intended to achieve. Yet rail movement costs are substantially lower than road movement costs, and road collection and delivery of containers or trailers are particularly expensive because of the low level of use of the motor units usually obtained. On the other hand, a denser terminal network could substantially reduce that cost without necessarily increasing rail costs by an equal amount.

After describing why the development of Freightliner took the form that it has today, the extent to which economies of scale have been achieved in terminal operation (by contrasting costs and performance at terminals of various sizes) was examined. The results of work undertaken by TRRL in 1976 and by the Research and Development Division of British Rail and Freightliner more recently show that unit costs for small or medium-sized terminals that are between 15 and 25 percent lower than those at large terminals. Interestingly, both theoretical studies, which cover per-lift costs for different sizes of cranes and average costs per container of throughput for various sizes of terminals, show broadly the same magnitude of difference between the large terminal, which uses the large crane, and small or medium-sized terminals. Average costs per container are a relevant measure of cost-effectiveness, provided that terminals are not operating well below rated capacity. Such costs reflect field conditions, where the pattern of terminal activity is influenced by the characteristics of rail and road traffic movement.

Small terminals with small cranes appear to be inherently less costly, the equipment and infrastructure required being much less elaborate and less expensive both to provide and maintain. At small terminals, labor costs are a higher proportion of total costs, but providing these can be varied to match throughputs; relatively uniform levels of unit costs can be achieved at almost any level of throughput. Initial performance measurements carried out at Freightliner terminals also appear to point to higher-quality service to the shipper at small rather than large terminals.

It needs to be said that perhaps these conclusions apply only to large terminals as Freightliner has designed them. It is likely that there are parallels elsewhere, but this has to be demonstrated. It is also likely that large terminals could be designed so as to avoid many of the defects discussed. However, that is a subject in itself. Freightliner experience does suggest that large terminals, if they are to be built at all, should not have just a few sophisticated and expensive cranes, but a greater number of smaller transfer devices.

The significant point about the comparisons is that it is the small terminal that both exhibits the lowest unit costs and offers the best opportunity for reducing road-collection and delivery costs through increased terminal coverage or density.

Increased terminal coverage need not result in dramatically increased rail haulage costs or in sacrificed service quality. The central sorting of containers or trailers at specially designed interchange centers facilitates a network of small terminals and private sidings that are served by intensively used low-cost block trains that operate to and from the centers.

As the recession continues and competition grows, intermodal operators must pursue not only technical innovation, but must also thoroughly explore new concepts and ideas in terminal and system design.

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Intermodal Freight Terminal—An Open System: The Infrastructural Perspective

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Attention is focused on those people who are involved with the planning, design, and operation of intermodal freight terminals and their essential support systems, i.e., their infrastructures. The interface role of intermodal terminals is significantly constrained by the quality of the related infrastructure, how it is operated, how access to it is controlled or regulated, and what pricing practices are applied. The intermodal freight terminal is a characteristically complex system operating, as it does, between two dissimilar modes of transportation. This means that terminal performance is affected by at least two separate operating policies. The terminal's administration must accommodate to the scheduling and performance standards of the management of the two modes and at the same time achieve acceptable levels of throughput—at a profit. Confounding these and other related matters is the infrastructure issue. Where two modes are involved, there are, necessarily, two dissimilar rights-of-way. Each may have different capacities and restrictions, neither of which is under the control of the intermodal terminal operator. For example, an ocean container terminal may be faced with uncertain channel depths, custom delays, tugboat and pilot shortages, and limited crane capacities on the waterside and, on the landside, traffic congestion, length and weight limits, clearance restrictions, and oppressive traffic regulations. Other infrastructural elements of concern include communications; labor quality and availability; services such as refrigeration, chandlery, fire, and police; medical services; and line-haul and distribution networks for the modes in question. The infrastructure concept is presented descriptively along with systems planning and analysis. Examples of intermodal freight terminals in the context of their infrastructure are offered to illustrate the need to take infrastructure into account in planning, designing, and operating intermodal freight terminals.

Intermodalism is the fusion of the services of distinct carrier types designed to improve the physical distribution performance of freight movements, thereby achieving less costly and wider access to product markets and supply sources. Intermodal applications apply to freight movements that may require or benefit from transfers of freight between the modes. A principal factor that distinguishes intermodalism from the simple cooperation of transportation modes is the method by which the freight transfer is accomplished. Current intermodal technology employs the highway trailer or the modes-adaptable container to achieve the transfer. Cooperation is achieved by the transfer of individual packages or unitized groups of packages from one modal container to another (1).

