Logistics and Supply Chain Management

K. Shridhara Bhat

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LOGISTICS AND SUPPLY CHAIN MANAGEMENT

(As per the Revised Syllabus 2016-17 of Mumbai University for T.Y.BMS, Semester V)

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Preface

Supply Chain Management has become an essential aspect of business today. It comprises the application of the total systems approach to managing the entire flow of information, materials and services from the raw material suppliers through production and distribution centres to the end customers. It includes all the processes that add value to material and bring the final product to the customers.

Logistics is concerned with getting products and services where they are needed and when they are desired. It involves the integration of information, transportation, inventory, warehousing, materials handling and packaging.

Logistics Management is that part of Supply Chain Management that plans, implements and controls the efficient and effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customer requirements.

Logistics and Supply Chain Management are closely related aspects which have been integrated and developed as a proven business strategy to meet the increasing customer demands for quality, delivery and speed. Logistics and Supply Chain Management are necessary cornerstones of competitive strategy, increased market share and shareholder value for most organisations in the 21st century.

The present era is the era of "supply chain competition". There is a need to create "value delivery systems" that are more responsive to fast changing markets. The entire supply chain *i.e.,* the value delivery systems must be focused on the achievement of the needed objectives and goals to compete successfully.

This book is organized into four modules, each module consisting of four units, thereby having 16 units (or chapters) in total. It covers the syllabus of BMS degree program of University of Mumbai. However, this book is useful for students of graduate or post-graduate degree or diploma in Business Management or Logistics and Supply Chain Management of any other Indian University as well.

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I invite readers – both students and faculty members to offer their valuable suggestions to improve the book in its future editions.

– K. Shridhara Bhat

Syllabus

Bachelor of Management Studies Programme at Semester V
with effect from the Academic Year 2016-2017

Course Code: UBMSFSV.1

Logistics and Supply Chain Management

Modules at a Glance

Sr. No.	Modules	No. of Lectures
1	Overview of Logistics and Supply Chain Management	15
2	Elements of Logistics Mix	15
3	Inventory Management, Logistics Costing, Performance Management and Logistical Network Analysis	15
4	Recent Trends in Logistics and Supply Chain Management	15
	Total	**60**

Objectives

Sr. No.	Objectives
1	To provide students with basic understanding of concepts of logistics and supply chain management
2	To introduce students to the key activities performed by the logistics function
3	To provide an insight into the nature of supply chain, its functions and supply chain systems
4	To understand global trends in logistics and supply chain management

Sr. No.	Modules/Units
1	**Overview of Logistics and Supply Chain Management** **(a) Introduction to Logistics Management** • Meaning, Basic Concepts of Logistics–Logistical Performance Cycle, Inbound Logistics, Inprocess Logistics, Outbound Logistics, Logistical Competency, Integrated Logistics, Reverse Logistics and Green Logistics • Objectives of Logistics, Importance of Logistics, Scope of Logistics, Logistical Functions/Logistic Mix, Changing Logistics Environment **(b) Introduction to Supply Chain Management** • Meaning, Objectives, Functions, Participants of Supply Chain, Role of Logistics in Supply Chain, Comparison between Logistics and Supply Chain Management, Channel Management and Channel Integration **(c) Customer Service: Key Element of Logistics** • Meaning of Customer Service, Objectives, Elements, Levels of Customer Service, Rights of Customers **(d) Demand Forecasting** • Meaning, Objectives, Approaches to Forecasting, Forecasting Methods, Forecasting Techniques, (Numerical on Simple Moving Average, Weighted Moving Average)
2	**Elements of Logistics Mix** **(a) Transportation** • Introduction, Principles and Participants in Transportation, Transport Functionality, Factors Influencing Transportation Decisions, Modes of Transportation–Railways, Roadways, Airways, Waterways, Ropeways, Pipeline, Transportation Infrastructure, Intermodal Transportation **(b) Warehousing** • Introduction, Warehouse Functionality, Benefits of Warehousing, Warehouse Operating Principles, Types of Warehouses, Warehousing Strategies, Factors Affecting Warehousing **(c) Materials Handling** • Meaning, Objectives, Principles of Materials Handling, Systems of Materials Handling, Equipments Used for Materials Handling, Factors Affecting Materials Handling Equipments **(d) Packaging** • Introduction, Objectives of Packaging, Functions/Benefits of Packaging, Design Considerations in Packaging, Types of Packaging Material, Packaging Costs

