. In essence, it proposes to meet the requirements of shippers for service, cost, visibility,^{vii} and other product features in specific ways, while reserving the choice of operating method to the provider. Traditionally, a transportation buyer gained trust in suppliers by understanding their operation, and observing the results they produced under a broad set of commitments. The mode-neutral supplier substitutes a more precise set of commitments, backed up by its own control systems. The product typically is time-definite to the hour or day, with mode selection a function of shipment size, consolidation opportunities, and transit requirements. The supplier is responsible for the price, the quality of service, in-transit visibility, and the institutional reliability – encompassing management processes, financial stability, integrity, and responsiveness – by which performance is assured.

Not only modal coordinators favor the advantages of this product form. Truckload and LTL carriers report that identifiable distinctions in levels of service discourage their customers from demanding higher performance than necessary. Because carriers are able to institute differential prices that reward service and promote choice, they in turn derive a greater breadth of operating flexibility than a uniform product allows. One company, describing the payoffs from their ability to sell varying levels of service quality, stated that 35 percent of freight in their system is not deliverable on the day of arrival. As a result, a sizeable portion of their capacity is consumed unnecessarily; the implication is that by offering the shipper a selection of time-definite services, the carrier becomes more productive.

Ownership & Control

The challenge in mode-neutral, coordinated logistics services is the institution of product reliability across multiple operations and participants. Does the provider have to maintain control door to door, and does control have to take the form of ownership – which implies asset ownership? Is ownership necessary for all stages of the operation, or are the pickup and delivery (the so-called “last mile”) stages most important, and the line-haul better suited to delegation? The freight industry is divided on these questions, with third parties and some capital-intensive companies hoping particularly to succeed with fewer assets – and while there are no definitive answers, a variety of points and comments from participants can be considered:

- One railroad envisions the international intermodal product not as an integrated door-to-door service, but rather as one coordinated among providers through information technology, and possessing enough in-transit transparency to make service performance manageable. Still, this same railroad is concerned with the commoditization of its products and the lack of adequate returns for its assets. It is arguable that intermediation breeds commoditization – and this railroad showed concern for the effects of intermediation in its domestic services.

- A different railroad reports that the portion of the market that demands integrated door-to-door products is not currently the portion that uses rail. As to the method of integration, this carrier expects to see both ownership, and coordination through information technology. However, it also asserted that the history of carrier alliances is not favorable, and that alliances are most successful when one party is dominant and the other acquiescent.
- A maritime expert describes steamship companies as deeply concerned about losing control of their customer and becoming subject to commoditization. Their solution is to set up logistics units in order to manage through service, to introduce satellite and radio-tag technologies for service and asset control, and to raise margins by offering a differentiable product.
- A motor carrier, a high-volume user of rail line-haul services, introduced a GPS-based tracking program for its trailer fleet. One explicit motivation for this substantial investment was that the technology established a mechanism for door-to-door intermodal service control.
- Another motor carrier attempted to guarantee truck-quality service regardless of its manner of line-haul. When unreliable rail performance simultaneously raised costs through the carrier's efforts at service recovery, and depressed prices as the carrier became viewed as an intermodal marketing company, the company addressed the problem by splitting the intermodal from the over-the-road product, and offering them both to customers at different price levels.

Perhaps most significantly, a leading shipper states that it has found an empirical relationship between the ownership of assets and the quality of a carrier's service, and attributes this to the positive effect of service performance on asset utilization. From such indications several conclusions can be drawn:

- That operating control contributes to an improved product;
- That ownership contributes to the quality of control; and,
- That an owner who does not control service door-to-door risks commoditization.
- These conclusions are not incontrovertible, and the way that a carrier or integrator resolves the issue of control has great influence on its organizational strategy, asset requirements, and investments in information technology.

