THE ROLE OF INFORMATION TECHNOLOGY IN TERMINAL DESIGN, PLANNING, AND OPERATIONS

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INTERMODAL TRANSPORTATION: A BRIEF HISTORY

Precontainerization

During the past 25 years the world of freight transportation has undergone a revolution, attributed to the introduction of the container and the changes that containerization facilitated. The most noticeable effect has been on turnaround time. Before containerization, ships would take weeks to discharge and load a few thousand tons of cargo of various shapes and sizes.

The packing cases and cartons in which loose cargo would be packaged for international delivery would be accepted at the port during a receiving period of up to 3 weeks. Many commodities had to be received and stored under cover in secure cages until the ship was ready to be worked. During this period it was possible for cargo to be handled many times.

This method of operating required large numbers of personnel and equipment. The diverse methods of loading and stowage applicable to each ship, and the complexities of planning stowage to facilitate sequenced discharge without crushing or other hazards, meant that even small ships would take several days to discharge and load. Even with this leisurely schedule, much cargo could still on board and even shipped before the paperwork could be completed and made available for the bills of lading to be banked.

Calculating costs was also time-consuming and complex. Freight and handling rates were based on algorithms of weights, cubes, lengths, and values, which necessitated inspections and checks to ensure accuracy. Information regarding progress only could be obtained from coopers or shed foremen, who carried most of the personnel and labor rosters in their heads.

The Container Era

The container revolution, which changed all of this labor-intensive process, occurred during the late 1960s and early 1970s, when the standard 20- x 8- x 8-ft freight container was introduced.

Many authorities site this single factor as the one in 25 years changed the customs, procedures, and practices that had remained almost unchanged for the previous 100 years. However, the introduction of the freight container may have been the initiating spark, but many other factors had to be in place for the revolution to take place.

It is my contention that the widespread introduction of information technology was an equally important factor in the container revolution and that the further evolution of containerized handling systems will be affected more by developments in information technology than by any other issue.

ROLE OF INFORMATION TECHNOLOGY IN THE CONTAINER REVOLUTION

The simple idea of standardizing external packaging to aid in loading and to minimize handling was initially thought by many in the industry to be limited in it application. For example, it was thought that any savings in handling would be diminished by the increase in cost of shipping the container itself. However, it was soon realized that massive cuts in landside and shipboard personnel could be achieved if the handling systems, berths, and ships were designed for containerization. These savings and faster turnaround would decease any loss of use on the ships. The economies of scale facilitated by the increased speed of handling and size of new ships were expected to produce massive efficiencies because a ship loading hundreds of thousands of tons could be loaded in hours rather than days. The results of these overall savings were so positive that millions of dollars would be forthcoming to build new ships, ports, and terminals in all major trading markets.

However, the increase in speed and efficiency brought about by container handling would produce little benefit to the lines or the shippers if the paperwork that supports the shipment was still processed in a conventional timescale and if information was not made available on prebooking, receiving, and loading.

The catalyst that changed the introduction of the container from an improvement into a revolution was the parallel development and introduction of information technology.

Although it has become physically possible to load the equivalent of five small ships into one container ship in a single day, this is achievable if the cargo from the areas previously served by these ships is consolidated and converged into a single containerized port. Equally important is the establishment of an information collection and distribution telecoms network that has systems and processing available to handle this new volume of data in a greatly reduced timescale.

Only through the use of information technology's power to plan, provide information, produce documentation, and manage and control processes can the increase in operational handling be matched by documentation and information-flow growth. This combination of improvement, resulting from containerization and the use of information technology, has yielded, across the intermodal industry, continuously increasing levels of productivity, savings, efficiency, and services.