The freight-bearing equipment, the transporting units, and the mechanical interfacing apparatus by which the intermodal transfers are accomplished are, necessarily, viewed and dealt with as a system; that is, system in the interacting elements sense. The design, capacity, and operating characteristics of each of the elements are constrained by the design, capacity, and operating characteristics of the companion elements. As the design or operation of one element is altered, some other elements are affected; therefore the system is altered, and the outcomes produced through the system are changed.

Intermodal freight terminals (IFTs) provide the location, mechanical devices, space, and operating conditions under which the transfer functions take place. Site selection, facility design, transfer technology, and administrative and operating practices are intended to achieve efficient container transfer. Space and structure considerations should reflect storage requirements, freight congestion avoidance for vehicle operations, and growth expectations. All of these elements fit together to represent the IFT subsystem of what is the wider total system. Usually, the IFT subsystem is seen as a costly constraint on the wider intermodal system and is responsible for backups and delays. To make such a judgment suggests that there is some standard by which IFT performance can be measured. If measurement is possible, can reliable design criteria for the handling of intermodal units at IFTs be established? There are several reasons why this will not be likely. The one considered here is that IFTs cannot be designed, operated, or evaluated according to valid performance standards until the total system in which IFTs function is identified and brought under scrutiny.

TOTAL SYSTEM

The panorama of intermodal freight system elements can best be viewed from the vantage point of the marine container terminal. We can observe the diversity of modes, factors, and considerations that influence the elements and their interactions. That is, we can identify and thus evaluate the entire commercial intermodal system, taking into account the widest range of modal alternatives. Further, the intermodal system can be placed into the context of the physical distribution system. [Note: Reference is made to the commercial system to recognize that additional interactions exist. These include environmental, political, recreational, and community considerations, both as inputs and products of IFTs. Awareness of these elements establishes the IFT as an open system (not self-contained or closed) and points to another area that requires analysis.]

System Goals and Standards

As expressed at the outset, intermodalism is employed to improve the physical distribution performance of freight movements in situations in which the attributes of two or more transportation modes are necessary to accomplish the move or are desirable for efficiency reasons. The physical distribution performance considerations normally include time in transit, security and reliability of delivery, handling and administrative costs incurred by the users of the transportation services, and transportation charges assessed by the carriers.

The two measures that can most clearly be applied to the performance of the intermodal system as it relates to its physical distribution efficiency goal are described as

1. Throughput, which expresses the number of freight-bearing equipment units that pass through the system in a specified time frame [for rail and ship or truck and ship operations, the term used is the twenty-foot equivalent unit (TEU), which reflects the increments in which intermodal units occur; one wonders, however, if the 20-ft standard will survive the 1983 U.S. law that permits 28-ft double trailers on major highways; the change also raises questions regarding the systems effect of such a growth in the container and trailer standard], and
2. Transportation-related charges assessed system users (i.e., the total of inland transportation, handling, accessorial, and ocean transportation charges that apply to an intermodal movement).

Users understand their physical distribution costs to be time (and reliability) sensitive (the consistently quicker the delivery, the lower the interest charges, the lower the inventory requirements, and the higher the user's sales success). Transportation charges reflect, to some degree, the costs of providing intermodal services. Costs, in turn, depend on freight volume handled, shipment sizes, shipment frequency, level of service quality provided, technology employed, and compatibility and cooperativeness of the companion elements of the system. They are, therefore, variables that must be measured and managed in order to achieve the goals of intermodalism. From the transportation providers' side, it means an optimal balance of throughput and cost. System users, on the other hand, see the intermodal goal as an optimal balance of service quality and transportation charges, i.e., minimized physical distribution costs.

Infrastructure: The Economic Catalyst

Infrastructure is the group of facilities and services that underpin economic and social activity. Infrastructures catalyze and facilitate productive activity. Some examples of the infrastructure of any urban community are health services, communications, transportation, and electric power. For desirable quality of life, economic prosperity and growth, and cultural enhancement, infrastructure of a quality, magnitude, and scope to support them must be in place.

Infrastructural facilities may be provided by the private or public sector or by joint funding arrangements. Access to components of the infrastructure may be provided at zero monetary price to the user, at market price, or may be subsidized to permit access at a less-than-market price (2). Examples of each of these funding and pricing situations are given, and the effects of the diverse functions are assessed as the specifics of the infrastructural component of the intermodal freight system are discussed in more detail.

