

**RETHINKING CONCEPT FOUNDATIONS  
IN LOGISTICS MANAGEMENT**

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The logistics discipline in recent years has struggled to gain proper identification of its role in business activity. Logistics research over the past twenty years has substantiated the discipline's growing importance by highlighting its strategic role in the decision-making process as well as in the organizational positions that senior logistics executives hold in business today.<sup>1</sup> However the business and academic communities' further understanding of the role that logistics plays becomes clouded by the many linkages that exist with other related functional areas of the organization. These linkages tend to cause confusion over the role and scope of logistics. A more fundamental issue is defining the concept foundations of logistics as it evolves and its relationship changes with the other functional areas of business.

This article reviews the major issues that are necessary to "rethink" how logistics concepts have been developed and classified in the past, and how they might be developed and classified in the future. To accomplish this, a new approach to structuring the basic concepts of logistics is introduced that supports expanded logistics applications. This article proposes a concept structure that will expand managers' breadth of knowledge to guide future logistics decision making, and presents a framework for the organization and classification of logistics concepts and foundations.

### CONCEPT AND THEORETICAL BASIS

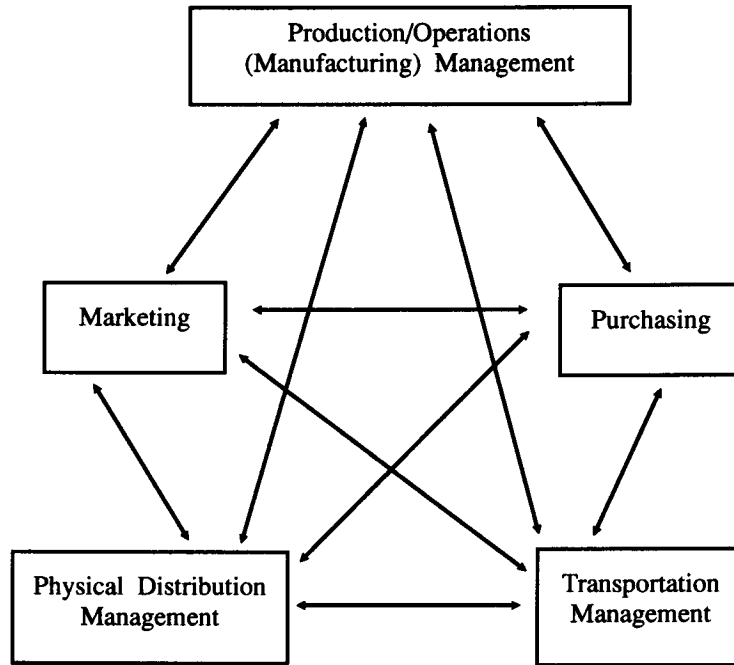
In the 1980s the logistics discipline witnessed a dramatic change in scope and direction. These changes generally followed the direction hypothesized in the 1981 A. T. Kearney study that introduced the three stages of logistics development.<sup>2</sup> These three stages emphasized the increasing integration of logistics activities throughout the firm and channel. While the concept of channel management is not new to the logistics discipline,<sup>3</sup> it only now is beginning to receive significant interest and treatment from academics and practitioners alike. This expanded philosophy is reflected by name changes in such related professional organizations as the Council of Logistics Management (formerly the National Council of Physical Distribution Management) and the American Society of Transportation and Logistics (formerly called the American Society of Traffic and Transportation).

When viewed from a channel perspective, it is possible to view the commonalities among all of the activities involved in two dimensions (see Figure 1). The first dimension includes the physical activities that are required to create the form, time, place, and quantity utilities of customer need. Therefore, the physical activities of creating the product or service (i.e., manufacturing or operations), and moving (i.e., transportation) and storing the product or service (i.e., physical distribution) contribute to creation of these utilities.

The second logistics dimension includes the transaction activities (behavior and information flows) that follow or initiate the physical activities previously presented.<sup>4</sup> These transaction activities provide the linkage between the organizational functions of marketing and purchasing that initiate the transfer of possession utility between the seller and buyer (see Figure 1). These specific activities include transaction negotiation (i.e., interaction between firms through purchasing of inbound materials, supplies, and products, with the marketing of outbound goods), and order cycle management (i.e., the management and control of information flows necessary to create customer service in the channel). Developing linkages across these traditional disciplines requires consideration of the common activities or processes between production/operations management (manufacturing), physical distribution management, and transportation management. In addition, common concepts and processes must also be established for the transaction activities that link purchasing and marketing as presented in Figure 1.

FIGURE 1

DISCIPLINE INTEGRATION OF LOGISTICS MANAGEMENT



Therefore, the study of logistics must include a definition that can provide a common understanding of the nature of the discipline and of the processes used to provide concept linkages. Logistics in this conceptualization is defined as the following:

Logistics involves the creation of time, place, quantity, form and possession utilities within and among firms and individuals through strategic management, infrastructure management, and resource management with the goal of creating products/services that satisfy the customer through the attainment of value.

This definition gives logistics, at all levels in the channel system, the central responsibility for attaining customer satisfaction by providing products or services that are valued by the customer. Therefore, logistics as a concept within each organization in the channel must influence both the operational functions that add form, quantity, time, and place utility to customer value, as well as the transaction activity between marketing and purchasing, which adds possession utility to customer value. Therefore this definition of logistics is applicable to raw material suppliers, manufacturers, distributors, retailers, consumers, and such service providers as transportation carriers.

Within this expanded scope of logistics it becomes necessary to understand the common processes that provide linkages between these different applications throughout the channel system. Therefore a basic understanding of processes is necessary to expand the understanding of logistics. Pearce defines a process as "an identifiable flow of information through interrelated stages of analysis directed towards the achievement of an objective."<sup>5</sup> While this definition provides an understanding of behavioral or information-based decision processes, it also provides a basis of understanding for the physical processes that occur in logistics activities.<sup>6</sup> Based on the work of Pearce, a process must have four common properties. These properties include (1) a set of concepts or activities that have interdependent and interactive components, (2) the components must take place in a sequence, (3) the flow of the process must be based partly on information gained from a feedback system, and (4) the process must occur in a dynamic environment.<sup>7</sup> Therefore, from an academic perspective, an understanding of the common logistics processes throughout the channel is necessary to advance the discipline and expand managerial thinking in the future.

