

**MANAGEMENT OF FACILITY AND HUMAN RESOURCES
IN MATERIALS AND LOGISTICS MANAGEMENT**

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Materials and logistics (MLM) managers have responsibility for the facilities and associated processes that comprise the materials and logistics system, the people that initiate MLM activities, and the financial decisions that impact MLM opportunities. Managing MLM facilities requires an understanding of the processes involved in such throughput activities as fabrication, assembly, and packaging in manufacturing operations; receiving, stock location, order selection, and loading in warehouse operations; and trailer unloading, cross dock movements, and trailer loading at transportation terminals. Each of these activities requires human resources. New technology has reduced but not eliminated the need for human resources in some situations. The primary change has been to reassign those responsibilities to other MLM operations that are labor intensive, or to the operation of the technology that has been implemented (such as operators of numerically controlled robotics equipment). This reallocation may also result from the skill level and knowledge base required of the human resources in the firm and throughout the channel. Finally, none of these activities can take place without a financial structure that creates the organizational assets or resource base necessary for logistics operations.¹

This article presents the MLM decision areas that are related to the two basic economic foundations referred to as land and labor. These foundations will be presented along with appropriate demonstration of the interaction of these concepts to establish the managerial perspective necessary for logistics managers, as well as the interface that the materials and logistics discipline must have with other traditional disciplines.

RESOURCE FOUNDATIONS

Resource foundations evolve from the traditional disciplines of operations management, personnel management, financial management, and marketing management. This section borrows concepts from these disciplines and demonstrates their use within an overall conceptualization of materials and logistics management.² This approach develops concepts from these disciplines that are applicable in traditional and nontraditional logistics environments.

Resource management includes all of those decisions and processes that allocate and manage productive inputs and assets of the firm and channel. Therefore, MLM managers must understand the elements that directly affect the operations processes in the facilities they manage, as well as the operations processes that they influence in facilities at other levels of the channel system. As part of that understanding, the manager must utilize human resources (people) to accomplish the organizational and interorganizational objectives established for the operations processes. This requires knowledge of how to interact and motivate people in order to accomplish the objectives of the firm and channel. The following sections address the specifics of these facility and human resource foundations.

Facility Resource Management

Facility resource management involves the management of the physical assets of the firm and channel (i.e., plant and equipment) used in producing the firm's products and services. This includes decisions such as facility layout, technology choice, and equipment selection, as well as decisions dealing with the design of the processes used for the production of products and services. These operational-based decisions are closely related to, and impact the facility location decision presented in the area of, the materials and logistics infrastructure.³

Facility resource management decisions can be considered as isolated optimization problems—finding the most cost efficient layout or choosing the equipment that maximizes return on investment. However, facility resource management can also affect the firm's competitiveness. Process design or equipment selection, for example, affects not only direct costs, but also quality, response time, and customer service. Facility resource management should therefore be viewed not in the narrow context of isolated optimization problems, but rather in the broader context of its role in the competitive strategy of the firm. The objective should

be to manage the firm's facility resources so as to meet its strategic objectives at minimum total cost to the firm and channel.

Market Environment

A critical issue in managing facility resources is the market environment in which the firm operates. Two important environmental characteristics are the volume and variety of demand placed on the firm. These two characteristics affect the complexity of the environment and the ability of the firm to standardize its outputs, and therefore its ability to standardize processes, dedicate facilities, equipment and labor, and achieve scale economies. With higher volume and lower variety, the firm is more likely to be able to justify dedicating facilities and/or workers to specific products or customers. When such dedication is possible, the firm can take advantage of learning effects and can spread fixed costs over a greater volume of output, resulting in economies of scale.

Higher volume and lower variety also enable the manager to focus his/her managerial efforts on a narrower set of performance objectives, tailored to the specific products produced or customers served. This is the concept, advocated in manufacturing, of the "focused factory." Skinner suggests focus as a tool for ensuring that manufacturing is a competitive asset rather than a liability.⁴

Process Flow Patterns

One concrete way in which volume and variety affect the management of facilities is in determining the process flow patterns that develop in the system. A process flow pattern is the pattern of movement of activities through the system. ("System" here may refer to either a single facility or the channel.) Flow patterns can have a major affect on the rate of output of the system, on variable costs, and on the reliability or predictability of system performance.