Sr. No.	Modules/Units
3	**Inventory Management, Logistics Costing, Performance Measurement and Logistical Network Analysis** **(a) Inventory Management** • Meaning, Objectives, Functions, Importance, Techniques of Inventory Management (Numericals – EOQ and Reorder Levels) **(b) Logistics Costing** • Meaning, Total Cost Approach, Activity Based Costing, Mission Based Costing **(c) Performance Measurement in Supply Chain** • Meaning, Objectives of Performance Measurement, Types of Performance Measurement, Dimensions of Performance Measurement, Characteristics of Ideal Measurement System **(d) Logistical Network Analysis** • Meaning, Objectives, Importance, Scope, RORO/LASH
4	**Recent Trends in Logistics and Supply Chain Management** **(a) Information Technology in Logistics** • Introduction, Objectives, Role of Information Technology in Logistics and Supply Chain Management, Logistical Information System, Principles of Logistical Information System, Types of Logistical Information System, Logistical Information Functionality, Information Technology Infrastructure **(b) Modern Logistics Infrastructure** • Golden Quadrilateral, Logistics Parks, Deep Water Ports, Dedicated Freight Corridor, Inland Container Depots/Container Freight Stations, Maritime Logistics, Double Stack Containers/Unit Trains **(c) Logistics Outsourcing** • Meaning, Objectives, Benefits/Advantages of Outsourcing, Third Party Logistics Provider, Fourth Party Logistics Provider, Drawbacks of Outsourcing, Selection of Logistics Service Provider, Outsourcing – Value Proposition **(d) Logistics in the Global Environment** • Managing the Global Supply Chain, Impact of Globalization on Logistics and Supply Chain Management, Global Logistics Trends, Global Issues and Challenges in Logistics and Supply Chain Management

Question Paper Pattern

Duration: 2.5 Hours **75 Marks**

N.B: 5 questions of 15 marks each.
All questions are compulsory.

Q.1. Attempt any two: **15 Marks**
(a)
(b)
(c)

Q.2. Attempt any two: **15 Marks**
(a)
(b)
(c)

Q.3. Attempt any two: **15 Marks**
(a)
(b)
(c)

Q.4. Attempt any two: **15 Marks**
(a)
(b)
(c)

Q.5 Case Study **15 Marks**

Contents

MODULE 1 : OVERVIEW OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

MODULE 2 : ELEMENTS OF LOGISTICS MIX

MODULE 4 : RECENT TRENDS IN LOGISTICS AND SUPPLY CHAIN MANAGEMENT

MODULE 1 : OVERVIEW OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT

UNIT 1

Introduction to Logistics Management

1.0 INTRODUCTION

Logistics is concerned with getting products and services where they are needed and when they are desired. In a modern society, most of the customers and consumers take excellent logistics service as granted and tend to notice logistics only when there is a problem, *for example*, non-availability of goods and services they need very badly. When consumers go to the retail stores, they expect products to be available in good condition, *for example,* fresh fruits, meat, vegetables and the like. It is difficult to visualise accomplishing any manufacturing and marketing activity efficiently and effectively without logistical support. Logistics is a broad, far-reaching function, having a great impact on the standard of living of a modern society.

To understand some of the implications of logistics activity to consumers, we may consider the following:

(i) The difficulty of consumers in shopping for food, clothing and other items in one place (super bazaar or retail shop) if logistical systems do not bring all these items together in one place.

(ii) The problem in locating the proper size or style of an item (say shoes or ready made garments) if logistical systems fail to provide a wide product-mix, colours, sizes and styles through the assortment process.

(iii) The frustration for consumers when they go to a store to purchase an advertised item and find out that the item has not arrived at the store yet.

The issues mentioned above illustrate how logistics affects many facets of the daily lives of consumers and the impact it has on individuals and the society.

Logistics involves the **integration** of information, transportation, inventory, ware-housing, materials handling and packaging. The operating responsibility of logistics is the geographical positioning of raw materials, work-in-process, and finished goods inventories where required at the lowest cost possible. Logistical process facilitates the flow of materials from suppliers to the manufacturing firms and the distribution of finished products through marketing channels to consumers. The complexity of logistics increases with the number of industrial manufacturers, suppliers, and the channel intermediaries such as wholesalers, distributors and retailers within a

nation. The complexity of logistics becomes awesome when we consider business on a global basis, having global manufacturers, global suppliers and global consumers.

1.1 WHAT IS LOGISTICS?

Logistics is defined as the process of anticipating customer needs and wants, acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants, optimising the goods or service — providing network to customer requests and utilising the network to fulfil customer requests in a timely manner.

***Box 1.1* lists the various perspectives of the definitions of logistics.**

Box 1.1 : Definitions of Logistics

Perspective	Definition
(i) Inventory	Management of materials in motion and at rest.
(ii) Customer	Getting the right product to the right customer, in the right quantity, in the right condition, at the right place, at the right time and at the right cost. (referred to as the seven 'r's of logistics)
(iii) Dictionary	The branch of military science having to do with processing, maintaining and transporting materials, personnel and facilities.
(iv) International Society of Logistics	The art and science of management, engineering and the technical activities concerned with requirements, design and supplying and maintaining resources to support objectives, plans and operations.
(v) Utility/value	Providing time and place utility/value of materials and products in support of organisational objectives.
(vi) Council of Logistics Management	That part of the supply chain process that plans, implements and controls the efficient and effective flow and storage of goods, services and related information from point of origin to point of consumption in order to meet customer requirements.
(vii) Component Support	Supply management for the plant (inbound logistics) and distribution management for the firm's customers (outbound logistics).
(viii) Functional Management	Determination of materials requirement, purchasing, transportation, inventory management, ware-housing, materials handling, industrial purchasing, facility location analysis, distribution, return goods handling, information management, customer service, and all other activities concerned with supporting the internal customer (manufacturing) with materials and the external customer (retailer) with products.
(ix) Common Culture	Handling the details of an activity.

