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## UNIT 3 LINKAGE WITH OTHER FUNCTIONAL AREAS OF MANAGEMENT

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### Objectives

After reading this unit, you would be able to:

- Converse on the role of Total Quality Management (TQM), Human Resources Management (HRM) in materials management;
- Discuss the environmental issues in logistics;
- Throw light on the use of information in materials management; and
- Argue on the aspects of cost productivity and performance analysis with respect to materials management.

### Structure

- 3.1 Introduction
- 3.2 TQM in Materials Management
- 3.3 Focused Human Resources Management: Key to Materials Management Effectiveness
- 3.4 Environmental Issues in Logistics
- 3.5 Information and Materials Management
- 3.6 Materials Management Cost, Productivity, and Performance Analysis
- 3.7 Summary
- 3.8 Self Assessment Questions
- 3.9 References and Suggested Further Readings

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### 3.1 INTRODUCTION

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The Materials Management can be directly connected to the functional areas of customer satisfaction through Total Quality Management (TQM); Human Resources Management (HRM); environmental issues in material management; cost and finance issues and IT related issues.

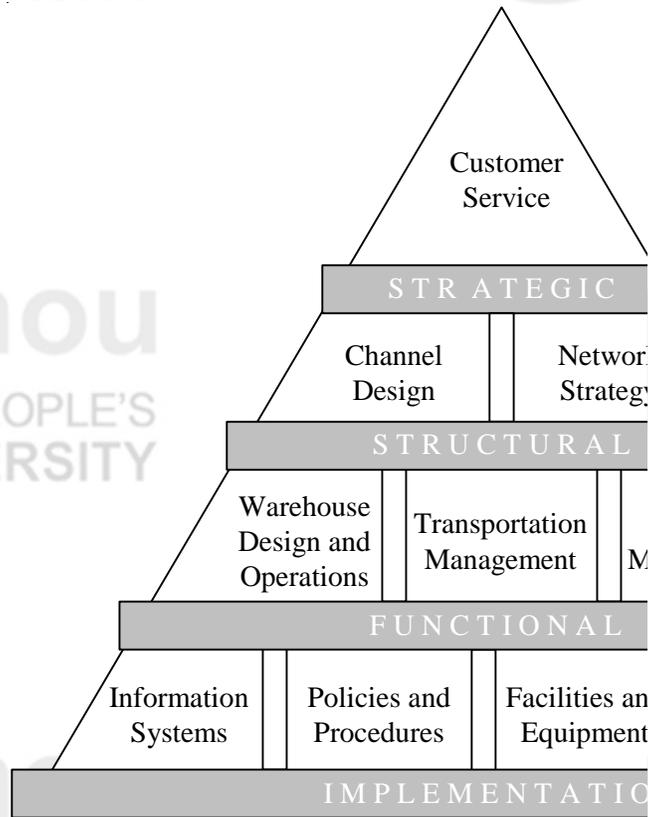
All the above-mentioned issues contribute to the material management function directly in more than one way and the success of each of these elements contribute to the success and the failure of the material management process. Subsequent sections shall highlight their contribution and will explain these concepts in greater detail.

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### 3.2 TQM IN MATERIALS MANAGEMENT

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In a continuing quest for competitive advantage, companies are calling upon materials managers to find innovative ways to reduce cost, enhance service, and increase customers' satisfaction. As a result many companies have taken significant steps toward identifying and implementing materials management quality improvement processes. Some of these processes are really consistent with broader corporate wide quality initiatives. However, materials management frequently assumes the leadership role in implementation of the formal quality process.



**Figure 3.1: The Materials Management**

Because of the increasing popularity of formal quality processes, materials managers need to be well versed in how the following topics manifest themselves in logistics.

- Creating customer value
- Formalization of quality process
- Materials management quality process
- Improvement through quality analysis
- Implementation strategies.

For quality initiatives to be accepted by the employees and suppliers who must implement them, the ultimate goal of these initiatives must be clearly understood and enthusiastically supported. Proceeding added value for customer enhances a company's ability to gain and retain profitable business relationships. Quality programs lay the foundation for this customer value ensuring that customer needs are understood and satisfied.

Unless materials managers have the proper orientation before embarking on a quality program, they may undertake the journey with no particular destination in mind and wander into failure, because customer value is the goal. It is also the final destination in mind and wander into failure, because customer values is the goal, It is also the final destination in the quality journey (described) later as the final phase in the evolution of the quality process. Thus, a discussion of the meaning of customer values must precede a discussion of quality.

#### **Creating Customer Value**

The 1980s introduced significant technological and environment changes to Materials management system yet through all these changes. The focus in logistics has remained on customers and the company's need to provide the best

comparative net value through effectiveness, efficiency, and differentiation of services. The quest to create and improve customer value through logistics has required the quest of quality within logistics.

### Logistics as Value – Creating Function

The attributes of logistics management can create customer value in the three general ways:

- 1) **Effectiveness:** Effectiveness refers to performance meeting customer requirements in Key Result Areas (KRAs). For example, L. L. Bean has identified seven-customer service KRAs in the area of Materials Management:
  - Product guarantee
  - In – stock availability
  - Fulfillment time (turnaround)
  - Convenience
  - Retail service
  - Innovation
  - Market standing (image)
- 2) **Efficiency:** Efficiency refers to an organization's ability to provide the desired product / service mix at a price acceptable to the customer. Wise resource management and leveraging expense into customer value are implicit in this concept. Activity – base cost management systems reinforce efficiency.
- 3) **Differentiation:** Differentiation refers to the ability to create value uniqueness and distinctiveness of service. For example, the limited Stores Distribute Division marks and tags all merchandise prior to store delivery, creating value for the company – owned retail stores within its overall system. Also, the ability of the Frito – Lay driver / salesperson to provide product integrity store level is valuable to independently owned retail stores.

### Evolving Strategic Role of Logistics

Traditionally, the role of logistics in creating customer value has been viewed as the trade – off between cost efficiency and competitive service levels (the cost – service curve.) customers can choose “average” service at an “average” cost nearly “perfect” service at an extraordinarily high cost, or very low cost but poor service, although this philosophy is customer – oriented through its integration of logistics activities and customer contact, it presupposes an optimal cost service mix.

Strategic logistics distinguishes itself from the traditional perspective through its ability to coordinate as well as integrate many interdependent activities, simultaneously across major functional areas. This coordination provides additional means for logistics to create customer value. Simply put, customer value is enhanced by adopting a total channel perspective in logistics. Integration of attributes such as customization, flexibility, innovation, and responsiveness results in highly valued and expected levels of service. These levels of service become the new standards required to achieve competitive advantage.

The scope and role of Materials management have evolved to the extent that many companies now believe that a strategic materials management orientation is

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required to create customer value and to sustain a competitive advantage “ the proposition that logistics can create value relative to a company’s product and service offerings is simple and intuitively appealing. It is a proposition that companies have increasingly come to accept. However, implementation of value-added logistics processes is challenging when customer satisfaction is achieved, quality in logistics has evolved to mean much more than simply having the “right product at the right place at the right time in the right condition at the right cost.”

**Identifying Materials Needs**

Understanding the specific need of customers is necessary to delivering quality and value – added service with logistics. Essential qualities for creating value are the willingness, desire, and capability to become a better supplier. Aside from achieving a one – time understanding of customer needs and requirements, the continually changing priorities of the customer must be formally monitored. Although internal resources can be directed to such a task, the use of outside consultants or services to provide objective information on regular basis may be justified.

Management focus in logistics is expanding beyond the existing company structure to involve suppliers. Historically, many companies treated customers with respect and dignity while bearing down unmercifully on vendors. Progressive companies now regard the role of suppliers as essential to achieve customer satisfaction. These companies are spending more time with suppliers, explaining not only their own but also their customers’ needs. Inter organizational alliances and partnerships are evolving that enable companies to make aggressive performance commitments for customers in advance, and then meet those commitments. These new performance capabilities arise from close and positive supplier relationships: anything less is counterproductive to adding value.

**Areas of Critical Importance**

Adding value requires a focus not on the individual business or its functional components but on the entire supply chain to enhance efficiency, effectiveness, and differentiation throughout. There are three related areas of focus for value creation:

- 1) **Goals, objectives must be served for achieving Customer Satisfaction:** This involves finding out exactly how customers perceive the organization as a whole and not just a single product line.
- 2) **Responsibilities:** Determine and assign responsibility for systems and processes that are necessary for creating and sustaining customer value. In many instances, this responsibility spans traditional functional boundaries and may even require reengineering of some processes.
- 3) **Benefits:** Marketing basics must be incorporated into the process of logistics delivery, transforming this basis onto benefits that yield value.

The key to successful management of the Materials function as a value – creating operation is to recognize that a company is viewed from many different perspectives. Each perspective must be taken into account if Materials Management is going to contribute to achieving the best comparative net value for that customer.

**Formalization Of Quality Processes**

A popular trend has been the development of, and commitment to a formal quality process. The quality process has enabled companies to ensure value creation for

customers. The evolution of a quality process is a movement through four distinct phases with notable characteristics.

- 1) **Quality Control (QC):** Quality Control entails the basic procedural and statistical management of quality.
  - Defect free service
  - Management – driven
- 2) **Quality Assurance (QA):** A greater emphasis on achieving customer satisfaction through customer – driven quality characterizes the shift from QC to QA.
  - 100% satisfied customer
  - Customer-driven
- 3) **Total Quality Management (TQM):** Management, employees, customers, and suppliers all working together toward a common goal characterizes the evolution to TQM.
  - Significant competitive advantage
  - Common goals
- 4) **Customer Value:** Customer value reflects the need to do things that create the best comparative net value for the customer.

#### **Impact of Quality on Profitability**

It is no wonder that companies are focusing on quality. A *Profit Impact of Marketing Strategy* (PIMS) study found that “companies with high quality and high market share generally tend to have profit margins five times than companies in the opposite extreme”. Companies’ return on shares (ROS) and return on investment (ROI) by the relative quality percentile in which their customers perceive them. These observations are reinforced by studies published by the Council of Materials Management.

Several PIMS studies show that achieving superior quality yields two fundamental benefits;

- 1) The relatively low cost of quality implies lower overall cost than that of competitors.
2. Quality is frequently a key attribute when selecting suppliers.

