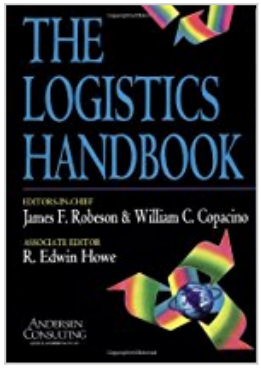

Logistics Handbook

By James F. Robeson

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"The Logistics Handbook" encompasses all of the latest advances in warehousing and distribution. It provides invaluable "how to" problem-solving tools and techniques for all the ever-increasing logistical problems managers face-- making it the most complete and authoritative handbook to date. Special features include: The most in-depth coverage of a wide range of topics, including information systems, benchmarking, and environmental issues Contributions found nowhere else from the leading executives, consultants, and academics in the field, such as C. John Langley, James Heskett, and David Anderson State of the art graphics Information-packed appendixes of logistics publications and organizations This all-inclusive reference will enable the next generation of managers to thoroughly integrate their logistics operations at all levels-- strategic, structural, functional, and implementation-- into a comprehensive logistics strategy.

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Editorial Review

Chapter 1

Evolution of the Integrated Logistics Concept
Bernard J. La Londe

One of the challenges in writing on the subject of "evolution of the integrated logistics concept" is trying to decide where to begin. To be sure, logistics was an integral part of warfare dating from the dawn of recorded history. The ability to move people, machines, arms, and supplies was an important determinant of the winner and loser in early conflicts and remains so today. In a book on the Gulf War, it is noted on the first page that U.S. forces planned, moved, and served 122 million meals during the brief engagement -- a task comparable to feeding all the residents of Wyoming and Vermont three meals a day for forty days. There is a long and illustrious history of logistics as an element of both ancient and modem warfare. One view of the derivation of *logistics* is that it comes from *logistique,* the title given to an officer in Napoleon's army responsible for quartering the troops and finding forage for the horses and other animals.

The importance of transporting products from their point of production to their point of consumption is also well documented in historical files. Applied logistics probably began when early cultures found that, because of a refined expertise, one community produced excess quantities of certain goods such as arrowheads and another community downstream could make better goods of another sort, such as pottery, because of access to better materials. Thus, applied logistics began with the inception of trade. In a more contemporary context, the industrial revolution and the advent of the mass production and mass consumption economy heralded the beginning of mass distribution in the industrialized countries of the world. As early as 1915, the two functions of marketing were identified as demand creation and physical supply. With urbanization and scale economies in the factory, the buyer and the seller grew further apart and it was necessary to bring the goods to the buyer. Specialized middlemen and transportation services emerged to serve this growing need. The task of the seller was not only to make and sell the product but also to deliver it to the buyer. In the early days of the United States, this often meant serving a buyer at a great distance without the benefit of roads or regular delivery services or agents.

The purpose of this introduction is to present a view of the "evolution of the logistics concept." As noted in the earlier discussion, distribution -- or logistics -- was recognized as a vital business process from an early time. However, during the past three decades, logistics has evolved considerably. This introductory chapter traces that evolution by addressing three questions:

* What is integrated logistics management?
* Why did the issue of integrated logistics (distribution) become important?
* How has integrated logistics evolved over the past three decades?

Executives and managers should be familiar with the history of integrated logistics management, for the history is enlightening and useful in today's business environment. Integrated logistics management did not develop by accident; the fundamental reasons for its evolution are as valid today as they were at its outset and can provide lessons and frameworks for tackling new challenges.

Integrated Logistics Management

The very definition of integrated logistics management is difficult and complicated by the fact that there has been a broad-based shift in business terminology during the past decade. When management first became interested in the potential of material flow to reduce cost or increase service, the term commonly used was *physical distribution.* The use of this terminology began in the 1920s and was adopted by post-World War II business management. In 1948, the American Marketing Association defined physical distribution management as "The movement and handling of goods from the point of production to the point of consumption or use."

Figure 1-1 identifies the distinction between various approaches to integration in the materials flow process. These distinctions were presented early in the development of physical distribution management theory to show the three basic approaches. The first approach, *physical distribution,* focuses on the flow of outbound finished goods. The second approach, *materials management,* is best described by Dean Ammer:

That aspect of the industrial management concerned with the activities involved in the acquisition and use of all materials employed in the production of the finished product. These activities may include production and inventory control, purchasing, traffic, materials handling and receiving.

The third approach, *business logistics,* encompasses the total material flow process from raw material through finished goods inventory. Here is an early definition of this approach:

A total approach to the management of all activities involved in physically acquiring, moving and storing raw materials, in-process inventory, and finished goods inventory from point of origin to the point of use or consumption.