Organizational Form

The recent history of transportation conglomerates is unimpressive. The CSX purchase of SeaLand never lead to any meaningful advantages, and the unit was ultimately spun off. Overnite in the hands of Union Pacific has not become much more than an independent subsidiary. American President Lines sold its trucking and distribution division, and then was sold itself. The Roadway Caliber venture led to a split up; J.B. Hunt's foray into new segments of the trucking market brought them back into the dry van business. There are diversified companies with more impressive records, but few compelling cases for modal

synergy. If cross-modal coordination is a viable strategy, and especially if ownership really matters to success, how is this to be accomplished?

The simplest answer is that operations will remain separate, and product improvements will arise from information technology. This appears to be the approach of many transportation providers, and certainly is the one favored by most third-party firms. A more complex answer comes from considering organizational forms in different segments of the freight market. For example, local trucking in the form of intermodal drayage is described by one railroad executive as impervious to the productivity gains of the past decade even through the adoption of information technology. Companies seeking to consolidate draymen have appeared now in the market, but their influence remains to be seen in the future.

LTL: Regional LTL companies have grown because of attrition among unionized firms, and because of the economic strength of distribution markets. Organizations have not changed, but they have invested heavily in information technology. Long-haul LTL carriers have reorganized terminal networks and line-haul systems, and found a strong correlation between cost reduction and service improvement. One states that it employs information technology to improve growth and returns, using it to create and manage diversity in its services. They believe that *"companies that provide the broadest transportation capabilities will be the most successful."*

Rail: There is a call for new business models in the railroad industry, and pessimistic predictions in their absence. One version outlined by a Class I carrier calls for railroads to become logistics providers and adopt the integrator role; to move heavily into information technology; to streamline operations, schedule trains, and exit certain commodity and vertical markets. A different version, presented by a railroad whose operations already are heavily scheduled, calls for carriers to sell capacity and not just transportation; to provide time-definite service and improved utilization of assets; and to treat on-time performance as the constraint to which other aspects of performance must conform.

Truckload: New organizational developments are taking place in the small package and in parts of the truckload sector, and both have consequence for coordinated logistics. The truckload model involves over-the-road carriers who utilize intermodal operations as an alternative transport channel, and have applied information technology to bring them under common control. More substantively, the logistics subsidiaries formed by these carriers uncover and organize volume economies latent in customer supply chains, for the client's benefit and often (but not solely) for the carrier's. This is effectively a channel of highly filtered business prospects. The subsidiary may also provide brokerage services that help sustain the capacity commitments made to customers and at a lower cost.

Beyond pricing and commercial development, applications of information technology may be extended to demand management and the production of consistency in traffic volume. These are powerful efficiencies if they are realized. For an organization with scale, they establish the means to maintain asset and technology investments, and perhaps to operate from a more favorable position on the cost curve. The combination of several truckload carriers in the Transplace^{viii} web exchange is an attempt to add to scale, and to discover and claim market volume economies sooner than competitors.

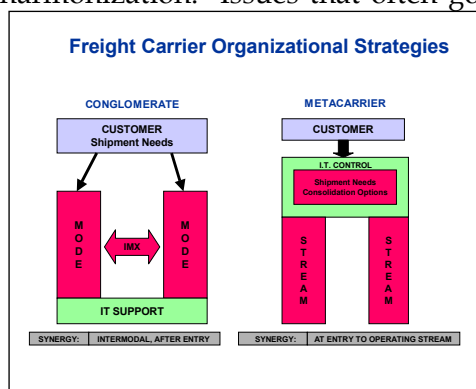
Package: The small package model represents a different approach to the transportation conglomerate, and a different view of the synergies. Federal Express, for example, has acquired a string of subsidiaries, most of who are leaders in freight applications of information technology, and cover a spectrum of submodes including small package ground service, express ground, and regional LTL. In addition, the company buys line-haul services from truckload carriers and intermodal railroads. The subsidiaries are left as separate operating streams, distinct in their service capabilities and shipment size accommodation. Products are specified on a mode-neutral, time-definite basis, with prices varied to the level of service. The network has global extent and exceptional in-transit product visibility. The product is controlled door to door, with pickup and delivery service under company ownership throughout much of the world.