#### **Defining and Understanding Logistics Quality**

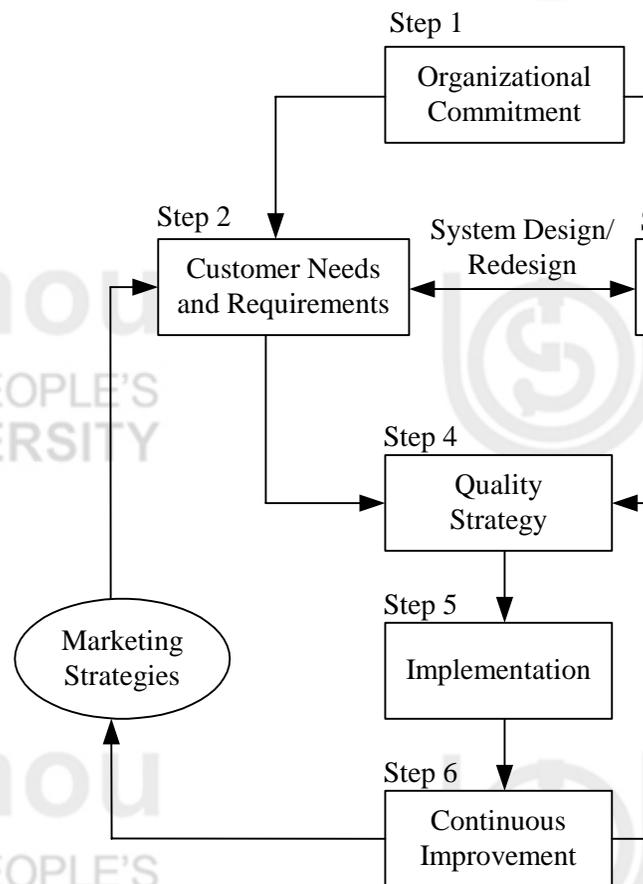
Generally, Materials quality may be defined as “anticipating and exceeding customer requirements and expectations”. While individual companies search for variations on this theme to characterize their particular commitments to quality, most formal quality processes have several elements in common:

- Emphasis on customer requirements and expectations
- Concern for the logistics process itself.
- Continuous improvement
- Elimination of waste and rework
- Measurement and concern for variability
- Total organizational commitment
- Dedication to a formal quality process

Adherence to a formal quality process will be accompanied by a greater likelihood of long term, sustainable improvement. While some companies have maintained excellent reputations for product and service quality in the eyes of customers, only formalization of the quality process will ensure those enviable customer opinions as both competition and customer expectations increase.

### Logistics Quality Process

The pursuit of quality must entail more than slogans, especially if a company desires to leverage quality into customer value. Inbound and outbound logistics have been key ways for companies to enhance the value provided to external customers. Similarly, the formal logistics quality process has, in general, enhanced the coordination and efficiencies of internal activities.



**Figure 3.2: Materials Management Q**

A formal logistics quality process is developed in six steps, as shown in Figure 3.2.

#### *Step 1: Organizational Commitment*

Top management must be the driving force behind quality. This commitment applies not only to corporate management but also to the vice president or director of logistics. These managers must be fully dedicated to the objectives and initiatives, for they are ultimately responsible for the success or failure. They must also provide adequate resources and continual encouragement to the people in their organizations of tangible results.

At the outset of a formal quality process, logistics should have been meaningful, well-developed statements of mission, goals and objectives; the quality process

must fit within the overall framework of the business. Logistics in particular, because of its operational focus and frequent contact with both vendors and customers, has the potential to be the leader of the quality program.

#### *Step 2: Customer Requirements*

Emphasis must be placed on understanding the requirements of the logistics function's customers. While companies traditionally focus on the logistical needs of their external customers. Equally important are the needs of internal customers like marketing, manufacturing, finance and logistics co-workers.

Besides achieving a one-time understanding of customer need and requirements, the marketplace's changing priorities should be regularly monitored. Outside consultant or services can provide objective information on a regular basis if a company chooses not to dedicate internal resources.

Companies desiring a successful quality process should begin to think of their suppliers and other channel partners as customers. The companies in a truly integrated supply chain must share significant coordination and singularity of purpose. A shortsighted company's failure to view these entities results in customers proving counterproductive to quality.

#### *Step 3: Current Levels of Performance*

After specific requirements have been determined, the company must measure how well it is currently performing for each one. For this information to be useful, it must be accurate, meaningful and understandable. For the information to be valid it should be gathered scientifically; validity may be important when defending a measurement of poor performance requiring painful changes.

In addition to gathering performance-related information pertaining to key areas like transportation, inventory, warehousing, information processing and packaging benchmarking against other companies or industry standards is valuable for understanding relative performance. Once current levels of performance have been established a company is likely to identify and immediately implement short-term initiatives for logistics system redesign (or reengineering), as some deficiencies are very easy to correct or too great to overlook.

#### *Step 4: Quality Strategy*

The term quality strategy refers to the specific initiatives selected as cornerstones for the over all quality structure. A first step is to study the philosophies of the quality gurus. Although the company should consider many approaches, its ultimate priorities should focus on the following aspects:

- Understanding customer's needs
- Continual improvement
- Performance measurement and variance monitoring
- Education and training
- Overall organizational commitment

The strategy chosen should improve performance from the current levels. Successful quality processes utilize a number of tools and techniques to measure changes in performance. Most prominent among the tools are those that are simple to create and easy to use, such as flow charts, cause-and-effect diagrams, check sheets, Pareto analyses, histograms, run, charts, control charts (statistical process control [SPC]), and scatter diagrams (correlation charts). Materials

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management departments have been using a growing number of quality comparison techniques like benchmarking and customer research. These tools and comparison techniques help in identify and explain logistics quality issues, remove cause of quality failures, and enhance the company's prospects.

*Step 5: Implementation*

Smooth and effective implementation is essential for success. A company should direct considerable attention to designing an overall quality strategy that will "roll out" productively and effectively.

Implementation has significant logistics implications. The people involved in Materials Management operations have the greatest impact on the service levels received by the company's external and internal customers. They are in a position to make positive contributions to the overall quality process. Although management is ultimately responsible for the success of the quality process, it is the inventory control specialists, warehouse and dock workers, vehicle drivers, product packaging personnel, order entry clerks and staff and others who ultimately perform the work and often have the most direct contact with customers.

An effective implementation plan should include a timetable as well as comprehensive list of necessary resources. These will help ensure the success of a well-conceived logistics quality process.

*Step 6: Continuous Improvement*

Although there is a temptation to think of this step as the last one, the process should be continuing and one should remember that an effective and meaningful quality process has no end as such. Continuous improvement demands more than one time performance. Goals should not be set to be achieved only once and maintained forever. Rather, reasonable goals should be set and reset higher as they are attained. Continuous improvement requires balance. Goals that are either overly ambitious or not at all challenging are counterproductive. Finally continuous improvement calls for relevant current information. Customer needs must constantly be monitored so that reactions to variations in performance and the setting of new goals can be done in a manner benefiting the customer.

A dedication to continuous improvement will result in modification and enhancement not only of the company's logistic strategy but also its marketing and operation strategies. Feedback from the logistics quality process will identify the changing needs and emerging problems customer face.

In the quest to create value for the customer, a formal commitment to quality represents another way for logistics to deliver the service essential to successful competition in today's business environment.

**Implementation Strategies**

In addition to the adoption of a formal quality process, six implementation priorities, discussed in the suggested order of implementation, will enhance the likelihood of success:

**Quality Audit:** Conduct a quality audit to identify opportunities for quality improvement throughout the logistics area. This should be a relatively formal examination of the company's Materials Management processes and the extent to which a gap may exist between supplier and customer expectations.

**Executive Education:** Conduct a formal two- to three-day course for executives and managers in the Materials Management area, on matters pertaining to quality

and quality processes. The objectives should include familiarity and “buy-in” to the basic concepts relating to logistics quality.

**Strategic Quality Plan:** The elements of the quality process including education, timing and responsibilities should be delineated in this step. With regard to education the needs of executives, managers, supervisors and workers should be given thoughtful consideration.

**Quality Improvement Projects:** Accomplishment of specific quality improvement projects will prove to be the best way to promote Materials Management quality. Quality improvement teams should be formed to address specific quality issues and to communicate these to others in the Materials management area.

**Employee Education:** Once the executives and managers have received formal education on the topics quality and a few quality improvement projects have been completed, it is helpful to introduce quality education at the supervisory and worker levels. These educational sessions are critical to the success of the overall logistics quality process and should be designed with intended recipients in mind.

**Implementation and Continuous Improvement:** The results of the logistics quality process will prove helpful to creating customer value through efficiency, effectiveness and differentiation. Continuing this process will greatly benefit the company and its customers alike.

#### Activity 1

Take up an organization of your Choice and explain how Logistic Quality process takes place in that organization.

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### 3.3 FOCUSED HUMAN RESOURCES MANAGEMENT: KEY TO MATERIALS MANAGEMENT EFFECTIVENESS

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Logistics is a functional area capable of sweeping, innovative results, yet it has traditionally experienced difficulty in delivering. Logistics authorities long back have proclaimed the coordinative power of the logistics function as one that can most easily integrate the product flow-related functions of marketing, manufacturing, and supply procurement to achieve quantum gains in customer service and profitability. However, many companies actual experiences often reflect the story of a logistics executive who developed an insightful vision and motivated his or her logistics managers into action but then ran into the police yet pervasive unwillingness of lower-level managers to change. This resistance comes both from within the company and from its suppliers and customers.

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The executive understood both the great promise of logistics and the great difficulties in implementation. But some of them were able to move beyond the ever-present inertial resistance to implement sweeping, effective programs. In later conversations, they made the following, revealing statements:

- “Our sales people and account managers resist our efforts to coordinate with our customers. Their incentive compensation gets in the way. Our top managers see the big picture, but they insist on product loading to meet Wall Street’s quarter-end goals.”
- “The big issue is how to get people to take a strategic, rather than a tactical, view – how to make a strategic decision that tactically may not look right to a buyer or a salesperson. The stumbling blocks are compensation and promotion.”
- “Our company is not run on a cash basis. Our officers prefer increased business to inventory savings, even if ROE drops. We need better internal controls and measures.”
- “You can explain the vision, they (counterpart managers) can see the vision, but then they do what they are paid to do.”
- “The big issue is taking down internal barriers to improve customer-supplier relations within the company. Planning and performance measurement must change radically for business processes to change.”