Types of Logistics

Logistics should be viewed as a part of management and has four sub-divisions:

***(i) Business Logistics* :** It is the part of the supply chain process that plans, implements and controls the efficient flow and storage of goods, services, and related information from point of origin to point of use or consumption in order to meet customer requirements.

(ii) ***Military Logistics*** **:** The design and integration of all aspects of support for the operational capability of the military forces and their equipment to ensure readiness, reliability and efficiency.

(iii) ***Event Logistics*** **:** The network of activities, facilities and personnel required to organise, schedule and deploy the resources for an event to take place and to efficiently withdraw after the event.

(iv) ***Service Logistics*** **:** The acquisition, scheduling and management of the facilities/assets, personnel and materials to support and sustain a service operation or business.

1.2 WHAT IS LOGISTICS MANAGEMENT?

Traditionally, organisations have divided the responsibility for materials management among three departments: *(i)* purchasing, *(ii)* production, planning and control and *(iii)* distribution. This form of organisation is defined to as a ***segmented structure***, having a manager for each of these three departments who reports to a different person. Because of the tremendous amount of co-ordination needed in the segmented structure, many firms have restructured to centralise most materials management tasks in one department and elevate its manager to a higher level in the hierarchy of managers in the organisation. Such a form of organisation is referred to as an ***integrated structure*** and the unified new department is called ***materials management*** or ***logistics management*** department. This approach brings to gather all the tasks related to flow of materials from the purchase of raw materials to the distribution of finished products and recognises that the various materials management tasks are all part of the same supply-chain management activity.

Logistics management is the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements.

The definition reflects the need for total movement from point of material procurement to location of finished product distribution. It also includes the flow of materials and services in both the manufacturing and service sectors (such as the government, hospitals, banks, wholesalers and retailers). In addition, the ultimate disposal, recycling and reuse of the products need to be considered because logistics management is becoming more and more responsible for removing packaging materials once a product is delivered, and removing old equipment and disposing of the same.

Because of the various diverse functions coming under the purview of logistics management, it is also known by several other names such as the following: *(i)* Business logistics, *(ii)* Channel management, *(iii)* Distribution management, *(iv)* Industrial logistics, *(v)* Physical distribution management, *(vi)* Supply management, *(vii)* Materials management, *(viii)* Quick-response system, *(ix)* Logistical management and *(x)* Supply-chain management.

Additional Definitions of Logistics and Logistics Management

(i) **Logistics** is a function or activity concerned with getting products and services where they are needed and when they are needed or desired.

(ii) Logistics involves the integration of information, transportation, inventory, ware-housing, materials handling and packaging.

(iii) Logistics facilitates the flow of materials from suppliers to manufacturing firms and the distribution of finished products through marketing channels to consumers.

(iv) Logistics integrates materials management with sales and distribution management.

(v) Logistics adds value by creating time utility and place utility.

(vi) **Logistics management** is that part of supply chain management that plans, implements and controls the efficient and effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customer's requirements - (definition of council of logistics management).

(vii) Logistics management activities typically include ***inbound*** and ***outbound*** transportation management, fleet management, ware-housing, materials handling, order fulfillment, logistics network design, inventory management, supply/demand planning and management of third-party logistics service providers. The logistics function also includes to varying degrees, sourcing and procurement, production planning and scheduling, packaging and assembly and customer service. It is involved in all levels of planning and execution - strategic, tactical and operational.

(viii) Logistics management is an integrating function which co-ordinates and operates all logistics activities as well as integrates logistics activities with other functions including marketing, sales, manufacturing, finance and information technology.

(ix) Logistics management is concerned with creation of value for customers, suppliers and stakeholders of the firm.

1.3 CONCEPTS OF LOGISTICS

The concept of logistics is fairly new in the business world. The scope and influence of logistics has evolved in the late 1940s. In the 1950s and 60s, logistics was used only in military organisations. The scope of logistics has been extended beyond the army, as it has been recognised as one of the important tools for developing competitiveness of business organisations. Competitive advantage means the company has the ability to differentiate itself, in the eyes of the customer and also is operating a lower cost and greater profit.

Logistics facilitates in getting products and services as and when they are needed and desired to the customer. It also helps in economic transactions, serving as a major enabler of growth of trade and commerce in an economy. The role of logistics is to ensure availability of all the required materials before every step in the supply chain.