In terms of flow pattern, a system may fall anywhere along a spectrum ranging from a "jumbled flow" to a "line flow" or "continuous flow" system. Between these two extremes, various shadings or mixtures of the two may exist.

A jumbled flow system is one in which each item produced or each customer served might follow a different path through the system, and may require a different set of operations or processes to be performed. In a manufacturing setting, this type of system is exemplified by a "job shop" operation producing a high variety of products. In the distribution environment, this type of flow pattern may exist

in a warehouse order picking operation in which orders are comprised of a relatively small number of items selected from a wide variety in stock. The path the order selector follows in assembling an order may be different for each order that is filled. From a channel perspective, a jumbled flow pattern might exist in a complex multi-echelon system in which many different items are stocked at many different locations, requiring transshipment to be commonplace.

A line flow or continuous flow system is one in which each item or customer follows the same path through the system and requires the same sequence of operations or processes to be performed. This type of flow pattern is typified in manufacturing by the production line. An example of a line flow system in transportation would be a contract carrier who makes regular just-in-time deliveries to points on a fixed route. An extension of this concept to the channel level could be seen in a contractual channel system in which a limited product line is distributed from the manufacturer through the same wholesalers and retailers to consumers.

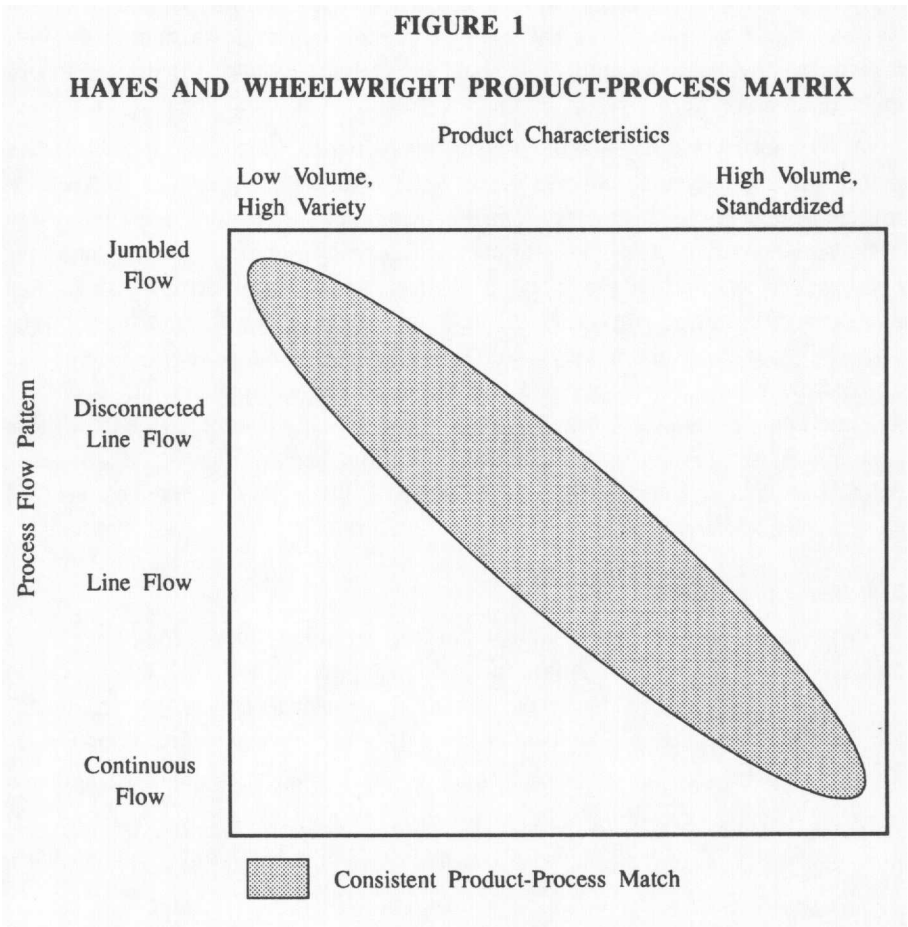
The general characteristics of the different flow patterns are important to the performance of the logistics system, and thus to the competitive position of the firm. These characteristics relate to matters such as cost structure, inventory levels, length and consistency of lead times, and operating flexibility.⁵