From a managerial perspective, it is necessary to restructure logistics concepts and eliminate the narrow functional focus of previous logistics thinking. This minimizes functional optimization in decision making that results in firm and channel suboptimization. Two primary changes are necessary to reduce this functional focus. First, there is a strong need to reduce the perceived functional barriers of the organization, including the barriers created by the logistics, manufacturing, and marketing disciplines. Therefore, managers must make decisions for their businesses without these organizational boundary constraints and the territorial protection measures that accompany these constraints. Second, managers must think of logistics from a process perspective rather than an applied functional perspective. In other words, managerial problems must be viewed from their position in the process and solved either as part of the process, or based on similar process applications that are used in other logistics environments. These changes will lead to a better understanding of the underlying processes and systems that comprise logistics management, as well as provide a more unified framework for future integrated thinking of logistics as a discipline.

#### A CONCEPTUAL FRAMEWORK OF LOGISTICS MANAGEMENT

Traditional definitions of logistics have focused on functional activities (e.g., transportation and warehousing). This focus is also reflected in the functional structure of most logistics organizations. The functional structure provides for easier accountability in firms. However, when the management of functions becomes the priority, the management of logistics processes (e.g., the order cycle) becomes difficult if not impossible.<sup>8</sup> The systems concept states that it is not the optimization of the individual variables that is important but the optimization of the system as a whole. This means that some individual variables, or functions, must be suboptimized so the logistics system and channel system are optimized.<sup>9</sup> A functional approach is not consistent with the systems approach because many times functions have conflicting goals or are measured on how they perform and not how they contribute to the whole. The systems approach, or process approach as this research will call it, is one underlying premise in the conceptual framework of logistics management (see Figure 2).



The second underlying premise of the framework is that there are certain management activities (process inputs and outputs) that are common across all logistics functions. It is the management of these common processes that is important and not the management of the functions. Managing systems and common processes are the keys that will allow logistics to add value to firm and channel outputs. The remainder of this section will discuss the various aspects of this framework.

### **General Structure of the Framework**

The entire framework is bounded by three separate but related concepts. Control systems, quality focus, and the environment are positioned as such because all three pervade both the firm and the channel and affect their operations.

There are six major categories listed vertically along the left side of the framework. They start very broadly at the top with a mission statement and become more specific with facility/organization management and organization/channel management at the bottom. The mission is the long term purpose of the activities of the firm and channel. Attainment of the mission in many cases is not completely under the control of the firm or channel because it is affected by the perceptions of the customer/consumer. (The term customer/consumer is used here to differentiate between industrial users and ultimate users; for the sake of simplification, the term "customer" will be used from here on to include all classes of users.) To achieve the mission, the firm and channel must have the objective of adding value to product and service attributes through a quality focus. The achievement of this objective is influenced by how well the three areas of general management—strategic management, infrastructure management, and resource management—are managed. Strategic management influences infrastructure management that in turn influences resource management. This horizontal relationship, along with the framework's vertical and diagonal relations, will be discussed in a later section of this research.

General concepts are the elements of general management; they identify the specific areas that managers must plan, implement, and control. These general concepts apply to the firm (facility/organization management) and the channel (organization/channel management). The term "facility/organization management" is used to refer to a single "facility" within a corporate channel or when all channel facilities are owned by separate companies (organization). From this point on, the terms "firm" and "facility" will be used to refer to this concept. The term "organizational/channel management" is used to refer to the channel system where

all members are owned by the same company as in a corporate channel (organizational), or when all members of the channel are separate companies (channel). From this point on, the term "channel" will be used to refer to this concept. The next section will present the concept of logistics channels.

### **Logistics Channels**

The term channels is widely used in the marketing literature to refer to those intermediaries and facilitators used to bring products to markets. Typical marketing channel members include wholesalers and retailers. Traditional marketing treatment of channels has been from a transactional/behavioral viewpoint.<sup>10</sup>

In logistics, the term "channels" also is used to represent those intermediaries used by a firm to deliver products to markets. Consideration of the term "distribution channels" in logistics has been used to refer to the operations of warehouses and transportation firms.<sup>11</sup>

Since the purpose of an intermediary is to add value to the output of a firm, there needs to be an integration of both the marketing and distribution channels into what can be called a logistics channel.<sup>12</sup> This integration would include all firms in the channel from raw material source to final customer and would treat the channel from behavioral, transactional, and operational viewpoints. The framework presented in this research implies the inclusion of the logistics channel concept.

The inclusion of logistics channels in the framework is important because logistics is an integrative concept. Logistics activities cross functional boundaries at several levels, including the areas within the traditional realm of logistics (e.g., linking transportation and warehousing), within the firm's functional boundaries (e.g., linking logistics with production and marketing), and between channel member boundaries (linking suppliers, customers, and third-party providers). Because of this integrative nature, logistics performance significantly impacts firm and channel performance. As such, the mission for each firm and channel must be to attain customer satisfaction.

### **Mission: Customer Satisfaction**

Many firms today would define their mission as the maximization of shareholder wealth or some other type of economic measure. Although this is a perfectly acceptable economic mission, the managerial mission of the firm is far more simple



to state: satisfy the customer.<sup>13</sup> In the short run, profits could exist without customer satisfaction. Take, for example, the instance of a dissatisfied restaurant patron who pays the check but vows to never return for another meal at the restaurant. In the long run, the achievement of customer satisfaction will result in profits. An economic mission, then, is a way to measure the achievement of the managerial mission; an economic mission is the end, the managerial mission is the means. Many firms are recognizing the important role that individuals play in creating customer satisfaction. These firms are making significant retraining investments to teach managerial processes that can be used to create customer satisfaction.

Customer satisfaction created by a firm and its channel are dependent on all members of the firm and channel working together to add value to some output. Expectations are set for each member and if not met result in the value created not meeting the customer's requirements. From a traditional viewpoint, logistics adds place, time, and quantity utilities (or values) to output. As such, firm and channel logistics is a key element necessary to satisfy the customer through the attainment of value.

#### **Objective: Value Attainment**

Value attainment occurs when the firm and channel create product and service attributes that meet the expectations of the customer and are perceived by the customer. Value is achieved by the firm and channel through a quality focus, i.e., give to the customer what is expected the first time and every time (quality focus will be the topic of the next section). Performing everything in the framework with a quality focus will result in the attainment of value.