Many of these managers did not turn from this task. Rather they identified the underlying behavioral drivers that were causing resistance, and developed powerful new measures to re-channel them to accomplish their programs. They understood that both the sources of resistance and the key points of management leverage are rooted in people. Thus we turn our attention to human resources management (HRM) with the discussion of the following topics:

- Fundamentals of human resources.
- Focused human resources management.
- The new strategic imperative.
- Ensuring effectiveness.
- The new logistics management.

A profound change transforming a variety of industries is requiring fundamental changes in the way that managers operate their businesses. In the future, it will be harder for a company to succeed alone. Effective managers must integrate product flow not only among the functional units within a company but also among tightly coordinated networks of companies in a channel. This presents complex new challenges to the logistics professional.

Critical to the success of this new form of competition are coordinative mechanisms that we call “inter-company (or inter-organizational) operating ties” (IOTs). These mechanisms create huge savings and new competitive advantage by redefining the traditional boundaries of companies and fundamentally changing the way product flows, both within a company and from one company to another, through supply and distribution channels.

The common trait of IOTs is that channel members work together to ensure smooth, efficient, and reliable product flow. In each case, tight integration is needed across the functional departments of the companies involved, and new forms of coordinative behavior must be identified and developed. IOTs introduce a

further management complexity because one channel member, by mutual agreement, may take over activities or decision-making authority that previously had been the prerogative of the other. However, the benefits outweigh the difficulties (which subside as time passes and relationships strengthen). A few examples illustrate IOTs:

- Baxter Healthcare, Baxter pioneered a “stockless” system in which it effectively manages hospital supply ordering and replenishment – in contrast to traditional uncoordinated buying by its hospital customers – by distributing a wide variety of hospital supplies (including those purchased from its competitors) directly to hospital wards; this largely replaces the traditional internal hospital materials management function.
- Bose Corporation developed an innovative “JIT II” concept, in which supplier representatives are situated in a Bose facility; among other unusual prerogatives, these individuals have full authority for scheduling shipments from their own plants.
- PPG Companies increasingly are taking advantage of key suppliers’ knowledge of products and technology by asking that the suppliers actually operate part of the buyer’s production process, rather than simply purchasing parts and materials on an arm’s-length basis. For example, PPG manages painting operations in certain General Motors factories.
- Polaroid, continuous product replenishment has begun to revolutionize many retail industries, including apparel, groceries, and office products. Suppliers have responded. For example, Polaroid receives daily sales figures from several large customers and effectively “pushes in” stock, without receiving orders.

There are persistent reasons why the huge benefits of coordinated product flow have remained untapped for so long, and most of these are rooted in narrow, long-standing turf-protecting behavior – often reinforced by HR policies that have outlived their usefulness. These reasons are:

- **Traditional boundary views:** Many functional managers have maintained a traditional view of their operational boundaries – especially, the decisions that are “rightfully” theirs to make – and this has both obscured and then constrained the new paradigm. This perspective has been reinforced by inward-looking compensation and performance reporting systems that act as organizational blinders.
- **Lack of resources and expertise:** Many executives lack the channel wide data, knowledge, and new methods of analysis are necessary to see the vast magnitude of the problems and opportunities. General-purpose corporate development programs fail to provide this focused expertise.
- **Traditional functional barriers:** Traditional barriers between the functional departments of many companies hamper necessary internal coordination. For example, customer relation is often allocated to marketing and supplier relations to purchasing. Structural change can entail heated turf battles.
- **Short-term focus:** A pervasive executive focus on short-term earnings, which leads to chronic quarter-end “product loading” sales tactics and “hockey-stick” financial performance, has bred subtle concern among some managers because artificially “managing” quarterly results is not possible in the context of coordinated, responsive product flow. Similarly, the forward buying associated with trade deals is threatened, creating a perceived threat to both sales people and buyers.

Because the potential gains from product flow coordination are so large, and because the required changes are so sweeping, top management must be directly involved on an ongoing basis. This is the bedrock precondition for success. Top management must drive the program in several concrete ways.

The general management of a company must publicly confirm both the strategic imperative of rapid, responsive product flow and the wisdom of the proposed operational changes. Top management must communicate explicitly that cooperative behavior is necessary to gain the new benefits, that the executive responsible for logistics has the authority to focus and tailor the company's HR policies to accomplish this goal, and that uncooperative behavior will not be tolerated. The top executives of a company must take a personal stake in the program's success.

"Top-to-top" contact is crucial in developing effective inter company operating partnerships. A company's top executives must show their counterparts in the partner company that it is essential for both companies to alter and focus their HR policies to drive the cooperative arrangement at the grass roots level. In IOTs, it is not sufficient for only one partner to change. There must be an explicit agreement at the onset of the relationship. In our study, we found that the failure to specify and gain this agreement was the root cause of many problems in otherwise promising partnerships.

Top management involvement is necessary to invest the logistics executive with the authority to go beyond persuasion and to enable him or her to influence key HR policies to implement sweeping, innovative programs. Because product flow crosses through all functional departments, coordination requires broad changes in the behavioral drivers throughout a company. Materials Management cannot be an independent and isolated function. Rather, it must provide an integrated vision and have the ability and savvy to work through the other departments to effect changes. Logistics executives must identify new points of leverage and become expert in using them to deliver results. HR policies provide these new points of leverage.

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### **3.4 ENVIRONMENTAL ISSUES IN LOGISTICS**

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"Green marketing," global warming, recycling, waste disposal, energy conservation, pollution and other environmental issues have become significant agenda items during the 1990s for individuals, businesses and governments. The issues impact all facets of society, both domestically and internationally. Environmental awareness has become an emotional, political and financial issue that has impacted logistics and the supply chain in many areas, including purchasing and procurement, transportation and warehousing. The various approaches that can be taken by logistics in response to environmental issues include source reduction/conservation (use less), recycling (reuse what we do use), substitution (use environmentally friendly materials) and disposal (dispose of what we cannot use).

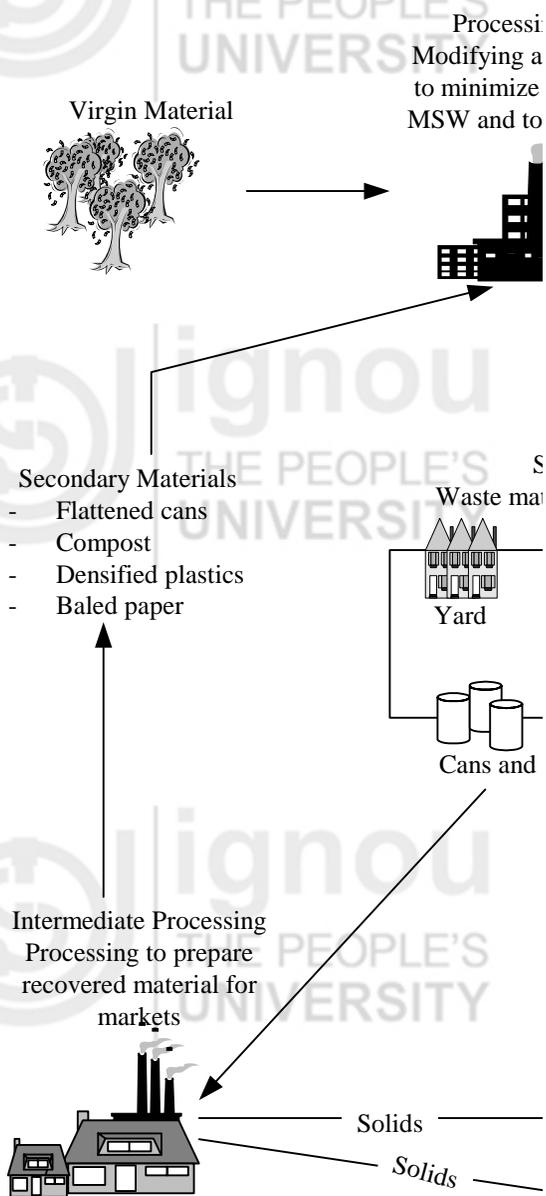
The majorities of mixed wastes ends up in landfills or are incinerated. Hazardous wastes are disposed of in approved sites or destroyed. Items that can be economically recycled are reprocessed into secondary materials. These reprocessed materials are used as inputs in processing and manufacturing, and so the materials flow continues.

In addition to the materials flows, by-products or conditions created by manufacturing and logistics activities have environmental effects. Examples include global warming, pollution, and depletion of the ozone layer and traffic congestion.

Discussion of the environmental issues of Materials Management specifically address:

- Purchasing and procurement
- Physical distribution (including transportation and warehousing)
- Waste materials (hazardous and non hazardous)
- Recycling

Some conclusions are presented with a brief examination of the future directions and implications of the environmental movement (referred to as "green marketing").



The purchasing of environmental friendly raw materials, components and packaging is an important responsibility of materials procurement. Acquisition of “unfriendly” materials that are difficult to dispose of or recycle is not an optimal environmental strategy, although at times it may be the most economical.

Virgin materials often cost less than secondary materials. From an economic perspective, companies can be at a financial disadvantage if they purchase secondary materials. Studies have shown that firms will not use recycled materials unless they are priced at least 25% below virgin materials.

Other issues also impact the purchasing of secondary materials rather than virgin materials. Many individuals and companies perceive that recycled or secondary materials are inferior. Additionally, industry inertia makes it easier to maintain the “status quo,” that is, to continue to make no change in processes or systems and continue to utilize virgin materials. Some production processes may have to be changed when secondary materials are used in manufacturing. Prices charged to customers may have to be increased to cover the cost of recycling, and many firms are fearful of being placed at a competitive disadvantage.

A number of environmental options exist for manufacturers, wholesalers, retailers, and Materials Management service providers that engage in purchasing and procurement. For example, suppliers with which the organization already does business can often provide recycled, substitute, and other environmental friendly materials to replace virgin materials that are being purchased. Companies can also use waste exchange organizations. Source reduction activities in purchasing and procurement can have positive environmental impacts as a result of one or more of the following efforts:

- Providing employee training that educates people on the benefits and specific activities associated with source separation, reuse, and other source reduction activities.
- Purchasing materials on a just-in-time (JIT) basis so as to minimize the potential of spoilage or obsolescence.
- Requiring vendors to minimize unnecessary packaging and to utilize and recyclable materials, and to use returnable packages whenever possible.
- Requiring vendors to provide cost and availability information regarding virgin and recycled materials that are being procured.