The synergies in this model are created *at the point of network entry*, when the shipment is routed into one of the operating streams. Some shipments, due to size or service characteristics, will be suited to a single stream while others are suited to several. Exploiting this operating option and guided by information technology, the carrier is able to make daily real-time adjustments to optimize load consolidation and line-haul patterns. This method yields the best load factors, street density, lane and terminal balance, and overall utilization of assets that the daily available volume allows. Compared to a carrier operating a single stream, the company has many more opportunities to create service economies, and a substantial competitive advantage. Unlike earlier modal conglomerates whose efficiencies were so often elusive, attempts to merge operations generally have not been made. This approach can be termed a metacarrier strategy, and it is a new solution to the questions of coordinated logistics.

■ Issues

Shippers endorse the coordinated logistics models as a more favorable alternative to the mode-based model. More innovation and competitive parity than had been available in the earlier structure have been cited. In addition, the lower total cost and enhanced service performance demonstrated by the early incarnations of the model have been praised. But while earning shipper praise, these early products offer only vertically integrated information. Significant challenges lie ahead as carriers move to add vertically integrate service products to the information stream.

The logical outcome of continued cross-modal coordination is a move towards greater harmonization. Issues that often go unresolved in the traditionally fragmented logistics



model are eliminated and could be more easily addressed as intermodal hand-offs. Included among these issues are intermodal container and shipment tracking. However, private sector initiatives may not move forward rapidly enough to be of value in the next decade, and there appears to be modest progress on the issue of international standards. This factor appears to be limiting the interest of carriers in performing international coordination activities. Furthermore, while shippers and carriers alike are anxious to

bring about the harmonization features of coordinated logistics, both question the economic benefits necessary to fund the information technology improvements, and each ascribes the greater benefit to the other party. Shippers point to equipment utilization and productivity increases, carriers highlight supply chain management and transparency advances, and neither thinks their own savings or efficiency rewards have been compellingly large. The information technology issues related to coordinated logistics, as in other aspects of transportation, appear to hold the greatest promise of overall productivity gain, but not sufficient gain for any party to make the needed investment independently.

A related item is the requirement of scale for information technology development. This ties into the possibilities for scale offered by new organizational forms, and the competition for market economies between shippers, carriers, and integrators. Carriers of unprecedented size and global scope already exist, one of which is still owned by a sovereign government. More carriers of this magnitude are sure to arise in the domestic, hemispheric, and world markets. The policy issues are challenging, apart from the jurisdictional boundaries. Should transport providers be allowed to expand the size of their multinational customers? Is it counterproductive to interfere with the scale required for information technology investment. If so, should information technology be made accessible through financing vehicles and thereby lower the barriers to competition?

The triumph of the coordinated logistics model over the fragmented modal structure that has long dominated the transport sector is not assured. It is most appropriate in certain transport sectors such as small package, truckload, and longer haul industries. It is perhaps irrelevant to most local trucking and various bulk transportation industries. The current incarnation of the trend, since it is technology driven with a broad base of support among modal sectors, may be more sustainable than in previous times.

Whether the evolution is complete or partial, the effects on the industry will continue. The profitability models for carriers in traditional mode classes will change as the business mix changes and new products and organizations may arise in other sectors, just as in the small package market. The success of the new models will determine the rate of duplication, and the speed at which coordinated logistics expands.

In addition, these new models create a need for a more flexible regulatory framework, one that can adapt to the cross-modal alternatives and encourage their productive potential. The traditional, modally defined regulatory structures could stifle cross-modal coordination, and result in costly and cumbersome guidelines.