Intermodal Infrastructure

The infrastructure associated with the intermodal system of which the marine container terminal is a part is, in turn, composed of a set of supportive facilities and services. The aggregate of the intermodal subsystems is a part of the physical distribution infrastructure that functions responsively to a core of demand, which is the group of product storage, transportation, and delivery conditions placed on the product's supplier by its customers.

The infrastructural components are given in Table 1. Each major component is identified, and its supportive facilities and services are outlined. An example is subsequently employed to illustrate the concept and to suggest the system effects.

Table 1 is intended to be an exhaustive listing of the elements of the intermodal freight system and the infrastructural components that underpin each of the elements, but other observers, particularly those intimately involved with the system elements, will be able to add to the list. Those who design new systems or their elements, or evaluate those that now exist, will want an exhaustive list so that a comprehensive planning and design job can be done. The missing variables in the table are the quality, magnitude, capacity, and interactions of the items indicated. These dimensions are the ones that investors, planners, and designers attempt to define through their respective arts. My purpose is to suggest the character of the investment planning and design problem by emphasizing the system, public, and infrastructural dimensions of the problem. The remainder of this paper is meant to underscore some of the planning issues that should be taken into account in designing or redesigning IFTs.

QUALITY AND CAPACITY OF INTERMODAL FREIGHT SYSTEM COMPONENTS

Ideally, the total intermodal freight system will be designed as a unit. Those involved in planning and decision making can specify the design and operational character of subsystems over which they have direct control. The ability of outsiders to influence subsystems not under their control depends on their negotiating power. Nonetheless, the system will succeed best if the components are effectively integrated.

To illustrate, consider the hypothetical example of a steamship company that proposes to provide triweekly, large container ship service, one from each of three northern European ports to a major eastern United States port. The proposal hinges on a 40-ft channel depth being maintained and a 24-hr turnaround with a minimum 80 percent load factor in both directions. The steamship company notified port officials that the line will not pay more in port service charges than are current at any time at the port's two principal competitors, both of which are less-well situated than the port receiving the proposal.

This offer by the steamship company has potentially wide-ranging implications. Not only must there be the commitment to maintain the required channel depths, but there must be a marine container terminal with available berthing capacity and sufficient storage, equipment, and operating capacities to provide the throughput required to turn the container ship around in 24 hr. (Note: Terminals of the future, which would handle "pods" of containers by "six packs," should be considered. This would not only change throughput, but would affect the entire system.) The marine container terminal's storage capacity should be augmented by the sequenced arrival and departure of barges, railcars, and highway vehicles delivering and picking up containers in coordination with the container ship's arrival. Further, port-related costs assessed to the ocean carrier had to be pegged to that of competitive ports.

Customs services must be in place, as must facilities for handling and storing cargoes that must be "stuffed" in containers at the marine terminal. Documentation, communications, financial, and insurance services, as well as tugboat and pilotage services, must also be on hand to accommodate the time and quality needs of these high-cost, time-sensitive ships.

A large group of agencies and firms must respond to the conditions set--the U.S. Army Corps of Engineers for channel maintenance; other federal units, states, municipalities, and regional authorities where these government units affect locational, environmental, funding, administrative, and pricing decisions; and private firms that provide direct and support facilities and services. It is certainly in the steamship company's decision domain to initiate

Table 1. Infrastructure of intermodal freight system.

Intermodal System Components	Supporting Facilities and Services
Inland transportation system of modal alternatives in which highway trailers or containers are employed	
Motor carriers	Highways, bridges and tunnels, interchanges and access roads, vehicular control systems, freight and vehicle handling facilities, communications, and control systems
Railroads	Rights-of-way, bridges and tunnels, train and car processing yards, freight handling facilities, communications, and control systems
Barges	Inland waterways, docking facilities, locks and dams, control systems, communications, and navigational systems
Ocean transportation capability to transport highway trailers and containers: steamships and ocean-going barges	Tugboats, navigational aids, and communications
Ports	Pilotage, channels, navigational aids, safety, tugboats, cargo handling facilities, recreational facilities, customer-related agencies and firms, financial institutions, chandlery and repair capability, communications, turning basins, breakwaters, control system, insurance adjustment capability, health care delivery, storage and bonded warehouses, anchorage, air and surface passenger transportation, brokers and forwarders, firefighting, and bridge locations and clearances
Intermodal freight terminals	Access to principal modal rights-of-way, container and trailer loading and unloading facilities, storage areas, control systems, communications, maintenance and repair facilities, processing capability, security, piers and other berthing structures, container lifting gear, trained personnel, heavy lift gear, freight handling structures and equipment, vehicle and equipment maintenance, closed and open storage for cargo, location with respect to cooperating modes, and accessibility to major inland routes and sea lanes
Companion terminals' intermodal freight system[a]	Similar supporting facilities and services as listed under intermodal freight terminals