With respect to substitution actions, firms can substitute lightweight materials like recyclable plastics for heavier materials like glass and metal. This will result in positive impacts on transportation, warehousing, and inventory costs, in addition to potential environmental benefits.

Disposal of materials is also important for purchasing and procurement. Although the major concern of firms is the inbound movement of goods, consideration must be given to how materials that enter the firm will eventually leave it. Therefore, a life-cycle approach to purchasing and procurement is optimal.

#### ***Physical Distribution***

Within Materials management, physical distribution is concerned with the distribution of finished goods to intermediate and final customers. Physical distribution activities include many components, with transportation and

warehousing being particularly important with respect to the environment, in both positive and negative ways.

The cornerstone of any environmental policy for a distribution operation will be centered on vehicles. Key areas that can be successfully tackled include fuel reduction, noise and emissions, and congestion. Providing that customer service objectives can be met, the option of rail transport should always be considered. Inter modal transport options should also be evaluated. As technology improves and the range of bimodal options increases, this alternative should become increasingly attractive.

The distribution industry in the developed industrialized economics is a victim of success. Although consumers are delighted to have an ever-increasing choice of goods, the downside of a commensurate increase in transport activity is not as welcome.

Warehousing, although less emotive, still intrudes upon the environment. For example, refrigerated warehouses can use chlorofluorocarbons (CFCs), which deplete the ozone layer. Additionally, the packaging used in the storage and transport of products creates waste, which must then be disposed of, recycled, or reused.

As firms become more involved in recycling and other environmental responses, warehouses will have to re-evaluate several operational aspects. Facilities will have to be redesigned and/or reconfigured to handle recycling and waste management in receiving areas. Decisions such as locating recycling and reprocessing equipment and the selection of the appropriate materials handling equipment must to be made.

Warehousing plays a key role in a number of reverse logistics issues relating to source reduction, recycling, substitution and disposal. "Reverse logistics" refers to the role of logistics in source reduction, recycling, substitution, reuse of materials, disposal (including hazardous and non hazardous materials), and product recalls. Within that context, relevant warehousing issues include facility location, layout and design decisions, use of materials handling equipment, and salvage and scrap disposal techniques and procedures.

In environmental terms, what are the key issues? Are trucks more environmentally harmful than cars? Are CFCs in temperature-controlled warehousing and vehicles damaging and to what degree? These and other issues like them are important.

### ***Depletion of Resources***

Fossil fuels are finite. Practical commercial alternative to petroleum have not yet been developed. As a major user of petroleum, the distribution industry has been depleting this nonrenewable resource. However, technological advances will almost certainly produce viable alternatives to fossil fuel in the long term. For example, some firms have begun to use multi fuel vehicles, that is, power units that run on a variety of fossil and synthetic fuels.

There are a number of ways in which significant progress can be made in reducing fuel consumption. By paying attention to the highest standards of maintenance, engines can be tuned to give optimum fuel economy. Driver training can alert drivers to the benefits of fuel-efficient driving practices and refresher courses can help to maintain heightened awareness. Disciplinary procedures for speeding can be enforced, and strict fuel monitoring can also help in identifying areas for improvement.

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Fuel efficiency should be a top priority when purchasing new vehicles. Manufacturers are making very good progress in this area, and it is not unusual to find up to 20% fuel savings with the most fuel-efficient new designs. It is also important not to over-specify a vehicle for a particular transport operation – a common fault in the industry.

**Waste**

Disposal of old vehicles and vehicle by – products is also a problem. Incineration of old tyres causes air pollution. Improper disposal of oil and batteries can result in contaminated groundwater. A number of recycling efforts exist in many countries to handle items such as used oil, tires and batteries to minimize contamination.

For example, in Germany, BMW has introduced a recycling facility on its Bavarian production line and Volkswagen is increasing the recycled content of new cars from 70% to 80% by partnership with recycle companies. Other similar initiatives from vehicle manufacturers can aid in the waste disposal problem. Additionally, at least 80% of all lead acid batteries used in transportation and materials handling equipment are now recycled.

Trucks are used to transport non-recyclable items to incinerators or landfills. Hazardous wastes are much more difficult to transport, and such movements are regulated in most parts of the world. Effective January 1, 1991, hazardous materials moving to, through, or from a United Nations member country had to be packaged, labeled, and certified as meeting UN packaging standards. Those requirements have impacted all parties involved in the handling, storage and transport of hazardous materials.

Vehicle washes should recycle water and use biodegradable cleaning chemicals. In general, maintenance activities should be scrutinized for wastefulness.

Potential environmental solutions for warehouse waste reduction include:

- Use of returnable and/or recyclable containers and pallets.
- Determination of the best methods for locating and handling recyclables and disposables within the warehouse.
- Use of methods to control inventory levels and thereby minimize waste (e.g. stock rotation and using the oldest purchased materials first, FIFO)
- Determination whether outdated stock can be returned to suppliers for regeneration.

**Waste Materials**

The logistics of handling, storing and disposing of waste is enormous. All sectors of the economy create some type of waste. In the United States, often referred to as the “throwaway society,” over 160 million tons of garbage is produced each year. Waste materials include both hazardous and non-hazardous items. Each category of waste has its own individual set of problems, opportunities and solutions.

As waste streams are assessed for reduction potential, develop accounting systems that calculate the true cost of disposal and recognize benefits of waste reduction. This means going beyond handling, transportation, treatment and disposal costs. Lost revenue of materials that could have been sold, as recyclables should be included in accounting systems, as well as the value of wasted input material.

A number of corporate, industry and government efforts have attempted to minimize or eliminate waste materials. For example, the European Recovery and Recycling Association has identified a number of key questions that must be addressed by logistics executives and corporate managers if waste reduction strategies are to be successful:

- Can a waste be reused within the process or a nearby process? Or does the waste have market value through a waste exchange?
- Should raw materials be purchased in smaller quantities?
- Can some of the toxic materials in the process be eliminated?
- What production technology would yield the same or better product with less waste?
- How can the firm or someone else reuse production scrap?
- Is it necessary to remove so much semi-finished product from production for quality sampling?
- Is the product designed for easy repair and/or recycling?
- Would better inventory practices, such as clearly marking all stocked items, maintaining segregation of unlike materials, using returnable containers and thoroughly emptying all containers, reduce waste?
- Are potential revenues from discarded materials lost because of unnecessary mixing or contamination? What housekeeping practices are necessary to prevent these losses?

In sum, companies should attempt to minimize the creation of waste materials. Source reduction (useless) techniques that utilize lesser amounts of materials that create waste are the optimal solution. When waste is created, especially that which cannot be reused or recycled, it must be properly disposed of using acceptable handling, transportation and storage techniques and procedures.

### ***Environmental Implications for Business***

Within the logistics function, road transport represents the biggest environmental threat. Using nonrenewable natural resources, contributing to air and noise pollution, trucks are environmentally unfriendly. Any steps to reduce transport activity will help to minimize the negative impact. In particular, noxious emissions must be reduced, but in the long term more environmental friendly vehicles are required.

Companies throughout the world have recognized the importance of environmentalism and the role of logistics in structuring a corporate response to environmental issues like recycling waste disposal, pollution and many others. Reverse logistics, the term often used to represent the role of logistics in environmentalism, is gaining acceptance by firms.

Within logistics, transportation is an important activity in the recycling and disposal aspects of reverse logistics. The “products” transported include recyclable materials, scrap, hazardous wastes, and reprocessed materials. Therefore, transport issues like routing and scheduling of vehicles, mode and carrier selection, use of private versus public transport, driver and equipment safety issues, and aspect of the traffic management function are relevant to reverse logistics. For example, transport accounts for over 25% of recycling costs that occur before reprocessing activities.

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Warehousing does not create emissions to any significant degree compared with transportation, but it plays a vital role in reverse logistics. Issues like facility location, warehouse layout and design, use of materials handling equipment and salvage and scrap storage are important concerns.

Other issues involving warehousing, as well as transportation, are the use of pallets and recyclable containers. Warehousing stores products on pallets or in containers. Transportation moves those products, perhaps on the same pallets or in the same containers. Therefore, the proper selection, use, and disposal of pallets and containers are considerations in transportation and warehouse management.

In addition to transportation and warehousing, all elements of the logistics process are important participants in responding to environmental issues. Environmentalism has become another component in the firm's cost-service trade-off analysis. In the same way that cost and service issues are considered when making logistics and marketing decisions, environmental issues must be examined as well.

Although there may be obstacles or impediments – perceptual, technical, operational and regulatory – to implement reverse logistics strategies, they are not insurmountable. Maintaining focus and persistence will result in successful strategies and programs. Firms typically develop partial, then complete, recycling programs, which are followed by significant changes in products and packaging. Gradually, firms fully integrate environmentalism into their corporate cultures until it becomes a way of life.

***A Future Perspective***

Effective corporate responses to environmental issues require comprehensive solutions and approaches to difficult problems as noted in packaging for the environment.

The emerging “green” corporation of tomorrow accepts the environmental imperative and willingly assumes the mantle of environmental leadership. It favors voluntary product and process redesign, as well as the avoidance of pollution and waste. In short, it takes the long-term view and addresses environmental issues by attacking their root causes.

Ultimately, environmentalism becomes part of a firm's way of doing business, and all members of the company recognize their role in responding to environmental issues. The direction is clear. Firms must be involved in reverse logistics in proactive, rather than reactive, ways. To be successful in the 1990s and beyond, a firm must be “green”! Firms can respond in a number of ways in the future.

First, Materials management executive must anticipate future environmental regulatory changes and be an active participant in shaping...legislation.

Second, Materials management executives should become knowledgeable about the green marketing revolution and how it can impact the components of the logistics process. There will certainly be some cost and service implications of green marketing.