The **"supply chain"** encompasses all activities associated with the flow and transformation of goods from the raw materials stage to the end user.

There are two major phases that are important in the movement of materials: (1) Materials management (the physical supply channel) and (2) Physical distribution (physical distribution channel).

Four key players in the supply chain are:

(i) Suppliers – Vendors, *(ii)* Manufacturers, *(iii)* Wholesales and Retailers and *(iv)* Customers.

The concept of logistics has its base upon the **"systems approach"**. There is a single chain, with flow of materials starting from the suppliers, then to the plant and finally to the end customers, and also these activities are done sequentially in order to achieve customer satisfaction at low cost.

The logistics activities can be classified into: *(a)* Core activities and *(b)* Support activities.

The **core activities** takes plac in every supply channel. They contribute the most to the total cost of logistics or they are essential to the effective coordination and completion of the logistics task. **These are activities include:** *(i)* customer service, *(ii)* Transportation, *(iii)* Inventory management and *(iv)* Information flow and order processing.

The **support activities include:** *(i)* Warehousing, *(ii)* Materials handling, *(iii)* Purchasing, *(iv)* Protective packaging, *(v)* Cooperating with production/operation and *(vi)* Information maintenance

Objectives of logistics are: *(i)* Reduction of inventory, *(ii)* Economy of freight, *(iii)* Reliability and consistency in delivery performance, *(iv)* Minimum damage to products during handling and storage and *(v)* Quicker and faster response

Logistics delivers value to the customer through three main phases:

1. **Inbound logistics:** Include the movement of materials and components from suppliers to manufacturing plants for processing.
2. **In process logistics:** Operations, which are directly related to processing. These include activities like storage, and movement of raw materials and components within the manufacturing plant.
3. **Outbound logistics:** Operations, which follow the production process: These include activities like warehousing, transportation and inventory management of finished goods.

1.4 LOGISTICS PERFORMANCE CYCLE

Performance cycle is the primary unit of analysis for integrated logistics. Performance cycles provide a basic perspective of the dynamic interface and decisions that must link to create an operating system. At a basic level, suppliers, the firm and its customers are linked together by communications and transportation. The facility locations that performance cycle link together are referred to as **"nodes"**.

In addition to the nodes and **links**, a logistical performance cycle requires **inventory**. Within nodes, inventory is stocked or flows through the node, necessitating a variety of material handling and at least limited storage.

Performance cycles become dynamic as they accommodate input/output requirements. The input of a logistical performance cycle is an order that specifies requirements for a product or material. System output is the level of performance expected from the logistical operation. The effectiveness and efficiency of performance cycles are key concerns in logistics management.

The logistical performance cycle includes:

1. Procurement performance cycle (Inbound logistics)
2. Manufacturing support performance cycle (In process logistics) and
3. Physical distribution performance cycle (Out bound logistics)

The procurement performance cycle includes: *(i)* Resource planning, *(ii)* Supply sourcing, negotiation, *(iii)* Order placement, *(iv)* Quality assurance, *(v)* Inbound transportation, *(vi)* Receiving and inspection, *(vii)* Storage and handling.

The manufacturing support performance cycle provides production logistics. It is positioned between procurement performance cycle and physical distribution performance cycle. Manufacturing logistical support has the primary objective of establishing and maintaining an orderly and economic flow of materials and work-in-process inventory to support production schedules.

Physical distribution performance cycles involve processing and delivering customer order. Physical distribution is integral to marketing and sales performance because it provides timely and economical product availability. From the logistical perspective, physical distribution links a firm with its customers.

1.5 STAGES OF LOGISTICS

1.5.1 Inbound Logistics

Inbound logistics is one of the primary processes of logistics, concentrating on purchasing and arranging the inbound movement of materials, parts and / or finished inventory from suppliers to manufacturing or assembly plants, warehouses or retails stores.

Inbound logistics is an integral element of business operations for a manufacturing firm involving the processes of receiving , storing and distributing raw materials for use in production. It is the first stage in the value chain.

Procurement logistics is a part of inbound logistics. It consists of activities such as market research, requirements planning, make-or-buy decisions, supplier management, ordering and order controlling.

1.5.2 In-process Logistics

Also known as **production logistics**, the term describes logistics process within a value adding system (*e.g.,* a factory) . Product logistics aims to ensure that each machine and workstation receives the right product in right quantity and quality at the right time. The concern is with production, testing, transportation, storage and supply. Production logistics provides the means to achieve customer response and capital efficiency. Production logistics becomes more important with decreasing batch sizes. In many industries, the short-term goal is a batch size of one, allowing even a single customer's demand to be fulfilled effectively.

1.5.3 Outbound Logistics

Outbound logistics is the process related to the storage and movement of the final product and related information flows from the end of the production line to the end user.