In the relatively few short years since the logistics concept was accepted by major finns, department names for the function have quickly changed. Each year The Ohio State University conducts a study on logistics career patterns. The study indicates, as shown in Figure 1-2, that the commonly accepted distribution or marketing titles are giving way to reflect the new emphasis on logistics, which now accounts for almost one-third of logistics-related department names.

Over the past two decades there has been a broadening of executive responsibility for total material flow. Executive scope has been expanded to control functions that had previously been fragmented among separate departments, with little operational integration and even less attention from senior executives. Now, some firms regard logistics as a strategic function on a par with other major departments such as production, finance, product development, and marketing. Figure 1-3 shows the level of logistics responsibility by functional activity. The broadening of scope is demonstrated well by the changes in functional responsibility for international distribution. In the first Career Patterns study in 1972, international distribution management received a 9% response, whereas in the 1992 survey, 65% of logistics-related departments had international responsibility.

Thus, structural changes in business organization and a new focus on bringing value to the customer have created a range of adaptive behavior on the part of business firms. For forward-looking companies, integrated logistics management as a dominant material flow strategy emerged during the last half of the 1980s and the first half of the 1990s. Neither a single prototype organization nor a single set of performance metrics characterizes firms that have adopted integrated material flow solutions. Rather, in the early stages of change, the firms that have adopted integrated logistics management choose continuous innovation and improvement as their path to change.

Development of Integrated Distribution

Integrated distribution systems developed during the 1950s and 1960s. Four primary factors shaped the

development of distribution thinking during this period: scientific management, data processing technology, a customer focus, and profit leverage.

Scientific Management

By the end of World War II, large gains had been made in production technology that, in turn, renewed interest in scientific management of the business enterprise. In the post-World War II period, particularly during the late 1950s and the 1960s, there was increasing emphasis on the marketing function. During this period, the amount spent on advertising in the American economy quadrupled and the number of new products launched increased almost geometrically. Thus, by the mid- 1950s, businesspeople were in a situation where production technology was well advanced and marketing costs were steadily increasing. To reduce costs and remain competitive in the increasingly crowded marketplace, it was necessary to look to one of the few areas that was relatively untouched, the distribution costs of the firm.

In most firms, the cost of distribution represents from 10% to 30% of total costs. These costs, however, are diffused throughout the company. Some of the costs are incurred in inventory, some in materials handling, some in transportation, others in warehousing and storage, and so on. It is logical that this focus on efficiency in distribution was an outgrowth of the American business environment, for distribution was one of the last remaining frontiers for significant operational cost savings. The principal method of securing such cost reduction opportunity was to view distribution as an integrated task rather than as the many traditional fragmented tasks taking place in many parts of the firm.

Data Processing Technology

Another major precipitator of the "distribution revolution" was the advent of new technology in data processing. As computer technology became increasingly powerful, less costly, and more accessible, the possibility of automated inventory control procedures was realized. Distribution data generally require high-input, low-calculation, and high-output processing -- the type of processing that both management and workers prefer to automate, as it is time-intensive and tedious. The new technology contributed to the technical capability of handling large amounts of order and shipment data in a rapid and efficient manner. Computers allowed data to be entered once and reused for various purposes including order tracking, production scheduling, shipping, invoicing, and analysis. Data processing technologies reduced repetitive, error-prone manual data recording and manipulation work.

A side effect of the computer was its impact on total integration of management within the firm. Data processing caused some breakdown in the traditional departmentalization within firms and paved the way for integrated distribution management, which, of course, cuts across departmental lines just as data do. Undoubtedly, increasing levels of computer technology will continue to contribute to expanding information system applications in logistics problem-solving and operations.

Customer Focus

The 1950s and 1960s brought increased management attention to logistics, for logistics was recognized as important in providing customer satisfaction. Management finally began to realize that selling a product is really only half the job. Getting the product to the customer at the right time in the fight quantity and with the right logistical support (parts and service) is the other equally important half. There was increased recognition that marketing management could not have a successful sales and marketing program unless the logistics system provided adequate support.

Customer satisfaction and logistical support of sales were of particular importance for those companies selling relatively homogeneous products like chemicals, paper, and dairy foods. Such companies often

competed on the basis of efficiency in logistics, and their profits, in large measure, were determined by their success in effecting a sound logistics system. Of course, companies selling differentiated products like automobiles, pharmaceuticals, and clothing also found customer satisfaction and logistical support to be important, especially those in premium niches requiring great attention to detail.

Profit Leverage

Management also realized that there was significant profit leverage available from reduced logistics costs. As markets constantly expanded during the 1950s and 1960s, emphasis was on increased sales. As the tempo of domestic and international competition increased, a "profit squeeze" was reflected in the financial statements of many American firms. This prompted many firms to look for cost reduction opportunities along with market expansion opportunities in the previously untouched logistics area.