[a] Companion ports represent constraints on the system, thus influencing the design, capacity, and performance of the remaining system elements. For example, the lack of lift capability or adequate depths at berths in certain ports may dictate the use of Ro-Ro or LASH ships at the origin and destination ports. This imposes the need for Ro-Ro ramps at the unconstrained intermodal terminal or, if depths are at issue, the need for LASH handling capability. In either case, investment, capacity, and performance for the system are affected (3). For a view of port characteristics and hinterland issues (such as road capacities that might limit container sizes and weights), a helpful compendium of ports and their characteristics is available (4).

and sustain the proposed service, but only if it is supported in its decision by its companion elements in the total intermodal freight system. And yet, what types of negotiating power can it bring to bear to gain the required support?

The answer comes principally in terms of incentives offered to those who provide the services and facilities or influence those who do. If sufficient employment and investment benefits to the region (state and so on) are anticipated, decisions with a political component can be influenced. If the expectation of acceptable profitability can be tied to the required facilities and services provided by the private sector, those facilities and services will be forthcoming. [Note: Suggestive of a port's interest response to infrastructural barriers to profitable business is the action of the Philadelphia Port Corporation, a quasi-public organization charged with developing, constructing, managing, and marketing the Port of Philadelphia. The Port Corporation is funding track and tunnel clearance improvements for the Consolidated Rail Corporation (Conrail) and the Chessie System. Historically, oversized loads have been excluded from the port. With the improvement, it is expected that the port's potential will be greatly enhanced. Because of the spill-out benefits, the Philadelphia Port Corporation has chosen to underwrite the risk (5).]

Loadcenter Concept

Sufficient cargo must be available to the port to justify the volume requirements of large container ships. To comprehend the significance of this volume requirement, certain aspects of the technology and economics of container ships and their operations must be understood. Specifically, because of the significant costs per day of owning and operating large container vessels, and their great potential for generating revenues as each trip segment is accomplished, such vessels are most efficiently employed by operating from a single origin port to a single destination port. There are significant economies associated with container ship size. These scale economies spill over onto the requirements for correspondingly large-scale marine container terminals (6).

The result is the development of the loadcenter concept, in which containerized cargoes originating from (and destined to) very wide regions are focused on a single origin port (and destination port) so that frequent, direct sailings can be achieved. This assumes that the efficiencies gained for single port container ship operations are not overwhelmed by the higher inland transportation costs, the possibly higher shipment delay costs (taking into account costs at both ends of the movement), and the higher costs imposed on other parts of the infrastructure. Physical distribution performance, in other words, should be improved rather than impaired. Other planning questions that should therefore be asked, and answered, are as follows:

1. What are the scale economies (or diseconomies) of the companion elements to the large container ship?
2. Are there joint positive or negative effects on any of the intermodal freight system's infrastructural components from the presence of other types of demands on those infrastructural components (e.g., does bulk cargo shipping or use of rails and rail yards for domestic container and other traffic improve the quality of rail service, or does it cause congestion)?
3. If bottlenecks or other infrastructural inadequacies in the system exist, how should they be dealt with? If added investment is called for, who decides and who pays?
4. If physical distribution performance affects port choices made by shippers, which variables influence that performance? Also, what factors influence carrier choices of ports on which to concentrate services? How should the affecting variables be weighted?
5. What are the determining factors in shippers' and carriers' port choices (i.e., tradition, regulations, or convenience)?

Responses to these questions will emphasize the implications of the design and operation of complex systems that are further complicated by the condition in which the system components are under the control of separate decision makers. Further, the circumstances occur in the changing contexts of technology, markets, economics, politics, and geopolitics. Any large-scale investment problem is difficult, particularly if it is risky. The ensuing discussion suggests a way to characterize and approach the difficulties.