The main trade-off is the cost of the value versus the customer perception of the level provided. Therefore it is very important that the firm and channel equate actual value and perceived value. Otherwise, a quality gap is created between the firm and its customers.<sup>14</sup> The more value that is added, the more it costs the firm and channel. Therefore, value attainment is based on a refinement of the total cost concept. The total cost concept, in its theoretical form, states that logistics decisions should be made that will result in the least total cost to the firm given a certain level of service. However, in its application, this concept many times omits the service aspect and becomes truly a total cost decision. Value attainment for the firm and channel occurs when logistics decisions add value to their output, in the perception of the customer, that is greater than the cost of adding that value.<sup>15</sup>

Value attainment also is based on the premise that logistics decisions should focus on meeting but not exceeding the value expectations of the customer. In some instances, however, it might become necessary for logistics to add more value than the customer expects, thus experiencing higher costs with little or no resulting increase in customer revenues. Take, for example, the situation where a firm must increase its service offering to match that of a competitor. If the increase in value added generates more revenue than the costs of providing that value, then the firm and channel benefit. If the extra value incurs more costs than it generates in revenues, then the firm and channel will not be attaining the desired economic goals.

Value added to a product by logistics is defined by time, place, and quantity utilities. This involves getting the right item to the right place at the right time in the correct quantity. Two other types of value—form and possession—are added to a product by manufacturing and marketing, respectively. The traditional definition of form value includes only those attributes added to an item through the physical alteration of combination of tangible inputs (e.g., the creation of a car by combining various components on an assembly or the creation of bread by adding heat to a combination of ingredients in an oven). Logistics also has an impact on the form of a product. The ability, or inability, to purchase and/or transport a desired raw material might require consideration of a substitute, thus changing the final form of the product. The design (e.g, strength and size) of the final product package might be affected by its ability to travel through the logistics system. So, this conceptualization alters the traditional definition of form value by stating that any activity that affects the final product adds form value; as such, it can be said that logistics contributes form value to the final product.

The traditional definition of possession value includes those behavioral and transaction attributes that are added to an item through the collection and dissemination of information to make the transaction possible. For example, market research is performed to determine customer needs for products; once this is done, advertising campaigns are devised showing the firm's desire and ability to meet these needs through the creation of products. At this point, the customer does not yet possess the product but only knows of its existence; marketing has made possession possible. Through the concept of physical distribution, logistics physically makes the product available for purchase by the customer. Logistics costs, along with quantity discount structure based on freight costs, will impact the final price of the product to the customer, thus affecting possession. With the product physically

available for the customer at a certain price, logistics has made possession a reality. This article refines the definition of possession value to include any activity that informs the customer and actually makes the product available for purchase. As such, logistics also contributes possession value to a final product.

As previously stated, place, time, quantity, form, and possession values can be added only by doing things right the first time and every time through a quality focus. Minimizing the addition of one of these values, while attaining the other four, will not result in customer satisfaction. Customer purchases are influenced by the relative value of the total package of products and services.<sup>16</sup> The quality of what a firm and channel do directly affects their value as perceived by the customer. The relationship between value attainment and quality focus is critical and is the topic of discussion in the next section.

### Quality Focus

There are two ways to view quality. First, there is the quality of conformance that measures how well a firm and channel conform to customer requirements. Second, there is perceived quality, which is an indication of the value that the customer believes is offered by the firm and the channel.<sup>17</sup> Managing logistics with a quality focus means looking at quality in both ways. The firm and the channel must focus its resources on doing things right the first time and every time as well as on making sure those things that are done are what the customer wants. For example, offering 100% on time delivery every time is not effective if the customer perceives quality to be high order fill rates or low damage rates.

Value is attained when conformance quality matches perceived quality. This "link" can occur only when all management activities and process within the firm and the channel perform in a coordinated manner with customer satisfaction as the ultimate mission. For this reason, quality focus spans the objective, general management, general concepts, facility management, and channel management areas of the framework (see Figure 2).<sup>\*</sup> Those are the areas that are under the control

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<sup>\*</sup>It is important to recognize that the quality focus refers to a management philosophy toward value attainment, not necessarily to the development of organization entities identified to have quality responsibility.

of the firm and channel that offer opportunities for performance modification. The ability to control an activity or process is critical in maintaining a quality focus.

### Control Systems

Many times control systems are equated with accounting systems because of their ability to collect data and measure performance. This is a narrow view and represents only a part of how this research defines control. Control is all of those *management* activities and processes that are used to assure that something happens in the manner that it was intended.<sup>18</sup> So, control is more than just measurement from an accounting perspective; it also requires management action based on those measurements.

Control systems exist in various forms. However, most control systems can be described as having the following common elements: environmental analysis, activity definition, establishment of performance standards with allowable variances, performance of the activity, measurement of activity output, comparison of standards with actual output, variance analysis, corrective action, and continuous monitoring.<sup>19</sup>

Control systems, then, should allow a logistics manager to determine whether or not customer expectations are being met, the causes of non-conformance, and the proper corrective actions to bring conformance quality and perceived quality back into line.<sup>20</sup> Value attainment through a quality focus is the end, control systems are the means. Only by being able to measure and manage the quality can value be attained.

Therefore "control systems" span the entire framework. Firm and channel control systems help in the attainment of value. From objective down through organization/channel management, the firm and channel have direct control; they can make corrections so that value is attained. However, customer satisfaction is under the control of the customer. Regardless of the level of conformance, the perceived quality is what drives customer purchases. This is the reasoning behind linking conformance and perceived quality. The dotted line between control systems and customer satisfaction represents the control that the customer has over the firm and channel. If the customer does not perceive quality, the firm and channel must do something to bring perceived quality and conformance back into line. Hence, control, in the form of customer purchases (which is feedback) is exercised by the customer.

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With the exception of the environment (which will be discussed later), all of those concepts that impact everything the logistics manager does in the firm and the channel have been presented. These issues provide the foundation necessary to address the activities and processes of logistics. The next portion of this article presents and discusses the managerial elements of the framework.