INFORMATION TECHNOLOGY AND INTERMODAL OPERATIONS

Interdependence needs to be maintained between operational investment and performance and between documentation, systems processing, and information availability in order to maintain acceptable returns on investment. Potentially, there is a higher return on investment in the information technology area (given the continuous cost reduction of computing) than on an equivalent investment in operational equipment. These two areas of investment must be orchestrated to achieve optimal overall returns. For an example of information technology investment linked to operational spending, we could consider the gate house.

Gate processing time and terminal dwell times are often used subjective benchmarking measurements in choosing a terminal by shippers, forwarders, and lines. The terminal operator will monitor timescales from arrival at the gatehouse window until positioning under the crane. Whereas the terminal users will be more aware of queuing times outside of the terminal, the number of times their vehicles are sent to the "sin bin" (for incorrect or incomplete paperwork), and the number of reactive enquiries they have to make, due to the absence of a proactive information system. The terminal operator may consider added investment to staff or open additional gates at peak times in search of an optimal way to improve service, but, unless the systems are efficient, proactive, and capable of responding to increased volumes, the users may see the terminal operator's "improvements" as merely a larger number of queues to choose from to wait in.

Alternatively, greater efficiency may be possible by improving the systems and system-response times. Improvement in procedures up and down the transaction chain can produce savings by reducing duplication. Provision of accurate and timely information by one party is observed as a qualitative service improvement for all parties who use or benefit from this information. Other examples may be generated by the changes brought about by new trade agreements which reduce the need for customs and regulatory inspections at ports.

Faster and cheaper computing has facilitated the development of fully automated handling, which has, in turn, promoted designs of new equipment and techniques. To use these techniques, information to optimize terminal operations must be available on an as needed basis and in an appropriate, usable form.

Ports and terminals are now often the first and only places where cargoes for a single consignee (carried by various operators) actually come together before going out to direct delivery. Therefore, the role of the port and the terminal as information and service providers has generated investment in added-value operations and information-technology services.

Techniques already developed for: express industries, supply-chain management, information data-base businesses, banking, teleselling, and retailing, can be used to the advantage of the intermodal-freight industry.

The vision industry leaders demonstrated during the past 25 years has been matched by the leaders of the information technology industry, who strive to understand the industries they serve and develop new technologies that facilitate faster processing of existing routines in order to gain more power at a relatively low cost and more flexibility in data capture, handling, and management techniques.

INFORMATION TECHNOLOGY DEVELOPMENTS OF RELEVANCE TO INTERMODAL OPERATIONS

Power, Price, Performance

The development of the 64Bit process has cost-effectively provided the power to facilitate and enable even extreme visions of information and systems improvement in the international intermodal freight industry.

Distributed Computing

Client-server computing and the ability to reengineer the business process without throwing away current systems investment, as related to multimedia data capture and storage:

- Image—data capture and storage by laser scanning (e.g., handover agreements);
- Video—damage control systems;
- Voice—yard reports, stock audits, and container inspections;
- Hand held—pen based, mobile, container inspections;
- Modeling and simulation preplanning using graphically user interfaces—bay + yard planning;
- Decision support—planned/preventative maintenance engineering;
- Scheduled operations—glide path and vessel traffic management systems;
- Wireless, mobile communications, and geographical information systems;
- Wireless location and control systems for equipment, containers and infrastructure management, and asset management;
- Document management and automated work-flow support systems—centralized bill of lacking production;
- Communications—integrated ship/rail/road/ interchange planning via shared networks;
- Information data bases—real time proactive qualitative and quantitative monitoring and reporting systems;
- GSM/tagging, track, and trace, positioning, and location monitoring; and
- GIS as part of terminal development planning.

All of these technologies need to be evaluated as part of the development planning or capital investment programs. Intermodal operators need access to these references and the technology behind them in order to evaluate the relevance to their business. The information technology developers also need exposure to your ideas, to hear your views, understand your business objectives and share your ultimate visions so that the products and services you will require can be developed and be available at the time you need them. This seminar, with its presentations, interactive sessions, and ongoing contacts and debates, presents a significant opportunity in the facilitation of this process.