Distribution logistics is a type of outbound logistics. It has as main tasks, the delivery of finished products to the customers. It consists of order processing, warehousing and transportation. Distribution logistics is necessary because the time, place and quantity of production differs with the time, place and quantity of consumption.

Disposal logistics has its main function to reduce logistics costs and enhance services related to the disposal of waste during the operation of a business.

1.5.4 Outbound versus Inbound Logistics

Inbound logistics refers to the transport, storage and delivery of goods coming into a business. Outbound logistics refers to the same for goods going out of a business. Inbound and outbound logistics combine within the field of supply – chain management, as managers seek to maximize the reliability and efficiency of distribution networks while minimizing transport and storage costs. Understanding the differences and correlation between inbound and outbound logistics can provide insight for developing a comprehensive supply-chain management strategy.

Supply chain partners: Companies work with different supply-chain partners on the inbound and outbound side of logistics. The inbound side concerns the relationship between companies and their supplies, while the outbound side deals with how companies get products to their customers, Regardless of the source or distribution, companies may work directly with third-party distributors on either side as well. A wholesaler, for example, might work with a distributor to receive products from an international supplier, while using their own fleet to deliver goods to their domestic customers.

1.6 LOGISTICAL COMPETENCY

Logistical competency is a relative assessment of a firm's capability to offer competitively superior customer service at the lowest possible total cost. A company seeking differentiation on the basis of logistical competency, outperforms its competitors in all facets of operations. This means that logistical performance is focused to support any or all manufacturing and marketing requirements in such a manner that exploits delivery capability. The strategy is to provide superior service at a total cost below industry average. **The characteristics of firms having superior logistics performance or competency are:** *(i)* alternative logistical capabilities, *(ii)* emphasis on flexibility, *(iii)* time-based performance, *(iv)* operational control and *(v)* commitment to perfect customer service performance.

Firms seeking strategic positioning focus on how to compete on the basis of four processes essential to success. These processes are: *(i)* ***creation of customer value***, *(ii)* ***planning***, *(iii)* ***control*** and *(iv)* ***succession generation***. A firm must perform all these processes for long-term survival and growth. Expectations regarding logistical competency directly depend on a firm's strategic positioning. All firms must perform logistics to achieve their primary business goals. Logistics competency must be proactively used to gain competitive advantage. Creation of customer value is essential to gain and retain a loyal customer base. Logistics is one of several competencies required to create customer value. Logistics must be managed as a **core competency** of the firm seeking creation of superior customer value.

1.7 INTEGRATED LOGISTICS

Integrated logistics integrates the activities such as physical distribution, materials management, logistics engineering, business logistics, logistics management, distribution management and even supply chain management. Even though all these activities vary from one another, they share one key ingredient; ***the concept of a continuous, uninterrupted flow of the product***. All logistics activities must work together to move the product smoothly through the channel of distribution to the final customer.

Integrated logistics is a ***service - oriented process***. It involves actions which help movement of the product from the source of raw material to the final customer. In doing so, it supports marketing and production in selling and producing the products. Even if the advertising campaign is very effective, or the sales force is very efficient, without integrated logistics, marketing cannot fill customer orders. Likewise, production lines will become idle if integrated logistics fails to transport raw materials and components from the source to the plant. Also, even if production produces goods in time, if the same can not be moved to a market efficiently and effectively, it does not serve any purpose. Hence, integrated logistics, marketing and production must intervene and how well they co-ordinate determines how well customers are served.

When managers use a systems orientation, they focus their attention to the interaction of all parts of the system. These parts of the system are referred to as ***components***. Each component has a specific function to perform toward facilitating system objectives.

1.8 REVERSE LOGISTICS

Reverse logistics is concerned with issues such as reducing the amount of raw materials or energy used, recycling, substitution, reusable packaging and disposal in addition to handling product returns from customers. Since logistics cannot deal effectively with these issues in isolation, it must be interfaced with manufacturing, marketing, purchasing and packaging engineering. Decisions made in each of these areas have an impact on the ability of logistics to conserve resources and achieve green goals of the organization.

The ***reverse logistics channel*** may utilize all or a portion of the ***forward logistics channel*** or it may require a separate design. The supply chain terminates with the delivery of the product to the end customer. The reverse channel must be considered to be within the scope of logistics planning and control.

The example of ***reverse logistics activities*** resulting from return of a defective product is illustrated in the following paragraph:

- The reverse logistics channel comes into play when a customer buys a product say an electric iron or a toaster.
- The customer returns it to the retailer who readily refunds the purchase price or replaces the defective product by a new one as per the terms of purchase.
- The retailer sends the defective product to the wholesaler/distributor or to a central return centre. Upon receipt, the product's Universal Product Code (UPC) is scanned for identification in the return centre's database.
- The product is shipped back to the manufacturer.
- The retailer makes a cost recovery for the defective product.
- The manufacturer repairs the product and sends it for resale on the secondary market; thereby gaining value for the defective product.