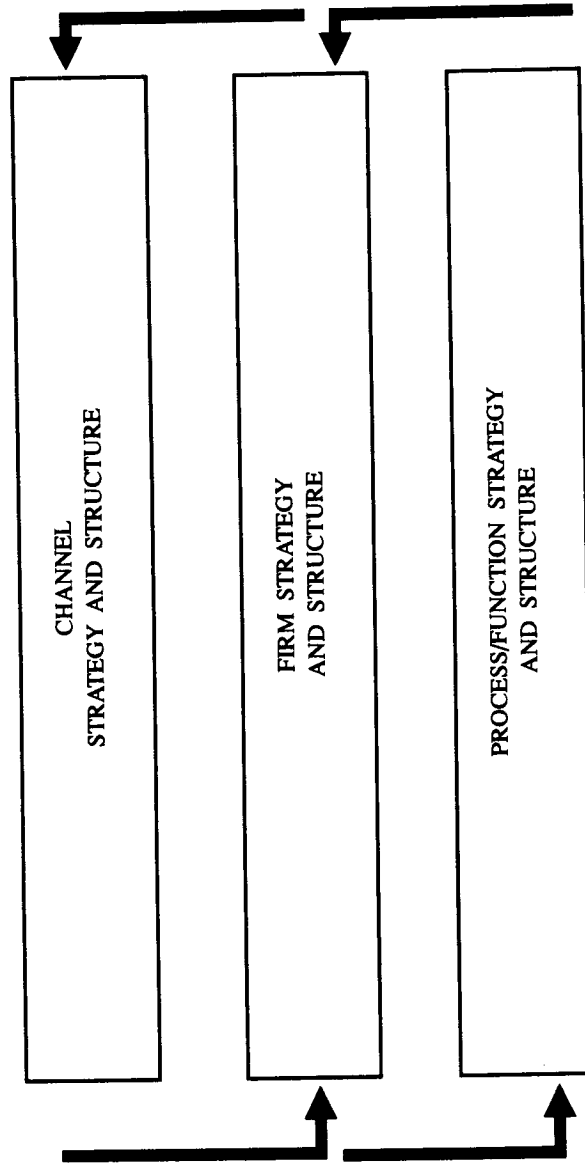
### **General Management: Strategic Management**

Traditionally, strategic management has been defined as a stream of decisions and actions that leads to the development of an effective strategy or strategies to help achieve corporate objectives.<sup>21</sup> Although it might be implied, this definition does not include the importance of structure in the development, implementation, and control of strategies. Structure can be defined as the design of organization through which the enterprise is administered.<sup>22</sup> The strategic management and organizational theory literatures have accepted the premise that structure follows strategy, i.e., the strategy is developed first and then the structure necessary to implement the strategy is designed. If the strategy-structure combination does not "fit," the strategy will fail and the firm will not maximize its financial performance.

In an attempt to recognize the importance of strategy-structure congruence to the firm and channel, strategic management is defined as the decision processes influencing the management of strategy and structure within the firm and the channel that link short term operational objectives with the long term mission of customer satisfaction. Two important elements of this definition are necessary to consider. First, this definition carries the strategy-structure relationship beyond the traditional boundaries of the firm. The strategy-structure of the channel influences the strategy-structure of the firm, which influences the strategy-structure of the process or function, e.g., logistics. The strategy-structure interactions at all levels in the channel must "fit" with one another so conflicts are eliminated and all participants of the channel are striving for the same goal. Figure 3 graphically represents this relationship.

Second, strategic management not only involves the strategy-structure concept but also the integration of other processes within the firm and channel for effective performance. Galbraith and Nathanson stated that the choice of organization form consists of a comprehensive design of structure, systems, and processes.<sup>23</sup> The framework offered for logistics in this research posits strategic management as the first general management area. This is done to imply (reading the framework

**FIGURE 3**  
**THE IMPACT OF STRATEGY AND**  
**STRUCTURE ON LOGISTICS**



horizontally) that strategic management means the correct fit between strategy and structure and the resulting management of capacity, movement, facilities (infrastructure management), people, and financial resources (resource management). These seven general concept areas must "fit" with one another at the channel, firm, and process or function level for customer satisfaction to be possible. The strategy and structure combination drives the management of capacity, movement, facilities, people, and finances.

### **Strategy**

The strategy a firm and channel uses will be unique and will be a reflection of the environment in which they operate. Strategies are as varied as are the definitions of quality. However, researchers have been able to categorize these various strategies into generic groupings. Porter identified three generic groupings for business strategies: low cost, differentiation, and focus.<sup>24</sup> Other research by Shapiro and Heskett identified three types of generic groupings that blended logistics strategy with corporate strategy: new product innovation, customer service, and cost leadership.<sup>25</sup> Recent research by Rao, Stenger, and Young has combined these two approaches to generic strategy groupings to arrive at three types of generic logistics strategies: cost minimization, value added maximization, and control/flexibility enhancement.<sup>26</sup> This approach is used in the conceptual framework for logistics.

A cost minimization strategy minimizes total logistics costs subject to some predetermined level of service. This approach also can be used to complement a differentiation strategy as long as the service provided by minimizing logistics costs does not erode the firm's or channel's area of differentiation. Value-added maximization also can complement the differentiation strategy of a firm or channel. This strategy adds value to the output of a firm and channel, giving that output a competitive advantage in the market. Control/flexibility enhancement would complement either a cost minimization or a differentiation strategy. This approach refers to a strategy that emphasizes the ability to make changes within established constraints, even at the expense of some obvious cost or value added benefits.<sup>27</sup>

Regardless of the type used, the strategies of the channel and firm must complement one another. Conflicts at this level in the framework will undoubtedly result in suboptimization for all members of the channel. Once all members of the channel agree on the strategy, structural issues must be addressed.



### **Structure**

Various studies have been conducted in the logistics discipline to analyze logistics organization structure. A 1980 study conducted by A. T. Kearney entitled *Organization of the Logistics Function* classified logistics organizations into three levels of sophistication.<sup>28</sup> A logistics organization became more sophisticated as it added direct line control over more logistics functional areas. A study conducted in 1989 by Michigan State University entitled *Leading Edge Logistics: Competitive Positioning for the 1990s* expanded on the Kearney research by asking how the functions are managed as contrasted to examining only how many functions report directly to the logistics executive.<sup>29</sup> The results of this research indicate that “no ideal model or model organization exists that fits all firms.”<sup>30</sup> Although increasing the number of functions reporting to a senior logistics executive should facilitate the planning, implementation, and control of integrated logistics activities and processes, this wide span of organizational control might not be necessary. More important for success is an understanding of the logistics concept by upper management and the development of information networks that link the various boundary spanning activities and processes.<sup>31,32</sup> In other words, it might not necessarily be the structure that dictates success, but the underlying concepts that hold it together.

Strategic management and organization theory includes various research addressing the strategy/structure interface. This literature also concludes that there is no model structure that applies in every situation. The choice of organization form consists of more than just structure; it also includes the choice of systems and processes that hold the structure together.<sup>33</sup>

Galbraith and Nathanson indicate that once strategy is determined, it is a combination of structure, task, people, reward systems, and information and decision processes that result in performance.<sup>34</sup> The purpose of these influencing factors is to integrate all the elements of the structure and give the participants an incentive to make it work. The framework includes these influencing factors under structure in intraorganizational functional integration (firm) and interorganizational functional integration (channel).