Appendix – Cargo Security

■ Introduction

The issue of cargo security was discussed with several transportation executives, and reinforced the perspective that cargo theft is anticipated to be a larger issue over the next decade than in the past one. The greater sophistication of cargo thefts and the increasing cost of cargo losses are combining to make solutions to this problem more elusive. Respondents affirmed that cargo theft, or pilferage, has increased dramatically over the past decade, and the number and scale of reported incidents continues to grow.

For purposes of this Appendix, the chief concerns and developments in cargo security are presented, as well as the comments of industry executives.

Discussion

It is estimated that cargo theft and pilferage represent an annual economic loss of between \$10 and \$20 billion, with the value of a single theft averaging approximately \$500,000. This astounding growth has drawn the attention of insurers and federal officials.

Pilferage, once the primary concern of the transportation industry, has been reduced through technological changes in the handling of freight (containerization, etc.) and the use of sophisticated surveillance and detection methods. In its place, outright cargo theft has eclipsed pilferage, and become a preferred activity for an increasingly sophisticated and organized criminal element. The FBI believes the reason for its growth is simple. Stealing cargo is safer than running drugs, with less chance of prosecution, but still with ample potential for large profits.

Carriers have historically been reluctant to report thefts, fearing a shipper backlash. Law enforcement officials are often unable to quantify losses without carrier or shipper cooperation, and theft crimes frequently go unreported. Judicial officials have historically viewed cargo theft as a victimless crime, and have thus been more lenient in sentencing.

One of the areas most commonly targeted for cargo thefts is consumer electronics. In the past several months, computer manufacturer and retailer groups have organized to exchange information and strategies to combat this growing problem. Other common targets of cargo theft include grocery items, meats, cigarettes, perfumes, clothing, jewelry, and seafood. A truckload of shrimp could be worth upwards of a half million dollars.

With the upscaling of criminal activity has come a trend to more violent and sophisticated thefts. Cargo theft has graduated from a box lifted from the loading dock to gunpoint hijackings of entire trailers or containers. The increased violence and scale of cargo theft has attracted the attention of the FBI, who has traditionally participated in any freight theft that involves an armed robbery or a loss exceeding \$50,000. The FBI has increased its effort to stem the increase in cargo theft, and has increased the size of its Interstate Theft Task Force nearly fivefold in the last three years. Generally, the FBI agents work to

support local law enforcement officials by investigating organized groups of thieves and fences. Officials agree that local law enforcement agencies are not well equipped to capture the new breed of cargo thief.

Many officials believe that the increasing violence and sophistication in cargo theft are linked back to organized crime. The NCSC estimates that traditional organized crime is involved in 40 percent of cargo theft incidents.

■ Trends

With the increase in reported thefts, insurers, carriers, shippers, and law enforcement agencies have united to promote congressional action to increase the arsenal of weapons in the fight against cargo theft. In 1999, the Transportation Security Coalition assisted Senator Frank Lautenberg, D-N.J., in drafting legislation, S. 1512, that would: 1) stiffen penalties for cargo theft; 2) broaden the definition of cargo-related crime; and 3) establish a national database on cargo theft. Within specific modes, the issues related to cargo security are somewhat different.

Air

Air cargo has been particularly hard-hit by cargo theft. The attractive combination of small shipments, high-valued cargo, and a complex chain of handling has made theft prevention a particularly daunting task. Officials cite that criminals frequently infiltrate air cargo organizations to provide inside information on shipment manifests and cargo security. Several carriers have worked to reduce security risk with sophisticated surveillance techniques, 10-year background checks on current and potential employees, and more aggressive information security procedures. One carrier reported spending between one and two percent of gross revenues on security efforts. Air cargo theft has most often been linked to organized crime, and several major FBI investigations, such as “OPERATION KAT-NET” (“Kennedy Airport Theft Network”) have been undertaken to reduce the theft problem.