Line flow systems generally provide shorter throughput times than jumbled flow systems, and in-process inventories are commensurately lower. Line flow systems are also generally more predictable and stable, due to their simpler structure and the repetitive nature of the activities performed. Thus, line flow systems often provide greater consistency in lead time. Line flow systems also characteristically have lower variable costs because of their ability to take advantage of specialized equipment and achieve economies of scale.

Jumbled flow systems, although typically less efficient and less predictable, have the advantage of being much more flexible than line flow systems. When new or different products must be produced, or different customers served, the line flow system may be slow to adapt, because the system is usually designed around the requirements of a single or very limited set of products or customers. And, while variable costs are typically higher for the jumbled flow system, its fixed costs are often lower because it uses more general purpose equipment and facilities.

From the standpoint of facility resource management, it is important to understand the characteristics of different flow patterns so that an appropriate match

can be achieved between the system's facilities and its products and markets. Hayes and Wheelwright have suggested a framework, known as the Product-Process Matrix, that describes consistent matches between product characteristics and process flow characteristics.⁶ Their framework suggests that firms producing a wide variety of products in low volume are most apt to be successful using a jumbled flow type of process, and firms producing a narrow variety of products in high volume are more apt to be successful using a line flow type of process. They describe this relationship using a matrix (Figure 1) with process characteristics on one dimension and product characteristics on the other. The consistent strategies are those that fall along the diagonal.



Hayes and Wheelwright also suggest that as a product evolves through its life cycle from the introductory stage, when volume is likely to be low and product design in flux, to the maturity stage when volume is higher and product design more stable, the process (and facilities) used to produce the product should also evolve from a jumbled flow system toward a line flow system.

While Hayes and Wheelwright's work was based on studies of manufacturing systems, the logic can be extended to service producing systems as well. Further, while Hayes and Wheelwright's work addressed itself to individual production facilities, the logic can also be extended to the channel level. A firm introducing a new product (or product line) with no established market is unlikely to be able to justify a specialized channel system consisting of participants dedicated to that product. But if the product is successful and the market grows, it may become attractive to develop a streamlined channel system with resources dedicated to that single product or narrow product line.

It may not necessarily be the case that all parts of a facility or channel system employ the same type of process flow. Volume and variety can be different at different levels in the channel system. For example, a firm (say, a brewery) that sells a single product in a wide variety of packages or container sizes may have very low variety through the inbound channels to the manufacturing stage, and high variety (through many types of packages) in the finished goods distribution stage of the system. Alternatively, some firms may have greater variety in the early stages of the system. For example, a firm that fabricates components and assembles them into a single complex finished product would have high variety in the fabrication stage, but limited variety in the assembly of the finished good and its distribution. Under these circumstances, different parts of the facility or channel may be organized and managed differently.

Dealing With the Environment

Firms and channel systems must develop strategies and tactics to address situations when the market environment is complex or does not lend itself to standardization. Therefore, materials and logistics managers must develop tactics that the firm and channel can use to mitigate these environmental effects.

As a general rule, simple is easier than complex. Simple products (or services) are easier to produce; simple systems are easier to manage. Many firms find that the products and systems they have developed over time are complex—often more

complex than they need to be—and they could improve their performance by reducing the complexity.

One way to do this is through a reexamination of the design of products and processes. The objective is to simplify the product or process by eliminating features or operations that do not add value. This may mean eliminating unnecessary components in the product or replacing components with others that are easier to make. In this manner, unnecessary steps may be eliminated or complex steps replaced with more simple processes.