The term scale economies has two dimensions. First, the term defines the threshold of demand that must be projected in order for a facility or service to be offered in a market. Second, it describes the influence that changing levels of activity have on the unit costs of operating the facility or providing the service. To justify the construction and continued operation of a ramp-style rail piggyback terminal, for example, railroad decision makers, according to Beier (7), must be able to predict a minimum of 10,000 lifts/year. Minimum costs are estimated at 20,000 lifts/year, with costs rising quickly beyond that volume. Mechanized terminals are reported as having threshold volumes of 20,000-30,000 units/year, with minimum cost levels for small mechanized terminals at 40,000 units.

With such data in hand for waterborne container operations (8), the impact of three large container ship arrivals and departures per week (which amounts in our hypothetical example to 7,500 TEUs arriving and an equivalent number departing the port) can be projected. Can the current system tolerate the additional volume? Can new or improved facilities now be justified? What effects would the new volume have on unit handling costs at terminals and other facilities? Will costs increase or decrease? Will congestion occur at certain facilities? What are the time and dollar costs of such effects?

Determinants of Port Choice

Shippers or consignees have the right to specify port, carriers, and methods of transport. However, inland carriers can influence these choices by advice, price, and service quality provided between inland points and the various ports. Ocean carriers may influence choice by restricting their service to specific ports or by providing through rates between origins and destinations. This is a central issue in evaluating and dealing effectively with the loadcenter concept.

What variables affect user choice of carriers and ports? Because of the influence that carriers have over user choice, the more important question is: What variables affect inland and ocean carrier port choice? If a carrier chooses to offer preferred service and price levels at one port, this may limit or even foreclose the options available to users. For example, twice-weekly sailings and favorable rail rates involving port X with respect to much of port Y's hinterland forecloses port Y as a choice to those shippers, particularly if, at the higher rate, port Y has only weekly sailings. This allows port X to encroach on port Y's natural market area.

The length of the time intervals consumed by intermodal freight system components, and by the system as a whole, is determined by the following characteristics of the components:

1. Quality--location (in terms of accessibility to and distance from other interacting facilities), technology, state of repair, and design;
2. Capacity--potential for accepting, processing, holding, releasing, or transmitting the volume levels or unit types involved;
3. Control--efficiency and responsiveness with which the system component, given its quality and capacity, is operated;
4. Coordination--ease and speed with which system elements achieve their required interactions or transfers of functions from one element to another; and
5. Integration--formal or tacit organization plan (including communication links) through which system elements interact to facilitate coordination.

The extent to which inland carriers, marine terminals, and other private-sector elements of the intermodal freight system possess various levels of these characteristics depends on factors such as capital availability, investment alternatives, managerial proficiency, communication situation, facilities already in place due to historical traffic flows and transportation practices, and freight volume projections.

The characteristics of public-sector components of the system may be influenced by the same factors listed for the private sector, but other factors probably predominate. These include "pork barrel" investments, investments due to special-interest lobbying efforts, public interest concerns, and national security considerations. In fact, certain private-sector components of the system may directly or indirectly be affected by government for those reasons.

The system components' characteristics for both the private- and public-sector components are influenced--and perhaps determined--by the use of the facilities and services for diverse purposes. Volume thresholds for the financial institutions that provide services required by international trade would be different if it were not for the other uses to which their services are put. The same is true of highways, rail rights-of-way, port services, channel depths, and most other elements of the system.

The net effect of these influences and considerations is a group of system components with capabilities and constraints that represent efficiency-affecting, time-absorbing, and cost-creating functions in the intermodal freight transportation process. Does the resulting system function or can it be made to function within cost, capacity, reliability, and time standards that users require in selecting routes, carriers, and ports? If the system components can be created, modified, or organized to function acceptably in these terms (particularly those most influential in affecting the choice), the likelihood of loadcenter volumes being generated is greatly enhanced. And this is the "name of the game."

Correspondingly, the physical distribution infrastructure tends to rise where its historical and projected demands are greatest. Thus, the quality of the system that enables the East Coast port to make the volume and turnaround rate minimums will be, in part, the product of its past activity levels and the perceived long-term future demand levels on its services.

Cost Component

All of this appears to overlook the capital investment issues as they affect the investors in and operators of the components and, ultimately, the users of the system, as costs become reflected in transportation charges and, more broadly, in distribution costs. The quality and capacity of the components; terrain and spatial considerations; the durability of the facilities; the performance of the personnel who construct, operate, and manage the facilities; and, finally, the volume of activity calculated for and the actual activity of the system will be important cost determinants.