Intraorganizational functional integration represents those efforts made by a firm to make the structure work to fit the strategy. Coordination and integration of tasks (accomplished through information and decision processes) means that all areas within the firm are linked to one another and work with one another



without conflict, for the purpose of achieving a common goal. For example, the linking together of purchasing, transportation, warehousing, inventory control, and production planning by assigning tasks and developing an information network would result in coordination and integration of these separate functional (task-related) areas. Related to this concept of functional integration is the human resource structure as it is presented in the organization chart. Issues such as span of control, layers of management, and reporting responsibilities are included in this concept. Also included are the assignment of tasks to specific individuals. Intraorganizational reward systems are developed to offer incentives to employees to motivate performance. Reward systems also must complement the strategy of the firm; they must be structured to produce that type of behavior necessary to achieve the strategy.

Interorganizational functional integration represents those efforts by the channel to allow the separate institutions within the channel to work together to achieve a common goal. This includes determining which participants should be involved in the channel and what their respective duties should be, such as the selection of a contract warehouse to perform outbound consolidation tasks. Once the institutions are selected and assigned tasks, it is necessary to develop coordination between institutions. Just like coordination and integration must exist among tasks within a firm, they also must exist between firms so duplication of effort is eliminated. For example, a 100% quality check by a supplier on a shipment going to a buyer should mean that the buyer need not duplicate the check upon receipt. Another example would include making sure that shipments from a manufacturing facility to a warehouse are unitized on the appropriate size pallet. These decisions will be based on the structure of the channel and the coordination and integration of tasks. The level of integration, also decided by the "channel captain," refers to the nature of the coordination and integration between the channel institutions. For example, the relationship between a manufacturing firm and a public warehouse under a thirty-day contract is a short term and relatively unsophisticated integration process; the development of a strategic alliance between a manufacturing firm and a contract warehouse for a ten-day period requires more integration and sophistication.

The logistics manager impacts and is impacted by all of the elements contained in the strategic management area because of the boundary spanning nature of logistics and the importance of logistics to the achievement of strategy and mission. Once the strategy and structure are determined for the firm and channel, the logistics infrastructure necessary to implement the strategy must be designed and managed.

### **General Management: Infrastructure Management**

The infrastructure of a logistics system can be compared to the veins and arteries of the human body; the purpose of the system is to allow products, services, and information to get somewhere on time, at the right place, in the correct quantities. Just as with veins and arteries, the logistics infrastructure must be planned, implemented, and controlled with a certain capacity and a certain speed and regularity of movement to allow for products and services to get to and through the facilities where they are needed.

In this conceptual structure, infrastructure management is defined as those decisions concerning tangible and intangible processes that allow for the minimization or elimination of spatial and temporal gaps between sources of supply and demand within the firm and between firms. Logistics provides a service that adds value to a product by managing distance and time between a supplier and a buyer. In some instances, e.g., JIT (Just-in-Time) manufacturing, distance and time are critical elements of customer value. Regardless, the logistics manager must identify these spatial and temporal gaps to match the needs of the customer and the output of the logistics system.

#### ***Capacity***

Capacity decisions at the firm level determine the amount of product that can flow smoothly from receipt to shipment within a single facility. The type of facility can be a manufacturing plant, a warehouse, or an office handling freight bills. Node design involves the path the product will take through the facility and how large the facility will be. In a warehouse, for example, an efficient internal design involves straight line movements and ceilings high enough to permit multiple stacks of product. The more circuitous the path and the smaller the facility, the slower product will move through the facility thus reducing its effective capacity.

Once the node is designed, node inventory location should be decided. The speed at which product can be retrieved from within the warehouse and orders picked, for example, will impact the speed and thus the capacity of the warehouse to ship product to the customer. In an office handling freight bills, the location of previously received but unaudited freight bills affects the auditors' ability and capacity to audit.

Capacity also involves making sure that the node inventory levels are appropriate for the level of customer service required. This means having the correct amount

of inventory in the appropriate facility. For example, running out of inventory during a heavy customer shipment period can result in stock-outs and/or split shipments. This situation results in a reduction in effective capacity for that facility.

Capacity issues also must be considered in the channel. The capacity of a facility affects the capacity of the channel and vice versa. A comparison can be made between a channel system and a pipeline with the pumping stations of the pipeline representing facilities in the channel. The number, size, and location of these pumping stations affect the amount of product that can flow through the pipe itself. So it is with channel capacity decisions. Channel system configuration, i.e., number of facilities, location of facilities, and size of facilities, greatly impacts the location of inventories that affect product availability.

The capacity of the channel is also affected by different requirements planning methods. MRP (materials requirements planning), DRP (distribution requirements planning), and CRP (capacity requirements planning for individual facilities) all attempt to minimize the inventory level in the channel and also can determine which channel member will hold inventory, how long it will be held, and when it will be released.

As previously mentioned, facilities in the channel can be compared to pumping stations in a pipeline. Following on this analogy, the pipe itself can be compared to the links within a logistics system where movement takes place. As with the pipeline, facility capacity and the ability of the link to handle that capacity are inseparable. The movement within and between facilities is critical in the design of the logistics infrastructure.

### ***Movement***

Many times movement within a logistics system is thought to include only physical movements between facilities by transportation companies. However, logistics managers must consider many different types of movement. Movement within a facility through material movement and handling systems is critical to a facility's efficiency of a facility. Movement of inbound inventories to the production line or to storage and subsequent to the shipping process allows the logistics manager to manage facility capacity effectively and maximize customer service. Material movement and handling systems can be manual, automated, or a mix of both; this decision is dependent on the speed and volume of product to be moved through the facility.

Information flows follow physical flows within a facility. In many cases, the information will actually precede the physical flow, thus enabling the firm to reduce inventories and increase effective capacity. Many warehouses, for example, use on-line bar-coding systems to track inventories from receipt through storage to shipment. As with physical flows, information flows can be manual, automated, or a mix of both. The speed and volume of information to be moved will determine the type of system to be used.

Movement within facilities is preceded or followed by movement between facilities. These movements also are physical and informational. Physical flow movements are accomplished by the five modes of transportation plus third-part providers. The type of movement system designed between facilities will depend on the speed and volume of movement required; and also will affect capacity and inventories. For example, air movements will increase the speed at which product moves between facilities and will reduce the necessary inventories at the receiving facility, thus increasing effective capacity of that facility.