Third, purchasing and procurement should be made aware of the company's priority in acquiring secondary raw materials rather than virgin materials. Formal policies and procedures need to be established that evaluate the relevant factors associated with secondary and virgin materials. Additional vendors and suppliers may have to be added to approve purchasing lists. Purchasing personnel need to buy into the notion that buying recycled materials is good business.

Fourth, Materials management executives must plan their firm's reverse logistics system so that the strategies of source reduction, recycling, substitution and disposal can be implemented as efficiently and effectively as possible.

Finally, some management individual must be assigned reverse logistics and/or environmental responsibility. In most successful organizations, the person in charge of environmental affairs is located at a middle or upper level management position. The person must have sufficient authority and responsibility to get the job done.

Environmental issues will not go away. In fact, they will become much more important to individuals, corporations, industries, and governments. A socially responsible attitude to the environment can tip the balance in relationships with customers, end users, employees, suppliers and governments. A socially responsible attitude can even help win business. It makes good sense for firms to respond efficiently and effectively to environmental concerns and problems.

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### 3.5 INFORMATION AND MATERIALS MANAGEMENT

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Logistic information systems combine hardware and software to manage, control and measure Materials management activities. These activities occur within specific firms as well as across the overall supply chain. Hardware includes computers, input and output devices, communication channels, ancillary technology like bar code and radio frequency devices and storage media. Software includes system and application programs used for Materials Management activities. Materials management itself includes the activities required to plan, execute and measure the movement of product from the raw material suppliers thorough the firm and ultimately to the final consumer.

#### Classification of Logistics Information Application

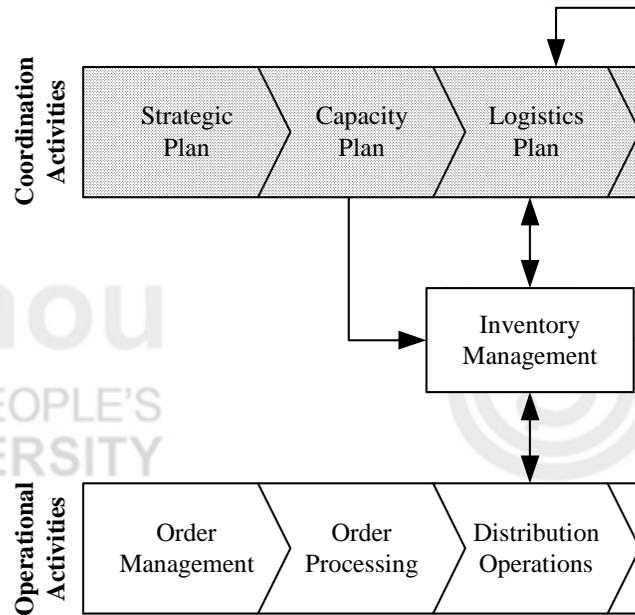
Logistics information systems include two flows that incorporate coordinating and operational activities. Coordinating activities include scheduling and requirements planning throughout the firm. Typical activities are the development of strategic, capacity, logistics, manufacturing and procurement plans.

Operational activities are the information procedures that initiate and track receipts, inventory assignment, and shipment of replenishment and customer orders, replenishment orders control finished goods inventory movement between distribution facilities. Customers' orders initiate inventory movements between distribution points and customer facilities. A typical replenishment or customer order requires a series of operational activities initiated by order receipt. For a single replenishment or customer order cycle, typical activities include order receipt, modification, processing / inventory allocation, picking, and shipment. The procurement order cycle is another activity of the operational plan.

Specific coordination flow representing the backbone application are discussed to develop additional perspectives on trends in logistics system information applications.

#### Coordination Flow

The coordination flow represents the backbone of overall information architecture for firms that primarily manufacture or distribute products. Logistics applications coordinate core activities that guide firm applications and control primary value-added activities necessary for firm stability and profitability.



**Figure 3.4: Materials Management & I**

The shaded components in figure 3.4 illustrate logistics coordination flow. Corresponding with the activities identifies above, coordination flow actions are as follows: (1) strategic planning, (2) capacity planning, (3) logistics planning (4) manufacturing planning, and (5) procurement planning. Materials management is an integral part of both operational and coordinating information flows. Inventory management is an integral part of both flows. Each coordinating activity is discussed below.

The primary information drives for manufacturing and distribution firms are strategic plans that seek to achieve marketing and financial goals. The marketing considerations include target markers, products, marketing mix plans, and the role of logistics value-added service traits. The primary capacity planning output is monthly or weekly requirements that specify dollar or unit volume by – product group or market region.

A comprehensive logistics plan specifies facility, equipment labor and inventory requirements using inputs from forecasts, customer orders and inventory status. The logistics plan coordinates cross – functional performance by quantifying future requirements and developing inventory requirements. Product forecasts are based on sales and marketing input and past experience. Customer orders include orders in process, future release, and contract commitments Promotional orders are particularly important when planning customer requests, because they often represent a large percentage of the total volume and have a major influence on capacity requirements and on inventory status in product available to ship.

The logistics plan is primary to inventory management, which, in turn, is the interface between coordination and operations. As such some inventory management characteristics are discussed within each information flow, inventory management schedules replenishment and transfers between manufacturing and distribute facilities. The logistics plan may be developed from reactive or planning logic or a combination on the two. Reactive logic uses customer requirements to initiate finished goods inventory replenishment. Reorder point logic (ROPL) is an example of the reactive mode. Planning logic on the other hand, initiates replenishment based on forecast, Distribution resources planning (DRP) is an example of logistics planning logic. Planning logic orients inventory management more closely to the coordinating plan while reactive logic shifts inventory management closer to the operational plan. The primary deliverable of the

Materials Management plan is a statement of time – phased inventory requirements.

The logistics plan is also a key input to manufacturing planning, which includes both the master production schedule (MPS) and the manufacturing requirements plan (MRP) that defines weekly or daily production and machine schedules. Given MPS input, MRP time – phase raw material and component requirements to support the designated manufacturing plan. The manufacturing plan schedules resources and attempts to resolve day-to-day capacity bottlenecks, such as raw material or daily capacity limitations within the material management system. The manufacturing plan deliverable is the day-to-day production schedule and material requirements.

The procurement plan schedules raw material release shipments and receipt. The procurement plan uses the capacity plan to drive overall decisions concerning range of acceptable suppliers, degree of material speculation, and desirability of long – term contracts. The procurement plan uses MRP to drive short – term vendor releases. The procurement plan deliverables are important to both long and short – term purchasing requirements.

While each planning activity can, and in the past frequently has, operated independently, the potential of inconsistency can create operating inefficiencies and excessive inventories. Failure to fully appraise the impact of strategic plans can result in uncoordinated manufacturing and logistics inventories. Similarly, failures consider procurement; manufacturing or logistics capacity can create facility and processing inefficiencies. Such failure to coordinate can lead to otherwise unnecessary safety stocks to buffer independent performance.

#### **Using Information to manage Materials Management**

Integrated supply chain management is characterized as the interdependent performance of planning, execution, and monitoring activities. In the past, these activities were typically performed at different times, often by different individuals and sometimes in different forms. Today's competitive pressures require that coordinating and operational activities be integrated and remain timely.

Increased performance requires quicker decisions covering more complex alternatives; information technology offers one way to satisfy these requirements. Logistics information applications, problems, and directions are discussed in this section. The discussion is focused on the primary concerns related to planning, execution, and performance monitoring.

#### **Application Characteristics**

The interviews indicated four characteristics of Materials Management applications that differentiate them from other information system applications, materials management applications:

- 1) Are date intensive
- 2) Have multiple flows.
- 3) Place Significant Demands on the application / user interface
- 4) Sequential Process

The explicit perception was that these characteristics make logistics systems more difficult to design, implement, and manage than other applications, each characteristic is briefly discussed below.

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- **Data Intensive:** Logistics applications are very data intensive because they must include information from all dimensions of customer, product, facility, and logistics activity. For each dimension, logistics application contains historical, current, and planned values. For example, for each combination of customers, products, and facilities, logistics applications must maintain past orders historical, current order (current) and forecasts (planned). In addition to the order and forecast volumes, logistics must also maintain the historical, current, and planned costs for completing each Materials management activity. The sheer number of combination resulting very data intensive application.
- **Multiple flows:** Materials management applications have substantial interaction between coordination and operating flows, while other application like accounting have coordinating and operating flows as well. Dynamic interactions are not as critical because there are defined closing times at which information is exchanged and updated. Materials Management applications, on the other hand, require dynamic interchange between coordinating and operating information flows. As future orders are entered into the application via the order management module, order information must be incorporated into the logistics, manufacturing, and procurement plans. This exchange of information cannot occur at a single point in time but must be continuous because the system is dynamic. Significant information exchange is necessary to achieve integrated coordination plans and operational activities.
- **Application / user interface:** some aspects of Materials management applications like order entry are structured. However there are many more that depend on user selection from range of alternatives. Examples include products substitution, promotional pricing, replenishment planning, and assignment of shipping locations. In some applications, user are guided through selection, such on line direction is not common in today's logistics applications. Further development of on – line decision aids in particularly important when one consider the experience and training of individuals who interface logistics and applications. Logistics application users frequently are young, inexperienced, and not well trained, and also change jobs often. This user profile, along with increasingly complex alternatives, places significant demands on the user interface and on – line decision aids.
- **Sequential process:** Materials management activities involve a high level of sequential processing offer operational applications. In most logistics applications, there is a prescribed sequence for completing operational module procedures. The transactions initiating this processing are often initiated manually. For example, orders are entered and changed using a transaction. The inventory shipped, and released as the last step in the sequential process. Inventory replenishment requests are processed similarly. The transactions are usually very structured in terms of initiator, receiver, data requirements, and processing sequence. An example of the difficulty imposed by structured sequential processing is illustrated by the relationship between order entry and credit checking. If the order is changed following credit checking, it may be necessary to route the order back to credit a second time. Many logistics applications have difficulty with rerouting because it is a counter to the standard sequence. Transaction in most logistics applications still model the sequence and structure of the paper flow transaction that existed prior to computerization. The paper procedures required very sequential processing and allowed limited part routing flexibility.

**Activity 2**

How can an organization achieve competitive advantage using Information as a key driver in the organization? Give examples to support your answer.