Evolution of Integrated Logistics Management

There are many factors that impact how a firm uses its resources to focus on strategic opportunities in the marketplace. Among them are external issues such as technology, globalization, and competition. There are also internal factors, which include management style, culture, human resources, and facilities. A firm must place its available resources against the more uncertain external resources in effecting strategy. Strategy, in turn, must leverage certain advantages that the firm has or feels it can achieve in the marketplace. Many firms have chosen to allocate resources to logistics as a strategy to gain advantage.

Those firms choosing to be in the forefront of the logistics concept development did not simply stumble upon "logistics" or distribution as a strategy. Rather, they reviewed alternative ways of bringing value to their customers and then decided that logistics offered more opportunity to impact value at the customer level than other business processes. Companies have pursued three general stages in their evolution into integrated logistics management: physical distribution focus, internal linkages, and external linkages.

Many firms do not even get to the first stage; or even if they do, they can be stalled for many years, depending on the combination of internal and external factors that play on decision-making processes of the firm. Thus, an explanation of evolution must not be viewed as a "biological" phenomenon that companies will naturally and automatically pass through, but rather as a characterization of change in the thinking of leading companies over the past three decades.

Underlying the stages of evolution philosophy is the concept that all manufacturing firms typically have three internal material flow loops. Figure 1-4 shows the internal loops as procurement, operations, and physical distribution. Procurement is the material flow loop that extends from the point of vendor location to the point of first manufacture (or perhaps reprocessing or simply repackaging). Operations is the material flow loop that extends from the point of first manufacture to a completed finished good. Accountants refer to material in this loop as work-in-process (WIP). Physical distribution is the material flow loop that extends from finished goods to the ultimate consumer.

Evolution of integrated logistics management is best framed in terms of inventory, because inventory represents 35% to 50% of current assets for an average company. This level of investment demands the attention of a firm's most senior executives and advisers. In a typical company, 30% of total inventory is in the procurement loop, 30% is in the operations loop, and 40% is in the physical distribution loop. Inventory was used as a buffer between the three internalmaterial flow loops and indeed was used as a buffer between the internal operations and the two flanking external material flow loops -- between the vendor and procurement on the inbound side and between physical distribution and the customer on the outbound side. The net result of this multiple inventory buffering was inventory turns (total unit flow ÷ average unit level) far below what could have been achieved if common inventory theory had been used.

Stage 1: Physical Distribution

Not surprisingly, the first stage, physical distribution, occurring in the 1950s and 1960s, focused on the 40% of inventory investment in finished goods. In this stage firms attempted to integrate finished goods transportation, warehousing, inventory management, customer service, and other functions directly related to delivering product to the customer. The focus of physical distribution management was to manage finished goods distribution in a way that met customer expectations at the lowest possible cost. So the firm's basic approach was to find the appropriate balance between costs and service (optimize the cost-service trade-off curve) with respect to customer requirements and the firm's resources. At that time, the National Council of Physical Distribution Management was active and carried both the title and focus that characterized this approach.

There were three reasons why the integration process started with finished goods. These reasons are still valid today for firms seeking to begin a logistics evolution. First, finished goods is the largest single segment of inventory to be managed. Second, because of its proximity, visibility, and frequent contact with customers, finished goods distribution most directly impacts customer service expectations and performance. Third, management of finished goods allows intervention in an important process without venturing into production processes or other powerful cost centers of the firm. That is, altering physical distribution management is a low-risk, high-gain endeavor relative to altering other functions.

The disadvantage of the physical distribution stage is identical to its primary advantage; it soon became obvious that managing finished goods dealt with only 40% of the total inventory commitment. Even if finished goods are efficiently managed, all the good work can be financially counterbalanced by poor management of either WIP or raw materials.

Although today's logistics concepts and practices are advanced beyond those of the physical distribution stage, managers must remain cognizant of the fundamentals that brought about the stage: focus on high-impact finished goods distribution inventories and operations, and careful monitoring and control of the cost-service trade-off.

Stage 2: Internal Linkages

The focus of the concepts in stage two, internal linkages, was an attempt to join two or all three of the internal material flow loops so that 60% to 100% of the firm's total inventory could be better managed. Logistics did not necessarily reflect an organizational change within the firm, but rather a change in the way the firm thought about value linkages across the three internal material flow loops. Developing internal linkages frequently entailed the elimination of buffer inventories between loops. The concept of inventory velocity was developed and embraced by practitioners of this business process. Thus, inventory flow was thought to be a process that involved horizontal movement of inventory and measurement of inventory from the time the raw material was delivered until an accounts receivable was recorded by the firm (a sale made and the product shipped). Prior to this time, most inventory thinking really involved *level* rather than *flow* of inventory. Pure economic-order-quantity (EOQ) thinking was supplemented by inventory velocity philosophies for many firms. At about the time this movement toward integrated logistics management began, around 1985, the National Council of Physical Distribution Management changed its name to Council of Logistics Management to reflect logistics rather than physical distribution thinking on the part of members. Most similar professional associations around the world did the same.