Channel system information flows between facilities are as important as the physical flows because of their impact on the speed and volume of movements and on the capacity of the facilities and the channel. In a JIT environment, information many times precedes physical flows and takes the place of inventories. Order processing and EDI (Electronic Data Interchange) linkages with both suppliers and customers allow logistics managers to make decisions concerning product movements. Customer research and promotion information allow the logistics manager to understand the product movement and volume needs of customers to make sure product gets to the right place at the right time in the right quantity.

Capacity and movement issues concern somewhat intangible aspects of the logistics system infrastructure. These intangibles are planned into the system through the utilization of the physical dimensions of the infrastructure referred to as facilities.

### ***Facilities***

Facilities span both infrastructure management and resource management elements of the model. As part of the infrastructure, facilities must be managed as an operation; as part of the resources, facilities must be managed as an asset. The discussion here will concentrate on the role of facilities in the infrastructure. A facility, whether it be a manufacturing plant, a warehouse, or an office, is made up of a series of processes. These processes begin with the receipt of a product

(e.g., a raw material, a finished good, or a freight bill), continue by adding value to the input, and end by sending it on to a customer. These operations processes are affected by many variables. Product volume might impact the type of process used (e.g., an assembly line) or the size of the process (number of freight bill auditors). Product variety might determine how many processes are to be used and how existing processes might have to be altered. Process flow refers to the nature of the flow through the facility. Many types of classifications can be used to distinguish among flows. One approach is the classification developed by Hayes and Wheelwright: jumbled flow process (job shop), disconnected line flow process (batch process), connected line flow process (assembly line), and connected flow process (refinery).<sup>35</sup> Note that although manufacturing examples were just used for the types of processes, these four types of processes can apply to any type of facility in a logistics system.

Process simplification uses engineering requirements and human resource requirements to make the process more efficient by reducing steps of making each step more productive. Postponement involves the decision to wait on process implementation until the last moment to add value to a product. For example, a warehouse receives flour in bulk in rail cars and then bags the flour for shipment based on customer orders. Dedication of equipment and facilities is an indication of the degree of flexibility built into them. Will the facilities and equipment be specialized or general purpose? What mix will result in the greatest asset utilization?

Processes also must be integrated between facilities in the channel. The design of the product could impact how one facility is required to handle the product. For example, a manufacturing plant produces a liquid in a plastic bottle that has a small diameter neck; this small neck specification allows the warehouse to stack the product only two pallets high. Therefore the product design impacts the operations of the warehouse.

Packaging interaction between facilities in a channel is another important variable in operations integration. For example, the type of exterior package used by the manufacturer might not coincide with the weight and size requirements of a wholesaler, or the manufacturer might be packaging six units per exterior package as its standard pack while the retailer requires ten. These small discrepancies between facilities in the channel can cause tremendous increases in channel costs and resulting decreases in channel productivity.

Product volume and product variety in the channel impact how each facility operates. The volume and variety flowing between channel members should be known by each facility to plan operations properly. For example, changes in volume or variety from a manufacturer to a wholesaler might require the wholesaler to add rack systems, change pallet patterns, or realign the use of inbound unloading docks. Not coordinating the volume and variety between facilities could result in various types of operational problems that ultimately result in customer service problems.

Functional postponement between facilities in the channel is considered to be the backbone of the JIT philosophy. Facilities in the channel do not deliver product to the next channel member until the last possible moment, thus postponing the addition of value until the actual point of customer need. Postponement decisions affect who holds the inventory and for how long.

Dedication of equipment and facilities in the channel is similar to that in a single facility. How flexible is the channel to respond to change and are the facilities specialized or generalized? For example, a grocery products manufacturer currently uses a non-refrigerated public warehouse for its products. If the firm introduces a new product that requires refrigeration, can it adapt the non-refrigerated warehouse to store the refrigerated product or does a new facility (refrigerated warehouse) have to be introduced into the channel?

Because processes are a series of actions with each successive action planned to add value, the integration of these actions into a coordinated system is critical to their success. This is true for a process within or between firms. Once a process is designed, it needs inputs in the form of resources for effective implementation. The next section addresses the concept of resource management.

#### **General Management: Resource Management**

In much the same way that traditional economists have identified the basic inputs for business, so has this research identified the inputs as facilities (land), people (labor), and financial (capital). Resource management can be defined, then, as those decisions and processes that allow the firm and the channel to allocate and manage productive inputs and assets that maximize their contribution to the firm and channel. Resources can be thought of as the “fuel” that runs the infrastructure in conjunction with the strategy/structure interface to achieve customer satisfaction.

**Facilities**

As mentioned previously, facilities are treated as both an operation and a resource. A facility, whether it be a single organization or a member of a channel, represents investment in "brick and mortar" that must be managed with monetary returns in mind. As an investment, a facility represents an opportunity cost to the firm and channel, i.e., it represents money tied-up that could be used somewhere else for possible higher returns. So, facilities must be managed for their tangible and intangible outputs and for their impacts on the balance sheets and income statements of each channel member.

**People**

Regardless of the logistics manager's position in the firm and channel, he or she must be able to manage the functional interaction that takes place between individuals. People must work with one another in an effort to achieve an outcome that will benefit the entire organization. Therefore, each individual in the process is treated as an "internal customer." These interactions between "internal" suppliers and "external" customers are influenced by many factors. Negotiation can occur at various levels and can be a formal or informal type of process. Informal negotiations take place between warehouse managers and traffic managers as to the choice of carriers to be used. Formal negotiations occur between plant managers and hourly workers over shift schedules. Negotiation in a business environment is a way of life; being able to manage it for the benefit of the entire organization is critical for success.<sup>36</sup>

Related to the process of negotiation are the concepts of power and conflict. Power can be exerted on a personal or organizational level and can be classified as reward, coercive, legitimate, referent, or expert.<sup>37</sup> The power-dependence relationship in a negotiation can influence its outcome. The logistics manager must be aware of the source and use of power in an attempt to maximize the output of human resource.

Conflict arises when two or more individuals have contrary goals or objectives. Negotiation can be used to resolve conflict; more important, however, is the ability to identify conflict and remove it successfully. The underlying systems concept of logistics has conflict as an inherent ingredient. Warehouse managers want to maximize warehouse operations at the expense of transportation managers who want



to maximize transportation operations at the expense of inventory managers. The goal is to remove these conflicts so logistics' and the firm's operations are maximized.