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### **3.6 MATERIALS MANAGEMENT COST, PRODUCTIVITY, AND PERFORMANCE ANALYSIS**

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Logistics costs are a major component of the total cost of doing business, and distribution assets represent major portion of a firm's total assets. Clearly, managers can improve corporate profits by improving logistics productivity.

Rather than attempt to minimize the costs of individual logistics components, one should select the level of expenditure for each component that leads to the greatest profit for the firm. Thus, total cost analysis is critical to the successful management of logistics. Accounting information plays a significant role in the analysis and management process, for without accurate cost data it is impossible to design or control the distribution system.

This section examines several fundamental and advanced concepts that are useful for analyzing and managing logistics processes:

- Accounting for logistics
- Distribution cost trade-off analysis
- Controlling logistics activities
- Activity-based costing
- A distribution database for decision making

#### **Accounting for Logistics**

The lack of adequate cost data has prevented the full implementation of integrated logistics management in many firms. Accountants have not kept pace with developments in logistics and, in fact, have shown relatively little interest in the area. Consequently, much of the necessary cost analysis is not performed. Costs

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related to separate functional areas and their interaction must be made available to logistics decision makers. With this information they can use total cost analysis to manage logistics operations, determine selling prices, and justify price differentials.

This type of decision-making is severely hampered by the lack of proper accounting data or the inability to use such data when available. The best and most sophisticated models are only as good as the accuracy of the data inputs. Several studies attest to the gross inadequacies of logistics cost data.

To answer these and other questions requires knowledge of the costs and revenues that will change if the logistics system changes. That is, determining a product's contribution should be based on how corporate revenues, expenses, and hence profitability would change if the product line were dropped. Any costs or revenues unaffected by this decision are irrelevant to the problem. For example, a relevant cost would be public warehouse handling charges associated with a product's sales; a non relevant cost would be the overhead costs associated with the firm's private trucking fleet.

**Key Accounting Concepts**

The accounting concepts necessary for logistics are the same as those used in manufacturing cost analysis. Functional cost analysis is a prerequisite to the identification of costs and their behavior. Although Materials Management activities are organized along functional lines like warehousing, transportation, order processing, and inventory, many firms capture costs not on a functional basis but rather in broad, "natural" account categories like salaries, depreciation, and general and administrative expenses.

Natural accounts are used to group costs for financial reporting on the firm's income statement and balance sheet. For example, all payments for salaries might be grouped into a salaries account, whether they are for production, marketing, logistics, or finance, and the total shown on the financial statements at the end of the reporting period. Other examples of natural accounts might include rent, depreciation, selling expenses, general and administrative expenses, and interest expense. It is entirely possible that a firm with a strong financial accounting orientation may not give separate headings in the natural accounts to logistics costs such as warehousing and transportation. Instead, they are lumped into such diverse catchalls as overhead, selling, or general expense.

Further, there has been a tendency, particularly in the case of freight, to abandon the accrual accounting concept and match costs of one period with revenues of another. These conditions make it difficult to determine logistics expenditures, control costs, or perform trade-off analyses.

Each firm must analyze its own Materials Management activities to determine meaningful functional account categories. The next step is to code the accounting data to make identification of the costs possible. Several key accounting concepts are applicable to the logistics function, including cost categorization, costing methods, and general cost analysis.

**Cost Categorization**

Within functional account categories, costs can be further characterized by their nature. This subcategorized provides managers with additional details about costs that impact decisions.

**Controllable vs. Non-controllable:** It is necessary to separate the more controllable costs from the less controllable or non-controllable costs so that individual managers are held responsible only for incurring those costs over which they exercise control. Generally, costs that vary with the volume of effort expended in an activity are controllable costs. These costs should be related to an appropriate unit of service and separately identified to assist in cost control. Costs that are fixed or budgeted for the fiscal period should be considered when logistics effort and capacity is subject to change.

**Direct vs. Indirect:** In manufacturing, direct costs are readily traceable to products (for example, direct material and direct labor). Direct costs also include those incurred by specific functions and are distinguished from allocated or transferred costs. In materials management, the classification of costs as direct or indirect depends on the business segment. The more general the segment (sales division or sales territory), the greater is the portion of costs directly traceable to it; the more specific the segment (products, customers), the greater is the proportion of indirect costs. Direct costs are those that can be traced to a business segment. If that segment were eliminated, the costs no longer would be incurred. Indirect costs, costs such as general administrative expenses, are often allocated to segments, but this process is arbitrary at best and should be avoided.

**Fixed vs. Variable:** The study of cost behavior in materials management is quite similar to that in manufacturing because most of the activities are repetitive in nature. Physical measurements like labor hours, units handled, and orders processed can be used to measure the activity. Changes in cost are usually caused by changes in activity.

Understanding Materials management cost behavior requires establishing relationships between costs and appropriate activity measures. Variable costs change proportionally with changes in volume. Fixed costs remain the same despite volume. Mixed costs contain both a fixed and a variable component. An example is warehouse labor; a basic crew of three may be required to cover the normal range of activity (fixed), but if volume exceeds the crew's capacity, overtime or part-time employees are necessary (variable).

Step variable costs and step fixed over a relevant range but may increase in steps. The major distinction between the two is the size of the steps. For example, in an order-processing department of 20 people, labor might safely be considered variable because a small percentage increase in the number of orders could result in the need for more employees. However, in a department of three people the cost might be considered a step fixed cost because a large percentage increase in the number of orders processed would be required to add an employee. Other examples of step fixed costs include management salaries, depreciation, and taxes associated with each company warehouse. Effective planning and control require that the total costs be separated into the fixed and variable components.

**Actual vs. Opportunity:** The conservative nature of accounting requires the use of current actual costs or allocations of historic costs in cases such as depreciation. Actual costs, of course, result from transactions that actually occur. However, for management decision-making, actual costs and opportunity costs must be considered. An opportunity cost is the surface associated with the choice of a specific alternative, the value of transactions that were possible but rejected. Examples of opportunity costs include the rate of return that could be earned on

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money not invested in inventory and the possible income from leasing or selling a warehouse. Although opportunity costs do not appear on corporate profit-and-loss statements, these costs are real.

**Relevant vs. Sunk:** Relevant costs change with a decision management is about to make. Any costs unaffected by the decision should not be included in the evaluation of alternatives. The costs that will not change are sunk costs. An example of a sunk cost is the price of a forklift truck after it has been purchased. When making the decision to keep or sell the forklift truck, the relevant costs are the cash flows experienced by keeping the piece of equipment, its current market value, and any income tax implications associated with the decision to sell it; the original purchase price is no longer relevant but rather it is “sunk.”

**Costing Methods**

Categorization is not the only way to characterize costs. The cost recording methods themselves can add useful information to the data. Both methods discussed here can be used alone or in conjunction with each other.

**Standards and Standard Costs:** Standard costing records costs in two parts, the standard or expected cost plus the deviation from that standard that is actually incurred. The application of performance standards to the efficient control of manufacturing costs is widespread, but relatively few firms have developed standards for distribution activities. A decision to use standard costs requires a systematic review of logistics operations to determine the most efficient means of achieving desired output – that is, to determine the standards. Accounting, logistics and engineering personnel must work together using time-and-motion studies, efficiency studies, and regression analysis to develop a series of flexible budgets for various operating levels in different logistics cost centers. Standards can and have been set for such warehouse operations as stock picking, loading, receiving, replenishing, storing and packing merchandise. In addition, they have been successfully utilized in order processing, transportation, and even clerical functions.

It may not be necessary to have standards for all logistics costs. Management should be selective about the activities to which it applies standards. Standards should be used only where the costs involved and the possibilities of inefficiency suggest the need for continued attention to cost control.

**Full-costing vs. Marginal Costing:** Full costing, or absorption costing, is a method of product costing that charges the product with both variable and fixed manufacturing costs. Marginal costing, or incremental costing (also called direct or variable costing), is a system of product costing that associates only variable costs with products while treating fixed costs as period costs. In addition to the direct costing versus absorption costing distinction, companies may value inventories based on actual costs or standard costs. The following are four distinct costing alternatives:

- 1) **Actual absorption costing:** Includes actual costs for direct material and direct labor, plus predetermined variable and fixed manufacturing overhead.
- 2) **Standard absorption costing:** Includes actual costs for direct material and direct labor, plus predetermined variable and fixed overhead.

- 3) **Actual direct costing:** Includes actual costs for direct material and direct labor, plus predetermined variable manufacturing overhead; excludes fixed manufacturing overhead.
- 4) **Standard direct costing:** Includes predetermined costs for direct material and direct labor, plus predetermined variable manufacturing overhead; excludes fixed manufacturing overhead.

The distinction between full costing and direct (marginal) costing is particularly meaningful for the calculation of inventory carrying costs, because only the direct costs are converted to cash by reducing inventory levels.

#### **Importance of Total Cost Analysis**

Total cost analysis is the key to managing the logistics function. Management should strive minimize the total costs of logistics rather than attempt to minimize the cost of each component. Attempts to reduce the cost of individual logistics activities in isolation may even lead to increased total costs. For example, consolidating finished goods inventory in a small number of distribution centers reduces inventory carrying costs and warehousing costs but may lead to a substantial increase in freight expense or lower sales volume as a result of reduced levels of customer service. Similarly, the savings associated with large-volume purchases may be less than the increased inventory carrying costs.

It is important that management consider the total of all logistics costs. Reductions in the cost of one logistics activity invariably lead to increased costs of other cost components. Only viewing logistics as an integrated system and minimizing its total cost can accomplish effective management and real cost savings. The cost categories are customer service levels (the cost of lost sales), transportation costs, warehousing costs, order processing and information costs, production lot quantity costs, and inventory carrying costs. Each category is discussed in turn.