The problem of circularity is obvious here. The prices associated with the use of a system are an important determinant in attracting volume to the system. Conversely, the use level that exists on the system is a principal determinant of cost and therefore price. Circularity is resolved by volume forecasting; by marketing efforts to attract freight volumes (and qualities) to routes, carriers, and ports; and by risk bearing, in which investors commit capital to facilities and services in advance of actual dollar or nondollar returns.

Private investment in infrastructure is influenced greatly by public investment in cooperating facilities that are (a) installed for extra-economically (i.e., socially or politically) motivated purposes and (b) priced at levels that do not reflect the economic costs or demand conditions of the component. Where cooperating facilities of higher quality, higher capacity, and lower price than the market would provide are available, the tendency is for private investors to direct larger investments toward these projects than would be justified if the cooperating facilities were provided on purely economic grounds. Where this condition exists, user prices, tolls, freight rates, and so on will be lower than market-determined prices for the government-benefited components. Thus, additional demand can be expected to be attracted to the system.

The effects of these conditions are noteworthy. Theoretically, the extra-economic investment and pricing practices push the economy away from its economic efficiency position. In practice, favored routes, facilities, carriers, and ports are overused and benefit at the expense of those that fail to be favored. These outcomes are not a basis for criticizing the application of extra-economic criteria to investment and operational decision making. Consider, for example, the effects of the conscious federal effort to relieve the isolation and poverty in Appalachia through the Interstate highway program. The purpose of this discussion is to suggest the nature of the decision processes, influences, and relations that lead to the development and use of the intermodal freight system. Governments are often best equipped to promote the long-term, high-risk, high-cost investments for its jurisdictions (2).

An additional point, one that deals with the interaction of components, is that of subsidized investments and operations. The effects as well as the reasons for the subsidies are similar to those of other government investment and pricing practices. Subsidies, however, can be used to offset the effects of inadequate facilities, high-cost operations, disadvantageous location, distortions caused by regulation, and other reasons for underuse. Our hypothetical East Coast port could meet the container line's demands by subsidizing certain port use costs, and would be advised to do so if it were less costly than new investments or if it were laboring under disadvantages in some port selection criteria. Assume, of course, that the new sailings are sufficiently beneficial to justify the subsidy costs.

SUMMARY AND CONCLUSIONS

Returning to our hypothetical example, note that the array of considerations and options relating to the port in question in responding to the steamship company's proposal illustrates the nature of the system in which the IFT exists.

The central point is that the IFT is a component of a wider intermodal freight system (part of the physical distribution infrastructure, which is an even wider system). Because of the interdependence of the various components, the characteristics (quality, capacity, performance, pricing practices) of the IFT cannot be judged separately but must be evaluated in the context of the whole system.

The port's ability to respond affirmatively to the proposal of thrice-weekly container ship service requires a wide-ranging inquiry of system cost and service performance, projections of user volume, and response to price, performance, and promotional options engaged in by the port. It is also affected by the prospects of various levels of government affecting the system's costs and service performance by altering applicable rules, by investing in or underwriting a facility's improvement efforts, by subsidizing capital or operating costs of certain system components, or by subsidizing the users themselves.

Planning and evaluation where IFTs are involved are particularly troublesome areas. The investor, planner, and analyst are faced with the problem of hitting a moving target with a shaky weapon firing an unbalanced bullet. Uncertain demand, coordination requirements, shifting technology, and government involvement in the system are but some of the elements that make decision making in the intermodal area so difficult. In spite of this, the complexities must be taken into account in making decisions involving IFTs, and planning must be done.

The theoretical ideal solution to the problem is to merge all of the parties to the intermodal system into a single entity so that a single decision maker can balance all of the interests and arrive at an optimal solution. In a system of interacting elements, to optimize the system some of the elements are apt to have reduced rewards as a consequence of an improved system outcome. Therefore, only a single firm can engross the net effect. Given the system of federalism, modified capitalism, and constitutional guarantees in the United States, this is not about to happen. We have to settle for an inferior solution. In recognition of this, planning at the highest level of professionalism is essential. Broad-based membership and participation by regional, interregional, and international authorities, which focus on information sharing and planning, appear to be the best substitutes to the single firm solution. Let competition among the carriers, ports, and so on continue, but bring them under the banner of complementary subsystems for the sake of efficiency and progress.

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