Reverse logistics systems are developed mostly to handle reverse flows on the outbound side of the logistics systems of firms producing durable products such as computers, telephone equipment and copy machines. Such products may be returned by customers for trade in (exchange offers), for repairs, or for salvage and disposal. Companies that deal with returnable containers or packaging materials that are reusable also need a **reverse logistics channel**. Also increased concern for protection of environment will require more firms to develop **reverse logistics systems** to dispose of packaging materials on used products.

Box 1.2 **illustrates the various definitions, features and benefits of reverse logistics.**

Box 1.2 : Definitions, Features and Benefits of Reverse Logistics

Definitions :

- Reverse logistics stands for all operations related to the reuse of products and materials. It is the process of planning, implementing and controlling the efficient, cost effective flow of materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.
- Reverse logistics is the flow of returned goods by the consumer to a state where the product is disposed of, repaired, recycled or internally consumed. Because of the strict norms pertaining to disposition of goods in the high-tech sector, reverse logistics is a very strategic area.
- Reverse logistics includes all activities associated with a product/service *after* the point of sale, the ultimate goal to optimise or make more efficient after-market activity, thus saving money and environmental resources.
- Other terms synonymous to reverse logistics are : *(a)* after-market logistics or after-market supply chain, *(b)* the reverse supply chain. Types of activity common with reverse logistics include : logistics, warehousing, repair, refurbishment, recycling, e-waste, after-market call-centre support, reverse fulfillment, field service etc.
- After-market supply chain refers to an activity or period in time in the product life cycle after the product leaves the shelf, reaches the consumer and then delivered for reuse in one form or another to the end consumer. This is synonymous with reverse logistics.

Features :

- Convenient returns management options.
- Closed-loop return cycle providing transportation and related warranty information flows.
- Product testing and disposition.
- Inventory replenishment.
- Technical repair and refurbishment services.
- Asset recovery and recycling management.

Benefits :

- Streamline returns and credit processes, reduce inventory and increase cash flow.
- Improve productivity through decreased time spent in handling returns.
- Increase efficiency and inventory velocity through the use of repaired parts as a low-cost source of parts.
- Shrink product obsolescence and asset re-utilisation cycle times.
- Reduce warranty reconciliation expense with automated controls and tighter accountability.
- Get a reliable source to manage asset recovery and recycling of high-tech products and components.

1.9 GREEN LOGISTICS

Green logistics describes all attempts to measure and minimize the ecological impact of logistics activities. This includes all activities of the forward and reverse flows. This can be achieved through intermodal freight transport, path optimization, vehicle saturation and city logistics.

Green logistics focuses on adoption of green technology and practices for firms which will offer an advantage and at the same time will suit to an environment.

Green logistics, in the context of humanitarian logistics encourages all stakeholders to consider the impact of their actions on the environment. The main objective of Green logistics is to coordinate the activities within a supply chain in such a way that beneficiary needs are met at "least cost" to the environment. It is a principle component of reverse logistics. In the past "cost" has been defined in purely monetary terms, whereas "costs" can now be understood as the external cost of logistics associated with climate change, air pollution, dumping waste (including package waste), soil degradation, noise, vibration and accidents.

Green Transportation and Logistics Initiatives Undertaken by Dell Computers

1. Delivering products with minimum environmental impact: Dell ships products to 180 countries worldwide, at a rate of one system per second. Whether sending one laptop to a student in India or thousands of desk tops and servers to an enterprise in Indiana, Dell must ship products in a way that gets each order to its correct distributor on time, with all contents intact. People at Dell work hard to minimize the environmental impact of each shipment. From choosing the right transportation mode for each order type to minimizing packaging, Dell continuously refines its global transportation and logistics network to make transactions more eco-friendly without added cost or complexity.

2. Optimising transportation networks for more efficient trips: One of the biggest ways Dell cuts waste is by continuously refining its global processes and tools to find the most efficient use of air, land and ocean transportation for every occasion-receiving supplies, shipping products, delivering services and accepting product returns.

3. Truck to Rail, Air to Sea: Dell is exploring new transportation modes and routes including shipments from Asia to Europe and from China to South Asia. Dell's **"air to sea"** initiative has reduced carbon emission by shifting many international shipment from aircraft to ocean freight.

4. Retail partner expansion: Dell has found ways to complete its retail orders closer to end customers and consolidate them into fewer shipments. This reduces travel distance, fuel consumption and carbon emissions.

5. Developing internal processes to cut waste: Dell's hard work has been recognised with many environmental awards. Dell understands the responsibility that comes with such recognition and continues to drive improvement for its customers through internal processes ranging from container optimization to packaging innovations.

6. Reverse logistics: Dell's new efforts to decrease product returns resulted in making 94 percent of returned assets available for resale through Dell outlets. These items can be quickly returned to usefulness and resold.