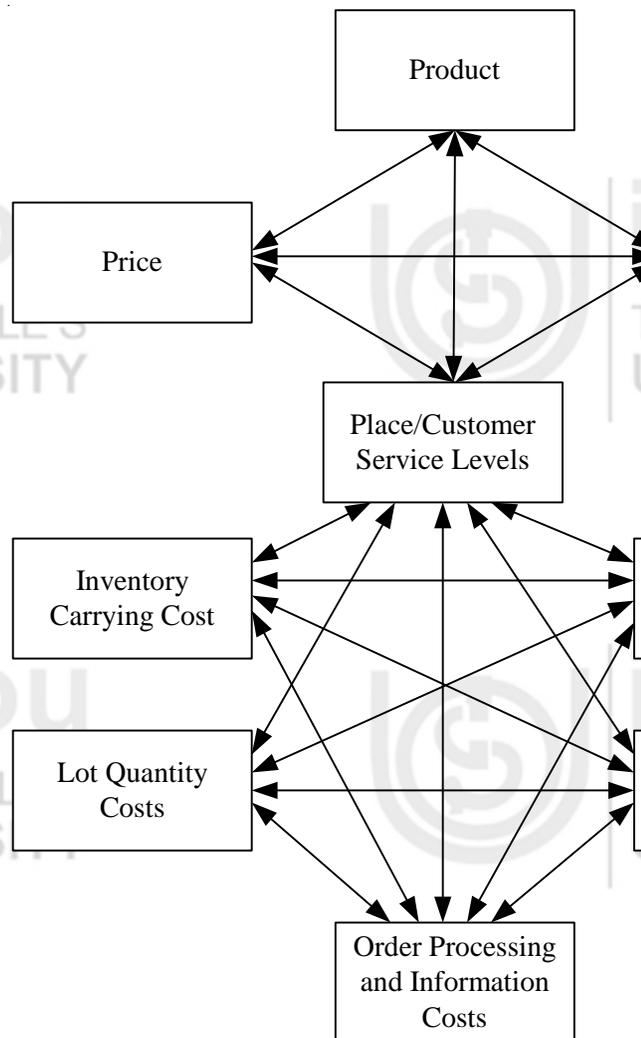
#### **Customer Service Levels**

The cost associated with customer service levels is the cost of lost sales – not only the margin lost by not meeting the current sales demand but the present value of all future contributions to profit forfeited when a customer is lost because of poor product availability. This cost is difficult, if not impossible, for most firms to measure.

For this reason, only the measurable costs associated with back ordering or expediting should be included in this category. The objective then becomes to minimize the total of the other logistics costs, given a level of customer service. With this information, it is possible to judge the likelihood of recovering, through increased sales, the increase in total system costs brought about by an increase in customer service levels. Another approach would be to reduce spending in some other component of the marketing mix (promotion, for example) to maintain profits with a similar sales volume. Likewise, with decreases in customer service levels, profitability can be improved or more can be spent on other components of the marketing mix to maintain or improve market position.

Even though the costs of lost sales may be impossible to quantify, if management determines service levels based on actual customer needs, better decisions are possible. The goal is to determine the least total cost, given the customer service

objectives. Accurate cost data must therefore be available for the other five cost categories shown in Figure 3.5



**Figure 3.5: Materials Management & Marketing C**

### Transportation Costs

Transportation costs can be managed in total or on an incremental basis. If not currently available in any other form, transportation costs can be determined by a statistical audit of freight bills for common carriers or from corporate accounting records for private fleets. Also, standard costs can be established for the transportation activity. For example, a firm used a computerized system with standard charges and routes for 25,000 routes and eight different methods of transportation. Up to 300,000 combinations were possible and the system was updated regularly. Clerks at any location could obtain from the computer the optimum method of shipment. A monthly computer printout listed the following information by customer.

- Destination
- Standard freight cost to customer
- Actual freight paid for shipments to customer
- Standard freight to warehouse cost
- Total freight cost
- Origin of shipment
- Sales district office

- Method of shipment
- Container used
- Weight of shipment
- Variance in excess of a given amount per hundred weight

Another monthly report listed the deviation from standard freight cost for each customer and the amount of the variance. This system obviously provided the firm with a measure of freight performance. Equally important, the standards provided the means for determining individual customer profitability and for identifying opportunities for logistics cost trade-offs. Because this firm used standards as an integral part of its management information system, it could easily determine the impact of such a system change as an improved, automated order processing system on transportation costs. (Refer figure 3.5)

### Warehousing Costs

Warehousing costs comprise all the expenses that can be eliminated or must be increased because of a change in the number of warehousing facilities. Sometimes warehousing costs are wrongfully included in inventory stocked but rather with the number of stocking locations. In addition, the costs of leased or owned facilities are primarily fixed and would not change with a change in the amount of inventory. However, additional labor costs may be incurred if the throughput increases. Therefore, warehousing costs should be separated into two distinct categories; throughput costs and storage costs.

- 1) **Throughput costs:** Throughput costs are the costs associated with selling a product in a given market by moving it into and out of a warehouse in that market. Examples of throughput costs are the charges that public warehouses assess for product handling into and out of their facilities. These charges are related to how much of a product is sold in that market. Throughput costs should be included in warehousing costs so that the increments can be added or subtracted easily with changes in distribution system configuration. The difficulty experienced in isolating warehousing costs is different for public warehouses and privately owned or leased facilities.
- 2) **Storage costs:** Storage space costs are those that public warehousing assigns to customers according to the amount of inventory stored in the facility and should be included in inventory carrying costs, not warehousing costs.

**Public Warehouses:** Generally, determining public warehousing costs presents no problem. Most public warehouses charge on a per hundredweight or per case basis for both handling and storage. Consequently, these costs are totally variable. In some instances, however, a one-shot billing system is used whereby the handling charge implicitly includes a storage component. With this type of billing, it is usually necessary to guarantee a specified number of inventory turns; a penalty is charged for recurring storage if turns do not meet or exceed the standard.

### Order Processing and Information Costs

Order processing and information costs include those for issuing and closing orders, the related handling costs, and associated communication costs. It is important to include only those costs that will change with the decision being made. Many managers make the mistake of arriving at estimates of these costs by dividing the total cost of the order-processing department by the number of orders processed. This is incorrect because of the large portion of fixed costs that are included. Such a procedure overstates the savings associated with a reduction

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in the number of orders processed. A better estimate could be obtained by dividing the change in order processing department costs over the previous two years (adjusted for inflation) by the change in the number of orders processed. Other methods include engineering-type time-and-motion studies and regression analysis, which are discussed later in the section on inventory-related damage.

***Production Lot Quantity Costs***

Production lot quantity costs change as the distribution system changes; they usually include some or all of the following:

- Production preparation costs (setup time, inspection, setup scrap, inefficiency of beginning operation)
- Lost capacity due to changeover
- Materials handling, scheduling and expediting

The production preparation costs and lost capacity costs are usually available because they are used as inputs to production planning. Taking the incremental total costs incurred for two different levels of activity and dividing by the increment in volume can approximate the other costs. Regression analysis is another technique that can be used to isolate and variable costs components. The numbers obtained can be used as an input to the design of a logistics system.

**Inventory Carrying Costs**

Inventory carrying costs should include only those costs that vary with the level of inventory stored. Because some of the concepts required to identify these costs are ambiguous, determining them can be difficult. Inventory carrying costs can be categorized into the following four groups: (1) capital costs, (2) inventory service costs, (3) storage space costs, and (4) inventory risk costs.

**Capital Costs on Inventory Investment:** Holding inventory ties up money that could be used for other types of investments. Consequently, the company's opportunity cost of capital should be used to reflect accurately the true cost involved. All inventory carrying cost components must be stated in before-tax numbers because all the other costs in the trade-off analysis, such as transportation and warehousing, are reported in before-tax dollars.

In some very special circumstances, such as the fruit-canning industry, short-term financing may be used to finance the seasonal buildup of inventories. In this case, the actual cost of borrowing is the acceptable cost of money. Once the cost of money has been established, it is necessary to determine the value of the inventory on which the inventory carrying cost is to be based. At this point it is necessary to know which of the costing alternatives is being used. For example, is the company using direct costs in determining the inventory value or is it using some form of absorption costing?

There are three common methods of accounting for inventory:

- 1) **FIFO (first-in, first-out):** Stock acquired earliest is assumed to be sold first, leaving stock acquired more recently in inventory.
- 2) **LIFO (last-in, first-out):** Sales are made from the most recently acquired stock, leaving items acquired in the earliest time period in inventory. This method attempts to match the most recent costs of acquiring inventory with sales. LIFO will result in lower inventory valuation and lower profits than the

FIFO method in periods of rising prices. The reverse is true when prices are declining.

- 3) **Average cost:** This method could use either a moving average in which each new purchase is averaged with the remaining inventory to obtain a new average price, or a weighted average in which the total cost of the opening inventory, plus all purchases, is divided by the total number of units.

Neither FIFO nor LIFO isolates and measures the effects of cost fluctuations as special managerial problems. However, when standard costing is used, the currently attainable standards automatically provide a measure of cost variance, gains or losses that can be reported separately.

For calculating inventory carrying costs, it is immaterial whether the company uses LIFO, FIFO, or average cost for inventory valuation. The value of the inventory for calculating carrying costs is determined by multiplying the number of units of each product in inventory by the standard or actual variable costs associated with manufacturing the product and moving it to the storage location. A manufacturer decreases its inventory investment by selling a unit from inventory and producing a replacement. Similarly, inventories are increased by manufacturing more product units than are currently demanded. Consequently, in either case, it is current manufacturing costs that are relevant for decision making, because these costs will be saved if inventories are reduced and will be incurred if inventories are increased. Likewise, if products are held in field locations, the transportation cost incurred to move them there plus the variable costs associated with moving them into storage, be inventoried just as are direct labor costs, direct material costs, and the variable manufacturing overhead.

The implicit assumption is that a reduction in finished goods inventory will lead to a corresponding reduction in inventory throughout the system i.e. a one-time reduction in finished goods inventory results in a one-time reduction in raw materials purchases as inventory is pushed back through the system. Similarly, a planned increase in finished goods inventory results in a one-time increase in the quantity of raw materials purchased and subsequently pushed through the system. When this one-time change in inventory value, a balance sheet account, is multiplied by the opportunity cost of money, it becomes an annual cost, a profit-and-loss statement account. This is important because all other components of the inventory carrying annual cost are annual costs and affect the profit-and-loss statement, as do the other cost categories like transportation, warehousing, production lot quantity and order processing.

**Inventory Service Costs:** Inventory service costs comprise taxes and insurance paid as a result of holding inventory. Taxes vary, depending on the state in which inventories are held; in some states, inventories are tax-exempt. In general, taxes vary directly with inventory levels. Insurance rates are not strictly proportional to inventory levels because insurance is usually purchased to cover a certain value of product for a specified time period. However, normally insurance policies are periodically revised according to expected inventory changes. In some instances, policies can be issued where premiums are based on the monthly amounts insured. Insurance rates vary, depending on the materials used in the construction of the building, its age, and considerations such as type of fire prevention equipment installed.