Another approach to reducing complexity in the system is to encourage flexibility in the design of facilities and equipment. That is, design facilities and choose equipment that are capable of producing a wide variety of outputs without time consuming changeovers. This can be done through the application of industrial engineering methods to reduce the time and effort required for setups or changeovers, or through the use of “flexible automation” that can easily be reprogrammed to produce different outputs. Flexibility can also be achieved through cross-training of workers, to allow greater latitude in assigning workers to jobs, which substantiates the importance of human resources in operational decisions.

A final approach for reducing system complexity is through “postponement.” Postponement simply refers to delaying, until the latest possible time, the final configuration or destination of the product. One typical means of postponement in the manufacturing phase is designing products that can be “assembled-to-order” from standard components or modules. From a relatively small number of standard modules, the firm can produce a relatively wide variety of final product configurations. The high variety, however, doesn’t exist until the final assembly stage. Earlier stages in the production process can realize some of the advantages of a higher volume/lower variety environment. Thus the firm avoids some of the complexity by postponing the commitment to final product configuration until a customer order is received.

Postponement can also be used to reduce complexity throughout the channel system. Here, the firm might postpone the commitment to the final destination of product by shipping from a central warehouse rather than pushing product out into field warehouses. Many firms are using this approach in combination with faster modes of transportation to provide a given level of customer service with a less complex channel system and less inventory than would otherwise be required.

There is also a variety of methods that can be used to increase standardization in product and service. Product design is an element that can very directly promote standardization. Many firms today, especially those using computer aided design (CAD) systems for product design are encouraging standardization by encouraging product designers to use common components, that is, components that are already in use in other products the firm and industry produce. This reduces variety and increases the volume of requirements for these common components resulting in more sourcing flexibility and reduced material costs. This may allow the firm to dedicate resources to the production of these common components, and achieve some limited economies of scale. Standardization can also be created in the channel system through the use of standard containers, pallets, etc. as evidenced in the grocery industry.

Another approach to promoting standardization is known as group technology, or cellular manufacturing. The heart of group technology is the identification of "groups" or "families" of items that require the same or very similar processing steps. Once these groups have been identified, equipment and/or workers can be dedicated to the production of the items in a group, forming a manufacturing "cell." Within a cell, the process is typically organized as a line flow system, and the efficiencies of line flow systems can be realized, albeit on a smaller scale.

Facility Summary

Facility resource management is closely linked to the management of human and financial resources. Choices or decisions made in this area influence the decisions made in each of the other two areas. Therefore, facility decisions cannot be made without regard to their financial and human resource implications.

People or Human Resource Management

Decisions concerning firm and channel operations must be made with consideration of the human or personal elements that are created through interaction of people. Within this area people or human resource management includes organizational and interorganizational behavior such as managing the planning, organizing, staffing, directing, and evaluation of personnel at the firm level. At the channel level, consideration must be given to the foundations impacting the transaction and relationship management activities of boundary spanners and organizations. Therefore, consideration must be given to how people deal with one

another in achieving the managerial and economic objectives of the firm and channel. The materials and logistics manager must understand the basic elements of five general areas of interaction concepts to be effective at achieving both the firm and channel goals through people. These areas include understanding of communication flows, coordination of resources, dependence and power/influence techniques, conflict management approaches, and negotiation skills.

Communication Flows

Communications skills are a crucial element for materials and logistics managers as reflected by repeated treatment of the communications process in marketing and organizational behavior textbooks.⁷ MLM managers responsible for warehouse operations must be able to effectively communicate ideas, organizational policy initiatives, and human resource instructions effectively through formal or informal channels to the people responsible for carrying out the facility activities. Therefore, the manager must deal with the importance of initiating the directive (sourcing and encoding the message) in a manner that enables the employee to interpret the instruction (decoding and receiving the message) and carry out the intended action. In this type of direct interaction, communications skills are necessary at all times. In addition, the importance of good communication skills becomes more acute when dealing with employees who speak a different language as their primary language, or when communication is being exercised through the established disciplinary format (i.e., the process of progressive discipline). Communication concepts are also very important for more subtle forms of interaction in the organization. For example, quality circles and project teams are used in organizations to enhance the communication of information and ideas for product and process improvements. The results of these applications can influence decisions over job design, or design of information systems within the organization. Ultimately, improved communication leads to increased benefit for the firm. Therefore, managers must understand the basic elements of the communications process to evaluate effectively the quality of interactions between people in the organization as well as the resulting effect on performance.