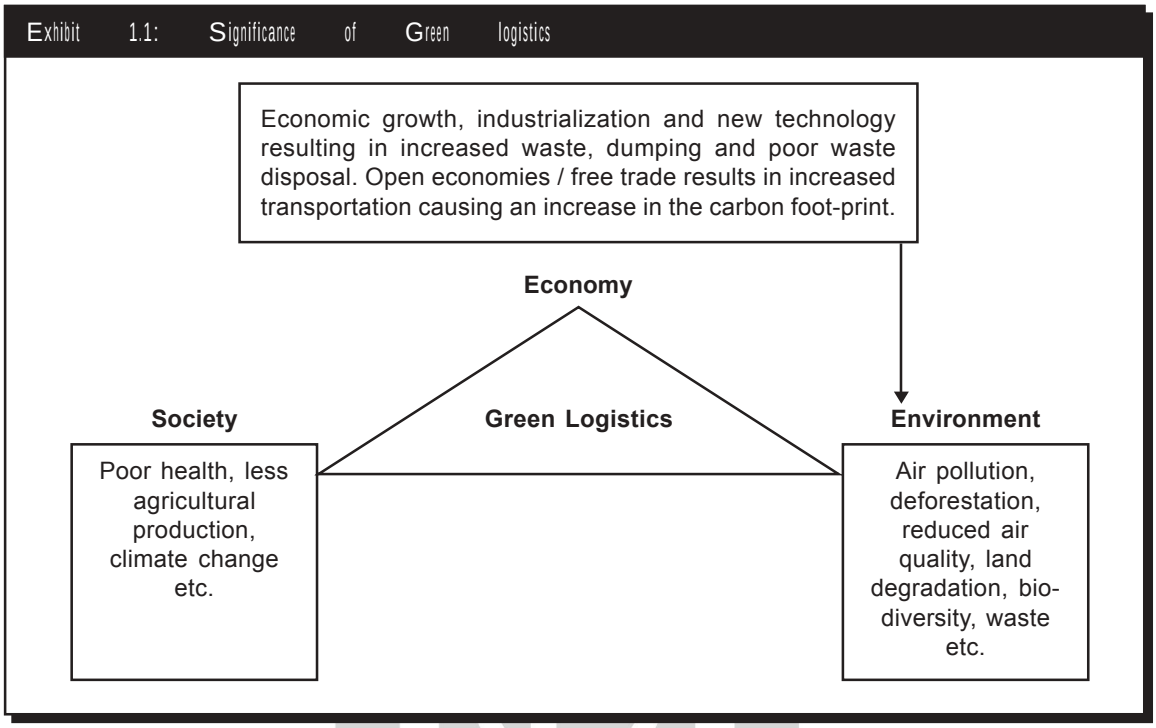
7. Collaborating with partners on green initiatives: Dell relies on the industry's best logistics and transportation partners to ship products safely to its customers, These partners such as DHL & Fedex share Dell's commitment to both efficiency and environmental stewardship.

8. ISO 14001 standards: Many of Dell's partners comply with the standards of ISO 14001 which help, companies improve their environmental performance. Their improvements include transmitting shipping documents electronically and using recycled card board dunnage to protect freight.

Significance of Green Logistics

Exhibit 1.1 **illustrates the significance of Green logistics.**

Exhibit 1.1: Significance of Green logistics



Green or sustainable logistics is concerned with reducing environmental and other negative impacts associated with the movement of supplies. Green supply chains seek to reduce negative environmental impact by redesigning sourcing/ distribution systems and managing reverse logistics to eliminate inefficiencies. For example, logistics deals with packaging of materials. Packaging represents one of the biggest challenges to environmental friendly logistics while at the same time being vital in shipping and storage. Packaging has consequences on the transportation, storage and volume of materials in a given space. This can increase the unit cost if packaging hinders optimization of storage space. The type of packaging presents the greatest challenge to logistics, and there is a responsibility for the supplier and the buyer to recover and recycle or effectively dispose of packaging materials after use.

1.10 OBJECTIVES OF LOGISTICS MANAGEMENT

The mission of logistics management is to plan and co-ordinate all those activities necessary to achieve desired levels of delivered service and quality at the lowest possible cost. Hence logistics must be viewed as the link between the market place and the operating activity of the business. **The following objectives of logistics management are to be achieved by a firm in order to fulfill its logistics mission:**

(i) The ***primary or major objective*** is to efficiently and effectively move the inventory in the supply chain in order to extend the **desired level of customer service at the least possible cost**.

(ii) The ***secondary objectives*** which facilitate achievement of the primary or major objective are:

(a) To reduce inventory to the minimum possible level.

(b) To achieve reliable and consistent delivery performance to enhance customer satisfaction and build long-term customer relationship.

(c) To achieve maximum economy in freight costs.

(d) To ensure minimum or no damage to products during transportation and storage.