Coordinating people involves assigning certain individuals to certain tasks, determining the number of persons needed for these tasks, and developing joint objectives between logistics functions. The logistics manager must allocate these individuals in such a manner as to maximize the output of the people resource and accomplish the logistics goals.

Communication in logistics must be both vertical and horizontal. Horizontal communication occurs within and between the various functional areas of the firm. Vertical communication occurs between different levels in the organization structure. For example, it includes communication between logistics management and upper management. Communication also must be both top down and bottom up, i.e., there must be a free exchange of information among all levels within an organization. The transference of ideas and their development into action can only be accomplished through effective communication along all individuals in an organization.

An organization moves as its people do. A logistics manager has the responsibility to develop and train individuals so they can achieve their full potential. Firms often undertake asset improvement projects to increase the returns of those assets. Development and training are asset improvement projects for the people resource.

Interactions at the channel level are both behavioral and transactional, both of which are accomplished by people. As such, transactions and interactions with external customers must be managed. Each firm in the channel acts as a buyer and seller, depending on whether the reference is to inbound or outbound relationships. Buying and selling relies on mutually beneficial relationships developed between firms. These relationships are created, managed, and controlled by people through the transaction process. How these relationships work, or don't work, is determined by the behavioral characteristics of the individuals.

Many of the people characteristics managed within the firm also are managed within these channel relationships. Negotiation, power, and conflict must be managed between people in different organizations just as they are between people within the same organization. The establishment of a relationship between a manufacturing firm and a transportation carrier many times uses negotiation to resolve conflict and can be decided by the level and source of power.



Coordination includes the allocation of the appropriate persons(s) to establish, manage, and control a channel relationship. Personality, experience, and training are but a few of the characteristics that must be complementary between the individuals of the buying and selling firms. The logistics manager must be able to identify these traits and use them to help maximize the impact of the relationship on all members of the channel.

Effective communication links are important within as well as between firms. If channel maximization results in firm maximization, then communication between channel members to exchange information freely regarding firm and channel goals and performance is critical. Therefore, each firm in the channel must communicate to suppliers and customers their requirements and abilities. This latter type of communication is part of the firm's promotion.

All of these people elements interact to form, manage, and control behavioral and transactional relationships within firms and channels. Management of people is probably the most volatile resource with the potential for the largest return, if managed properly.

### ***Financial***

Capital is an essential resource for any firm or channel; it allows for the acquisition of facilities and people and it must be managed to maximize the returns it brings to the firm. Assuming that firms and channels are limited to a finite pool of capital investment, decisions will be made that allow for the "best" use of that capital. Decisions to build a warehouse, build a manufacturing plant, or acquire a private fleet are all based on the returns (both financial and nonfinancial) they might bring vis á vis other investment possibilities. As such, a logistics manager must understand and manage the financial aspects of logistics resources.

The decision to buy vs. make vs. lease is mostly financial in nature. The evaluation of such a decision uses cash flow, balance sheet and income statement impacts, future value, pay-back, and other measures to determine which method is best. All of these methods determine the effects of a decision on the firm's financial position.

Once a financial decision is made, the structure and source of funds must be decided. Many firms have policies dictating the source of funds for capital projects, e.g., debt vs. equity. The structure of the funding also will determine the source; selling shares to the public or acquiring a bank loan. Many times logistics managers

will not have input to the structure and source decisions because of corporate policies. However, when they do, they must understand the impacts of these decisions on the corporate financial position.

The financial impacts of logistics influence the transactions that take place between a firm and its customers. Logistics costs, impacted by people and facilities, will affect the costs of the firm and ultimately the pricing policies for the firm's output. The higher the logistics costs, the higher the firm's prices or the lower the firm's margins. The level of prices for a firm's output will certainly affect transactions with customers.

Logistics practices and costs also can affect discounts and special terms offered by the firm to its customers. Quantity discount pricing structures are greatly influenced by transportation costs; customers private fleet pick-up allowances are affected by the transportation and warehouse network of the selling firm. These special programs can influence the transactions between the firm and its customers.

Because a channel is made up of facilities and people, it too must be subject to financial evaluation. A manufacturing firm's decision to integrate vertically will influence its financial structure and must be subject to ROI (Return on Investment) evaluation. The use of a public or private warehouse as a channel member must be evaluated for its financial and nonfinancial impacts.

Logistics also can influence channel transactions through the granting of credit and the transfer of funds. These actions help to facilitate transactions between channel members by making the movement of capital from one channel member to another easier and more efficient. For example, the granting of credit by a wholesaler to a retailer for product and the electronic billing and payment attributes of EDI make the movement of product easier between channel members by making the movement of capital easier.

So, a logistics manager must possess the abilities of a strategic manager, an operations manager, and a financial manager in trying to add value to firm and channel output. Even with all of these capabilities, the logistics manager must still anticipate and adapt to unseen events that occur in the environment; these events can significantly alter the best laid plans.

**Environment**

Various types of schemes exist that try to classify the elements of the environment. No one system is better than another because the goal of each is to identify and classify those internal and external forces over which they have little or no control. Although the discussion of the environment in the framework is presented last, its analysis should be one of the first activities performed by the logistics manager. The classification scheme developed by Busch and Houston will be used for this discussion.<sup>38</sup>

**Individual Factors**

Logistics is a very "people" oriented discipline. As such, the personal and psychological characteristics of the individuals involved in logistics transactions will influence their outcomes. Common psychological factors identified in the literature that influence these transactions include values, motives, learning, perception, beliefs, and attitude.<sup>39</sup> Personal characteristics identified in the literature include age, sex, general physical condition, formal education level, and professional affiliations.<sup>40</sup> These individual factors will influence transactions within and between firms in the channel.

**Intraorganizational Influences**

The firm itself will greatly influence the manner in which logistics must be managed. Firm specific factors such as interpersonal influences, organizational technology,<sup>41</sup> organizational structure,<sup>42</sup> organizational goals and tasks,<sup>43</sup> organizational context, organizational climate, department goals, department communication, participant responsibility,<sup>44</sup> and department policies and procedures<sup>45</sup> influence logistics decisions.

**Interorganizational Influences**

Channel influences also affect logistics decisions and transactions. The two most common channel influences are supplier loyalty and opinion leadership.<sup>46</sup> Many times loyalty grows from an extended relationship between a buyer and a supplier, or a personal relationship that has developed between the representatives of the buying and supplying firms. This loyalty will dictate that the buyer continue the relationship with the supplier even when the supplier fails to meet its obligation.