At the channel level, communications skills are necessary to facilitate the transaction or customer service interaction activities that take place between representatives of the supplier and customer. This exchange environment is solely dependent on the ability of the two boundary spanners to provide information to each other that is pertinent to their sales and procurement objectives. For example,

communication of service offerings and product characteristics can influence a customer's decision to purchase the product from one supplier over another. Conversely, a successful transaction can lead to dissatisfaction for the customer if those responsible for customer service do not communicate the available service options. This in turn creates conflict between the service offered and the customer's expectations of what the service should be. Therefore, understanding the communications process is central to the process of transferring information during transaction negotiations between the supplier and customer, which impacts each party's perception of the quality of the information used by the parties.

In addition to linking buyers and sellers in individual transaction negotiations, communications process foundations are also necessary for effective utilization of jointly managed relationships between channel organizations. Recent research suggests that effective interorganizational communication is critical to successful channel relationships.⁸

Coordination of Resources

As part of the traditional management functions, the materials and logistics manager must utilize human resources of the firm and channel as effectively as possible. This includes making decisions on how human resource assignments will be made (e.g., seniority-based or skill-based), what activities can be combined or separated to meet work schedule constraints (i.e., combining job functions during periods of limited demand), and personnel needs (i.e., number of people needed for specific activities of certain operational functions or operating shifts). In order to accomplish these objectives, MLM managers must organizationally control the assignment of human resources to different activity areas. Human resources flexibility, an important element of the firm's ability to achieve operational flexibility, can allow firms to use cross functional assignments as a method of training people, which provides the opportunity for maximum utilization and productivity of personnel. Also, the creation of joint objectives between departments and operating shifts can help to achieve the necessary integration of materials and logistics operations at the organization level.

Coordination must also occur in the channel system, which results in the proper matching of suppliers and customers. For example, personality differences between a sales person and purchasing agent can cause wide differences in the perceptions of potential transaction opportunities.⁹ Therefore, the responsibility for assignment

of individual purchasing agents to supply accounts should partially be based on the personality dimensions of the individuals involved in the buying-selling relationship. In a corporate system, when one organization owns operations at more than one level of the channel (e.g., a grocery chain operating warehouses to service their retail stores), coordination may be achieved directly through the organizational structure. This may reflect the authoritative nature of managing and controlling a corporate system. Whether the channel system is controlled through corporate ownership or through individual transaction relationships (e.g., conventional or free flow channel systems), these assignments are a crucial element of the relationship management process and can only occur through the coordination of the human resources which have boundary spanning responsibility.¹⁰

Dependence Assessment and Motivation Through Power/Influence

Use of human resources in materials and logistics at both the firm and channel levels requires an understanding of the nature of power and dependence relationships. In each interaction the manager must ascertain the level of dependence that each party has on the other. The inverse of this level of dependence for each party can be treated as the amount of power that they can exercise in the relationship.¹¹ Understanding the level of power that each party has in the relationship affects the strategies the manager may use in interacting with superiors and subordinates in the firm, as well as with suppliers and customers in the channel system.

Managing human resources within the firm must involve the process of motivating people through the use of power and influence. The logistics manager should know what types of power are available when dealing with human resources, and how that power may be used to accomplish the desired level of motivation.¹² Therefore, the manager should understand each individual's reaction to the use of different types of power. For example, some people react most effectively to reward power, such as that used in production incentive systems or sales commission and bonus programs. Others respond more effectively to the use of coercive and legitimate power, when management must continually monitor and correct human resource actions. In other situations, managers may influence behavior by demonstrating power through their knowledge of specific logistics activities (expert power) or in other cases this can be accomplished through the use of referent power, when both parties recognize that their benefits can only be gained through mutual cooperation. Therefore, the MLM manager's goals can be achieved only through implementation of these types of power, and must be based on his/her

perception and knowledge of the other party. For example, in a unionized environment, management may find a greater need to implement legitimate or coercive power strategies based on the terms of the union contract. On the other hand, in new operations, when management and employees are creating a new environment, reward power based on an MBO (management by objectives) or incentive system may be a more effective motivational tool.