Rail

Railroads have traditionally provided private cargo security, or railroad police, for the beneficial interest of shippers and the railroads. Railroad police, unlike most private security agents, are state-certified law enforcement officers. Railcar thieves generally target intermodal containers, although automobile tires in boxcars are also preferred. Automobile theft has been all but eliminated, but radios and sound systems are common targets. Railroad police frequently coordinate their activities with local law enforcement officials, and have been successful in obtaining arrests and convictions of railway thieves.

Trucking

The trucking industry has been a long-time leader in the area of cargo security. The American Trucking Associations (ATA) is underwriting the development of a nationwide

database of reported cargo thefts, and has lobbied aggressively for congressional action to strengthen cargo theft laws. The ATA routinely sponsors various national workshops and conferences to facilitate the exchange of strategies and tactics in the fight against cargo theft. Historically, security risks for motor carriers were limited to those times when a loaded trailer was unattended, such as at a truck stop or terminal. The trucking industry, in the U.S., Canada, and Mexico, has responded with more aggressive security tactics, larger recovery and information rewards, and the formation and support of several theft prevention coalitions.

Water

Most of the cargo theft in the ocean carrier industry occurs on the dry land of port terminals and freight staging facilities. Like all transportation industries, cargo is most susceptible to theft when it is stationary. The growing congestion at major port facilities has only served to increase the opportunity for pilferage as customs officials often streamline procedures during busy periods. Today's cargo thieves have significant experience with complex international shipping documents and thefts often go undetected for long periods. Ocean carriers have responded with tighter levels of security at port and terminal facilities, but the complexity of port activities has made finding permanent solutions to the problem rather vexing.

■ Issues

- The growing problem of cargo theft has drawn greater attention and involvement from private and public sector officials.
- The expansion of Government supported crime databases is perceived to be a meaningful asset in the war on cargo theft.
- Insurers, carriers, and shippers are aggressively promoting legislation to strengthen and expand the arsenal of weapons available to prevent and deter cargo theft.

ⁱ This phenomenon is discussed in additional detail in the related theme papers, "Economy: Rapid Change in Manufacturing and Service Sectors," and "Business Logistics: From Push to Pull Logistics."

ⁱⁱ The theme paper, "Trade: From National Markets to Global Markets," in this series treats this subject further.

ⁱⁱⁱ J. Reilly McCarren, President of Wisconsin Central Ltd., which at the time of interview ran railroads in the U.S., Great Britain, New Zealand, and Australia.

^{iv} Klaus Zumwinkel, interview in *Traffic World*, 9/25/00. Deutsche Post is the former government-owned German Postal Agency that has expanded through the acquisition of Danzas, DHL, and the diversification into financial services (Postbank) to become one of Europe's largest logistics providers. Deutsche Post seeks to provide an array of transportation and logistics services including small package, freight forwarder, and third-party services for clients all across Europe. The firm has entered the US market for air freight and third-party logistics services through its purchase of Air Express International and the DHL acquisition.

v Comments by DuPont during FHWA interviews.

vi Comments by General Motors and DuPont during FHWA interviews. More specific information on these interviews is covered in the theme paper titled “Business Logistics: From Push to Pull Logistics”

vii “Visibility” and “transparency” are terms used to describe the availability of electronic location-specific information for in-transit shipments. To take an ideal example, a shipped product is assigned a bar-coded tracking number, and then followed through all of the stages of transport from shipper door to receiver door, with accurate, real-time information about the product’s location and arrival schedule accessible 24 hours a day. The idea is that a product in transport should be much in the customer’s control as a product in the warehouse.

viii Transplace is a leading Web-based transportation exchange, founded by several of the nation’s largest truckload carriers. It serves as an Internet forum for logistics collaboration and transactional coordination.

Real-time information enables parties to optimize freight and assets while reaping the benefits of cost-efficient systems for acquiring goods and services. By connecting shippers, carriers, and suppliers through an [online marketplace](#), Transplace streamlines processes and reduces associated trade and procurement costs.