For both insurance and taxes, the actual dollars spent on each of these expenses during the past year can be calculated as a percentage of that year's inventory value and added to the cost of money component of the carrying cost. If budgeted figures are available for the coming year, they can be used as a percentage of the inventory value based on the inventory plan – the forecast

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inventory level – to provide a future oriented carrying cost. Generally, few significant changes occur in the taxes and insurance components of the inventory carrying cost.

**Storage Space Costs:**

In general, four types of warehouse facilities should be considered: (1) plant, (2) public, (3) rented, and (4) company-owned (private).

- 1) **Plant Warehouses:** The costs associated with plant warehouses are primarily fixed. The few variable expenses that would change with the level of stored inventory, like the cost of taking an inventory, should be included in inventory carrying costs. Fixed charges and allocated costs are not relevant for inventory policy decisions. If the warehouse space could be rented or used for some other productive purpose when not used for storing inventory, and the associated opportunity costs are not readily available to the manager, then it makes sense to substitute the appropriate fixed or allocated costs as surrogate measures for opportunity cost.
- 2) **Public Warehouses:** Charges for public warehouse facilities usually are based on the amount of product handled and the amount of inventory held in storage. In some cases, the first month's storage must be paid when the products are moved into the facility. In effect, this makes the first month's storage handling charge because it must be paid on every case of product, regardless of how long it is held in storage. Public warehouses are usually used because they offer the most economical way to provide the desired level of customer service without incurring excessive transportation costs. For this reason, the majority of costs incurred from the use of public warehouses, the related handling charges should be considered as throughput costs, and only charges for recurring storage that are explicitly included in the warehouse rates should be considered in inventory carrying costs. In situations where a given throughput rate is based on the number of inventory turns, it is necessary to estimate the storage cost component by considering how the throughput cost per case would change if the number of inventory turns changed. Of course, the public warehouse charges paid at the time that inventory is placed into field storage should be included when calculating the value of the inventory investment.
- 3) **Rented (Leased) Warehouses:** Space in rented or leased facilities is normally contracted for a specified period of time. The amount of rented space is based on the maximum storage required during the period covered by the contract. Thus, the rate of warehouse rented charges does not fluctuate from day to day with changes in the inventory level, although the rental rates can vary from month to month or year to year when a new contract is negotiated. Most costs, such as rent payment, the manager's salary, security costs, and maintenance expenses, are fixed when related to time. However, some expenses, such as warehouse labor and equipment-operating costs, vary with throughput. During the contract very few, if any, costs will vary with the amount of inventory stored. All the costs could be eliminated by not renewing the contract and are therefore a relevant input for decision-making. However, operating costs that are not variable with the quantity of inventory held should not be included in the carrying costs but rather in the warehousing cost category of the cost trade-off analysis. Fixed costs and costs that are variable with throughput should not be included in inventory carrying costs. Such a practice will result in erroneous decisions.
- 4) **Company Owned (Private) Warehouses:** The costs associated with company-owned warehouses are primarily fixed, although some may be

variable with throughput. All operating costs that could be eliminated by closing a company-owned warehouse or the net savings resulting from a change to public warehouses should be included in the warehousing costs and not in inventory carrying costs. Only costs that are variable with the quantity of inventory belong in inventory carrying costs.

### Inventory Risk Costs:

Inventory risk costs vary from company to company but typically include charges for (1) obsolescence, (2) damage, (3) pilferage, and (4) relocation.

- 1) **Obsolescence:** The cost of obsolescence is the aggregate cost of each unit that must be disposed of at a loss because it is no longer possible to sell it at the regular price. It is the difference between the original cost of the unit and its salvage value, or the original selling price and the reduced selling price, if the price has been lowered to move the product to avoid obsolescence. This figure may or may not show up on the profit-and-loss statement as a separate item. Usually, obsolescence results in an overstatement of the cost-of-goods-manufactured account or the cost-of-goods-sold account. Consequently, some difficulty may be experienced in arriving at this figure.
- 2) **Damage:** This cost should include only the portion of damage that is variable with the amount of inventory held. Damage incurred during shipping should be considered a throughput cost because this damage will be incurred regardless of inventory levels. Damage attributed to a public warehouse operation is usually charged to the warehouse operator if it is above some specified maximum amount. Often damage is identified as the net amount after claims. Because it is not always known just what portions of damage, shrinkage, and relocations costs and related to the amount of inventory held, it may be necessary to determine mathematically whether a relationship does exist. Damage can be a function of such factors as throughput, general house-keeping, the quality and training of management and labor the type of product, the protective packaging used, the materials handling system, the number of times that the product is handled, and how it is handled. To say which factor is the most important and how much damage each one accounts for is extremely difficult. Even an elaborate reporting system may not yield the desired results, because employees may try to shift the blame. The quality of inspection during the receiving function and the fact that higher inventories may hide damaged product until inventories are reduced may contribute to the level of damage reported, regardless of the cause. The portion of a cost that is variable with inventory can be determined by the use of regression analysis or plotting the data graphically. Simple linear regression can be used as a tool for segregating the portion of a cost component that is related to the level of inventory held.

### Standard Costs and Flexible Budgets

Control of costs through predetermined standards and flexible budgets is the most comprehensive type of control system available. The use of standard costs represents a frontal assault on the logistics-costing problem because it attempts to determine what the costs should be, rather than basing future cost predictions on past cost behavior.

Nevertheless, the use of standards has not been widespread. In part, this is because logistics costs are believed to be, by nature, quite different from those in other areas of the business. Although there may be some merit to this argument, logistics activities are, by nature, repetitive, and such operations lend themselves to control by standards. A more compelling reason why standard costs have not

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achieved widespread acceptance is that few attempts have been made to install such systems. In fact, it is only recently that the importance of logistics cost control has been recognized.

The lack of standard costs for logistics is unfortunate because management accountants and industrial engineers of most firms have developed a wealth of experience in installing standard costs in the production area, which, with some effort, could be expanded into logistics. However, developing standards for logistics may be more complex because the output measures are often more diverse than they are in production. For example, in developing a standard for the picking function, the eventual control measure could be stated as a standard cost per order, a standard cost per unit shipped, or a standard cost per shipment. Despite these complexities, work measurement does appear to be increasing in logistics activities.

Once standards have been set, the firm must compare actual performance with the particular standard to see it is acceptable. If performance is acceptable, the system is deemed to be under control and that is the end of the control process. Inherent in this notion is that management operates under the principle of exception, exerting no changes in the system so long as it operates satisfactorily; and the measure of "satisfactory" is found in the standard.

It is highly unlikely that performance will exactly equal standard. Where there is a departure, the procedure is to break the variance into its components to try to ascertain its sources. For example, the standard may be a budgeted amount for transportation in a territory. If the actual exceeds the budget, management would like to see the variance analyzed into separate measures of volume and efficiency. It is impossible to know how to proceed unless the variance is analyzed into meaningful sources.

The next question is whether the observed variance is great enough to be deemed significant. It is possible to handle such a question in strictly statistical terms, setting quality control limits about the standard. This may be done in terms of standard deviations and an acceptable limit establishment on the downside only, or the limit may be on either side of the standard. Thus, in the latter case, if performance exceeds standard, management may decide to raise the standard or reward the performer accordingly. Probably of greater concern are those departures in which performance is below standard.

Much of logistics lends itself to measures of statistical significance in departures from standard. However, as with demand obtaining activities, it is probably more meaningful to judge departures from standard in terms of their practical significance. A form of sensitivity analysis here raises the question of how critical is the departure in its effects on bottom-line performance (net profit).

Regardless of how the assessment is made, the variance will be termed either significant or not significant. If it is not significant, performance is judged acceptable and the control process ends. If significant, the next question is whether action is required.

The variance may be significant but, in analyzing and explaining it, we do not judge the departure from standard controllable. If so, no action may be indicated and the control process is terminated. If action is indicated, it will be one of two broad kinds. Either the standard is held to be wrong and must be changed, or the process itself is not producing the results it should and thus must be changed. The feedback goes up to the appropriate levels. If the process is changed and the standard is held, comparisons are again made. If the standard is changed and the process remains unchanged, the feedback is to be standard. It is possible they

both would be changed. Thus, both feedbacks may result from the action phase, and the system will cycle through again.

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### 3.7 SUMMARY

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Many companies have taken significant steps toward identifying and implementing materials management quality improvement processes. This happened as a consequence of their continuing quest for competitive advantage. Materials managers are called to find innovative ways to reduce cost, enhance service, and increase customers' satisfaction. The results of the logistics quality process prove helpful to creating customer value through efficiency, effectiveness and differentiation. Continuing this process will greatly benefit the company and its customers alike. It is now understood that both the sources of resistance and the key points of management leverage are rooted in people. Human Resources Management (HRM) provides these new points of leverage. Discussion of the environmental issues of Materials Management is specifically addressed on the issues like purchasing and procurement, physical distribution (including transportation and warehousing), waste materials (hazardous and non hazardous) and recycling. Today's competitive pressures require that coordinating and operational activities be integrated and remain timely, hence the section on information and materials management. Giving importance to materials management cost, productivity, and performance analysis can improve corporate profits. This unit thus completes the discussion on overview of materials management. You will read about these issues in details in the further blocks.

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### 3.8 SELF ASSESSMENT QUESTIONS

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- 1) How does TQM support in creating customer value in materials management?
- 2) What TQM implementation strategies would one adopt to bring about the best in materials management?
- 3) Identify the criticality of the role of information in logistics operation in materials management
- 4) Explain the role of materials management in the conserving environment.
- 5) What business implication do you foresee in the area of environmental management?
- 6) Strategically, how do materials management and human resources management go together?
- 7) What are the various cost elements that contribute to the total cost in area of materials management? Quote examples to support your answer.
- 8) Explain the various cost characterizations, quoting examples as given below:
  - a) Controllable Vs Non-controllable
  - b) Direct vs Indirect
  - c) Fixed vs Variable
  - d) Actual vs Opportunity
  - e) Relevant vs Sunk

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### 3.9 REFERENCES AND SUGGESTED FURTHER READINGS

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