Power and influence is also important for managing channel relationships. All logistics personnel who interact with other channel members must recognize the personal power that they possess through their interpersonal relationships with other buyers and sellers. In addition, those boundary spanners are influenced by the power that their relative organizations bring to the relationship. For example, a captive shipper may feel dependent upon the only carrier offering to service that market. Therefore, both parties must understand the power that their respective organizations have in the relationship. The manager must understand the nature of these power bases and manage the relationships with customers and suppliers accordingly to minimize channel conflict.

Managing Conflict

Logistics managers must be able to recognize and understand conflict when it arises. Many times the conflict occurs between superior and subordinate. In these situations the manager must know the proper procedures for handling the conflict, including the proper uses of power and influence to resolve the situation. However, in other situations conflict arises between contemporaries, such as that between two managers representing different shifts in a warehouse. In this type of situation, resolution of the problem must be handled with careful attention to its effect on all of the people and shifts in the facility. Consequently, each conflict episode is unique and the manager must respond to each episode in a manner that is consistent with his/her interpersonal characteristics while considering the characteristics of the other parties involved. For example, the manager must know how an employee will react to different disciplinary applications. Some employees require direct responses from management to correct actions, while other employees may be offended by direct approaches and respond more effectively to less direct forms of communication, such as suggestions or additional instruction of how the activity is to be performed.

Conflict is also a basic characteristic of relations between firms in the channel. Levy and Zaltman define the transaction environment between buyers and sellers in the channel system as a "mild" form of conflict.¹³ In these channel relationships, conflict management strategies must be developed to coordinate the two parties and recognize their relative contributions. For example, franchisors control franchisee actions concerning product supply through the terms of the franchise contract. The franchisor uses the power of the franchise contract to create the expected franchisee operating environment, which reduces the amount of conflict in the channel. Therefore, the nature of the relationship between the parties affects the approaches used to manage conflict leading to some form of resolution.¹⁴ Examples of approaches to resolve conflict can include power manipulation by the party that controls the situation, or negotiation techniques that can be used to help the parties work toward a mutually beneficial solution.

Resolving Conflict Through Negotiation

In many cases resolving conflict in logistics environments requires an understanding of negotiation concepts. Negotiations take place on a daily basis between superiors and subordinates. These negotiations are the result of the normal "give and take" that is characteristic of interactions in society. Many times this informal give and take results in standard job performance, such as managers that negotiate with workers on the floor in a warehouse to accomplish specified tasks. In other situations the negotiation process becomes more formalized as firms attempt to reduce grievance costs under the terms of an established labor contract or when management and labor negotiate the terms of the labor contract. Successful implementation of negotiation strategies with the firm's human resources, which yields mutually beneficial outcomes, leads to improved levels of job satisfaction and increased organizational performance.

At the channel level, negotiations also take place on a daily basis and like those at the firm level, they also have a range of complexity. Negotiations conducted for the creation of transactions between suppliers and customers in the channel system in many cases are informal, such as the constant interactions that take place between sales persons and purchasing agents. Here the negotiation process evolves from the combined efforts of the organizational buying process and the sales process.¹⁵ On the other end of this continuum is the complex negotiation process that occurs between firms attempting to secure long term relationships with product or service suppliers or customers. In these situations, the negotiators must go through

a period of relationship assessment, preparation, bargaining, and outcome assessment.¹⁶ Understanding this process is necessary for materials and logistics managers if they are to attain their objectives and maximize their effectiveness in gaining and maintaining channel relationships.

The foundations of human resources are necessary to manage interactions effectively within the firm and channel. These foundations cannot achieve proper implementation without an appropriate operating environment.