Making a purchase from a supplier based on the opinions of other buyers is called opinion leadership. This is based partly on the buyer's expectations that the supplier will provide quality output based on input from other buyers who have used the supplier. Both supplier loyalty and opinion leadership are subtle influences on transactions because they can be the result of informal communication networks between buyers and intangible criteria used to evaluate the performance of supplier.

### ***External Influences***

External influences are probably the most commonly cited elements of the environment because they are the most pervasive and least likely to be controlled. Examples of these elements are government, competition, the economy, technology, market structure, culture, and customers. These environmental factors influence logistics decisions at the firm and channel levels.

### **Framework Conclusion**

The ideas presented in this logistics framework are not necessarily new to logistics professionals. However, their application as processes rather than as functions is new. The idea of minimizing the focus on logistics functions in favor of logistics processes is not an easy one to implement. It would require different organization structures and different thinking by logistics professionals.<sup>47</sup> Function-based performance evaluation systems will have to be deemphasized and process-based systems would have to be developed. This will not be an easy task in today's modern organization.

The framework consists of many elements; it is eclectic and is applicable to many types of logistics situations. Some parts of the framework might not be as important as others, depending on the competitive situation or product mix of the firm and channel. The logistics manager must identify what is important for logistics to add value and implement those parts of the framework that will result in customer satisfaction.

### MANAGERIAL IMPLICATIONS OF INTEGRATED LOGISTICS DECISION MAKING

Managing logistics processes requires an understanding of the concept relationships presented in the previous framework. Treating logistics as a process must include analysis of the concept relationships of the framework. These concept relationships are influenced by the constraints previously presented and outlined by Pearce. (A process must have four common properties: a set of concepts or activities that have interdependent and interactive components, the components must take place in a sequence, the flow of the process must be based partly on information gained from a feedback system, and the process must occur in a dynamic environment).<sup>48</sup>

This framework of logistics meets each of these four criteria. For example, the consideration of multi-component decision making to assess total cost for logistics recognizes the characteristics of interdependent and interactive components to the decision process. Therefore determination of total cost must incorporate many logistics components into one decision. This briefly exemplifies the need for sequential decision making in logistics. Sequential decision making demonstrates the interaction and influence that occur from the decisions of strategy development to the decisions over the financial resources necessary to implement those strategies. Finally, because there is a dynamic component to most business decision making, it becomes necessary to structure management decisions so that the processes used are appropriate for the time of application. Therefore, while the framework appears to have a start and finish (left to right may be appropriate in many situations) it should be recognized that the dynamics of individual situations may dictate that the starting point in the decision-making process may be elsewhere in the framework.

Logistics decisions influence other elements of the framework through horizontal, vertical, and diagonal effects. First, decisions at both the facility and channel levels have horizontal influence on the next sequential area of the framework. For example, logistics managers making channel strategy decisions such as the decision to use specialized distributors will directly affect the structure of the channel system. The structure of the channel system will in turn affect the capacity available for total system inventory requirements. This may affect the decisions about the type of order processing system used, and where and how transportation and delivery of inventory will take place. These decisions affect the need for coordinated operations activities throughout the channel system as value is added to the product and services.

In addition, the operations processes influence the nature of the interaction that takes place between human resources in the channel. This interaction influences the types of contracts used to link channel participants together. However, all of these relationships may be constrained by the financial resources of the suppliers and customers in the channel system. Similar examples of horizontal influences across the framework can be developed at the facility level.

Logistics decisions also can influence decisions vertically throughout the framework. Specifically, the logistics manager must recognize the impact that each decision has on the other level. For example, decisions concerning facility strategy (i.e., the decision over what size pallet to use in a facility) can affect strategies at the channel level's (i.e., the type of transportation and material handling equipment used at the customer's facility). If the facility objective is to minimize cost by using a "Just-in-Time" strategy, then consideration must include the impact of that decision on channel cost and market competitiveness. Linkages also must be established for structural characteristics at both levels, to insure coordination of activities between facilities in the channel system. Management of capacity requires consistent decisions that affect individual facilities and the total channel system that the organization must use to reach the market. By reversing the direction of the influence, decisions concerning modes of transportation can affect the types of material handling equipment necessary for each facility in the system. In addition, consideration of the location of production activities influences the need for certain types of operations processes at individual facilities in the channel system. Issues that determine the nature of the relationship may influence the importance of specific skills and characteristics of the human resources employed in each organization. Finally, determination of channel financial constraints can cause the individual organization to reassess its financial position. For example, this may influence the deployment of resources within the facility—a decrease in the credit allowed by suppliers might affect the cost structure and pricing strategies of the firm, for example. These relationships demonstrate the need to assess vertical concept relationships from both directions in the conceptual framework presented.

The final linkages in the model are diagonal—specifically, the influence of decisions that are made in one general concept area at one level of the model (facility or channel) with another general concept area at the other level. For example, if the channel structure is modified because of the loss of a major account, the organization's facility may not be required to hold as much inventory as would

normally be expected. While this situation may not necessarily change the organizational structure at the facility/organization level, it can change capacity constraints, material handling requirements, and operations process activities. Therefore, each decision made by a logistics manager must be evaluated for its impact throughout the decision areas at both levels of the framework.

### **BENEFITS OF INTEGRATED LOGISTICS DECISIONS**

Two major benefits can be gained through the implementation of the thought processes reflected in the conceptual framework presented in this article. The first major benefit is the increased conceptual integration that managers can gain from viewing these decision areas from a broader perspective. The integrated perspective provides managers with an understanding of the total logistics interactions and the integrated strategies and activities that contribute to the overall objective of satisfying the customer.

The second benefit is that the concepts presented remain applicable as functions and organizations evolve through changing environments. As the environment and organizations change, due to increasing global competition or changes in economic conditions in different countries, it becomes critical for logistics management to be able to adapt the procedures and activities to the new environment. This framework can be used as a guideline to that end.

### **CONCLUSION**

This article presents a conceptual framework for logistics that can be used by managers and academics to expand current thinking about the logistics decision making process and to guide development of the discipline. It also should be recognized that the ideas presented are not intended to criticize previous or current research in the logistics discipline. However, one intent of this article is to demonstrate how existing research and conceptualization of logistics thinking can be structured within this conceptual framework to help support the ideas presented.



## NOTES

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<sup>19</sup>Same reference as Note 6, at pp. 33-37.

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<sup>28</sup>Same reference as Note 2.

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