Stage 3: External Linkages

External linkages, stage three of the evolution, shifted the logistics concept to include externally focused change. Firms began to think "out of the box" and searched for efficiencies in relationships with vendors,

customers, and third parties. In many cases, external relationships began with one link, such as supplier-customer, and migrated to multiple links, such as vendor-supplier-customer. The extended view of enterprise offered firms an opportunity to think in new ways about bringing value to the customer. It also allowed firms to use new and/or improving technologies to manage the relational interface between themselves, vendors, third-party logistics support agencies, and customers.

The development of Electronic Data Interchange (EDI), Just-in-Time processes (JIT), Distribution Requirements Planning (DRP), and other elements of the logistics parlance appeared. Today, aggressive firms are able to reduce inventory and improve value by expanding their concept of logistics efficiency and effectiveness to include elements outside the firm. For example, reducing inventory held at the inbound external linkage reduces a firm's costs because vendors reduce extra holding and handling expenses that ultimately get built into the price of raw materials.

Future Directions

There is ample evidence of two current trends that will significantly impact the practice of logistics management. The first trend is cycle-time-to-market and the second is supply chain management. Both will change the focus of what is now termed "logistics management" and increase corporate management's expectations of the logistics function.

Cycle-Time-to-Market

Cycle-time-to-market is variously interpreted in different industries and in different channels by different acronyms and titles. For example, it is becoming increasingly common to see considerations of JIT, Quick Response (QR), process reengineering, and other initiatives, some of which are even copyrighted such as "JIT II." Although these different words usually have different meanings as they are applied in the marketplace, a thread of commonality runs through all: the removal of time as a competitive factor. For example, time might be removed by reducing the design-build-ship cycle. The major difference in the terms for time reduction initiatives usually has to do with the segment of the total order cycle that is covered. For example, some approaches to cycle-time reductions involve virtually all processes and linkages including the vendor, the design process, the manufacturing process, and the distribution process. However, other approaches simply focus on a single element such as transit time from the end of the production line to the customer or vendor lead times.

Organizational structures among leading-edge firms are being redefined to focus on cycle-time reductions and process step eliminations. Many business firms are attempting to promote cycle-time approaches to developing competitive advantages and bring new values to customers. These firms must integrate and manage this extended process, both internally and between themselves and their customers. To capitalize on these opportunities the logistics manager must stand ready to build a boundary spanning consensus across the traditional functional "stovepipe" alignments of the firm. The elements required for success are new skill sets, new organizations, new information systems, and new sets of corporate performance measurement metrics within the firms and at the firms' interfaces with suppliers, third parties, and customers.

Supply Chain Management

The second and related trend will also impact the practice of logistics management during the last half of the 1990s and on into the twenty-first century. A growing number of companies are using the term *supply chain* to describe a process whereby both internal and external units are forged together to bring low-cost and high-value performance to the consumer. The supply chain concept is related to the cycle-time concept in that the firms that develop a continuous flow inventory system frequently do so with a limited number of primary accounts, often using third-party logistics support agencies.

Thus, implementation of a cycle-time-to-market strategy may result in a focused implementation of a supply chain management strategy. The movement toward more responsive inventory systems, especially for primary accounts, will lead many firms to reorganize according to supply chain management. An increasing number of *Fortune* 500 firms have managers with "supply chain" in their official title. Usually, these managers design, develop, and maintain a set of relationships both within and outside the firm (between the firm and vendors, third parties, and customers) capable of executing the overall corporate strategy. As organizational restructuring continues, traditional logistics organizations will evolve into organizations that design and manage internal and external supply chains.

Supply chain management presents a whole new range of career options for individuals who select logistics as the foundation of their management careers. The ability to manage *between* functions will become as important as the ability to manage *within* a function. The ability to develop a consensus across function groups will become more important than the traditional functional management skills. Also, the ability to manage across national borders may become more important than the ability to manage in the home country.

Whatever the future holds, it is certain that logistics managers will not blindly follow past patterns and restrict themselves to past practices. Rather, firms, executives, and managers who have an understanding of the past can adapt successful strategies to new situations and avoid previous errors. The future will undoubtedly present a range of opportunities, both domestic and global, that will challenge the energy and creativity of even the most progressive firms and the most intrepid logistics executives.

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