INTEGRATING CONCEPT IMPLEMENTATION OF FACILITY AND HUMAN RESOURCES IN MATERIALS AND LOGISTICS MANAGEMENT

Effective management of materials and logistics resources in the firm and channel requires the MLM manager's understanding of the importance of integrated decision making based on knowledge gained from other business disciplines. Specifically, recognizing the linkages between facility and human resource decisions is important to the success of the strategies developed. For example, a firm's decision concerning the implementation of new forms of technology—automation of production, storage and retrieval processes, electronic data interchange, or computerized inventory control systems for example—may affect its human resource requirements. Jumbled flow-type processes typically require a more skilled direct labor force than line flow systems. Line flow or continuous flow systems, on the other hand, may require more technically skilled indirect labor to maintain and operate more sophisticated technologies. As new technologies are developed and introduced into the work place, changing skill requirements and job functions may require the firm to implement retraining programs or offer alternative job opportunities to employees in situations in which location is not a part of the consideration.

In recent years, United States firms have created jobs requiring more technical human resource skills than physical capability. Such firms are able to take advantage of improved economies of scale, resulting in improved operating performance, by implementing strategies that allow their human resources to work smarter rather than harder.

The facility location decision is also linked to the human resource constraints and the operations processes used by the firm. For example, a firm's desire to build a new manufacturing facility in a small rural community (because of the

community's cultural work ethic and desire to attract new business) must be linked to the type of manufacturing process to be implemented and the characteristics of the available labor pool. Domestic and foreign auto manufacturers are a good example of the importance of these linkages. During the 1980s, manufacturers based their location decisions for new manufacturing plants in the United States on the interaction of facilities (where suppliers and markets are located) and people (the cultural base of the labor pool and their propensity toward organized labor). Consequently, companies like General Motors, Honda, Toyota, and Nissan have developed operations in Ohio, Kentucky, and Tennessee to take advantage of the opportunities in those states. In addition, foreign manufacturers were able to produce at locations that are closer to their markets than their previous facilities allowed.

Closer relationships with customers and suppliers is also a reason for managing resources from a channel system perspective. Firms that recognize the importance of integrated resource management internally will also see benefits in the channel. For example, traditionally a boundary spanner that leaves the firm and goes to work for a supplier or customer is viewed with skepticism by the firm. However, the firm that approaches resource management from a channels perspective is more likely to view this situation as an opportunity to develop a stronger working relationship with the supplier or customer. The firm with the channels view would capitalize on the situation by attempting to develop a longer term relationship with the channel partner, which could lead to more effective operations for both parties. This type of situation can help the supplier or customer to better understand the constraints and opportunities of the channel partner.

One result of this type of resource management for more cost effective channel operations might be the postponement of manufacturing activities to the distributor level in the channel system. As part of this strategy, logistics managers must emphasize the importance of product and logistics process standardization for consistent applications throughout the channel system. For example, manufacturers in the drapery hardware industry postpone the production of specialized drapery hardware to be used in bay windows from the traditional manufacturing facility to the distributor level that is closer to the markets dictating the specific product design characteristics. Therefore, common materials and parts must be used in all related product lines to allow distributors to handle specialized customer service applications that cannot be addressed by the manufacturer. In addition, distributor personnel responsible for the production of the specialized products must receive training in appropriate

production processes. These changes improve overall total cost to all organizations in the channel and contribute to overall system effectiveness.

From these foundations it can be seen that managers must understand the linkages that exist between facility operations and human resources. Without this broadened perspective, logistics managers will miss opportunities to improve internal operations as well as channel system performance.

CONCLUSION

This paper argues that effective facilities and human resource management require the materials and logistics manager to have an integrated perspective. Consequently, managers must emphasize coordination between facility operations and human resources to achieve the desired firm effectiveness as well as the benefits that coordination of those decisions can have between facilities and firms in the channel system. This coordination enhances conceptual integration in the MLM discipline and can help to develop broad-visioned managers who are needed for more complex and interdependent roles in logistics.

NOTES

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³Same reference as Note 2.

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