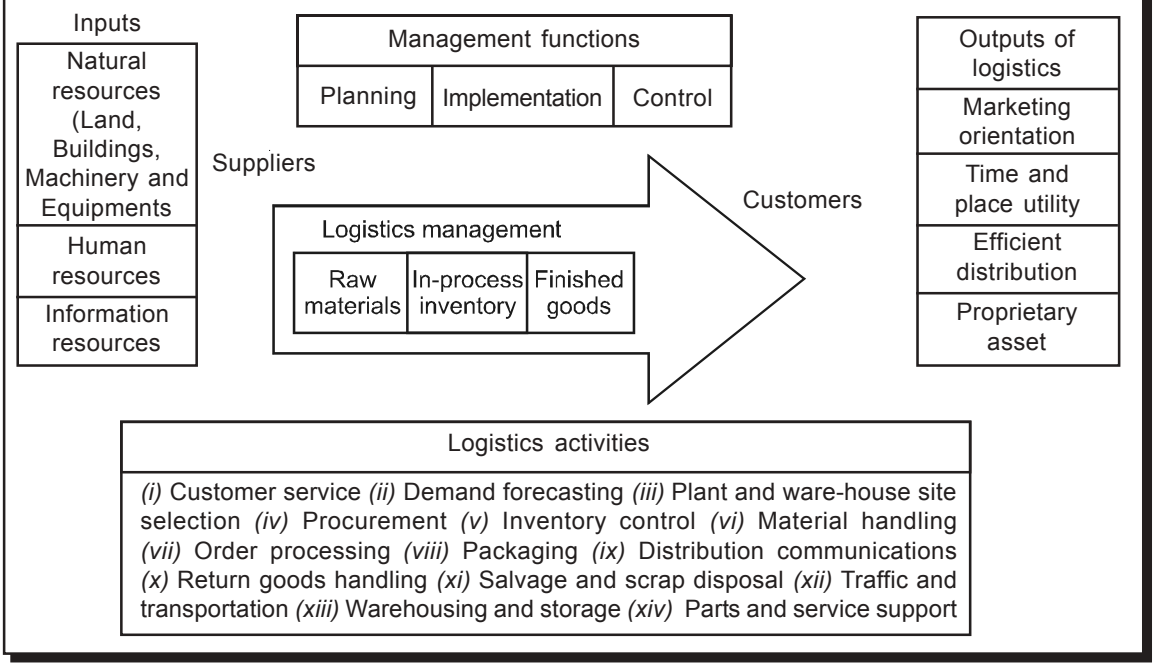
(e) To ensure quick response to customer requirements.

1.11 SCOPE AND IMPORTANCE OF LOGISTICS MANAGEMENT

Logistics is not confined to manufacturing operations alone. It is relevant to all types of enterprises including organisations such as government departments, institutions such as hospitals, universities, and service organisations such as banks, financial service institutions, wholesalers and retailers and the like.

Some of the activities encompassed under logistics umbrella are illustrated in *Exhibit 1.2*.

Exhibit 1.2 : Components of Logistics Management



Logistics is dependent on inputs such as natural resources (raw materials), human, financial and information resources. The raw materials supplied by suppliers are converted into in-process inventory and then into finished goods by logistics management. Management functions such as planning, implementation and control provide the frame-work for logistics activities. The outputs of the logistics system are competitive advantage through time and place utility, efficient transportation of finished goods to the customer and providing a logistics service mix, making logistics a proprietary asset to the

organisation. Efficient and effective performance of the logistics activities listed in *Exhibit 1.2* will result in the desired outputs.

In a manufacturing organisation having an integrated structure, activities such as purchasing, production planning and control, ware-housing, and inventory control are centralised under materials management department and distribution of finished goods is done by marketing department.

Although many activities and decisions are integrated under materials under management, considerable amount of cross-functional co-ordination is required. *For example*, marketing typically does the forecasts for demand and processes the incoming customer orders. Production planning and control uses this information to plan work force schedules and work priorities. At the same time, marketing needs information regarding current production schedules and production capacity so as to process incoming customer orders in order to make realistic delivery promises. After receipt of brought-out materials sent by suppliers or finished goods shipped to customers, the information regarding the same must be made available to accounts department for making payments to suppliers or billing customers. All these cross-functional co-ordination requires an efficient information system. Logistics management includes all these **cross-functional co-ordination activities** and it co-ordinates the function of materials management, production planning and control and physical distribution management including finished goods inventory and selection of transportation suppliers. Consequently logistics management decisions have a cumulative effect on the profitability of a firm and thus attract considerable attention from the top management.

Logistics management adds **value** when inventory is correctly maintained to facilitate sales to meet the customer demand. But creating ***logistics value*** is itself a costly effort and also it is difficult to measure. It is estimated that the logistics expenditure accounts to about 10 per cent of the gross national product (GNP) of a country and hence it is quite substantial in terms of money value. For individual firms, logistics expenditure may range from 5 to 35 per cent of sales depending on the type of business, geographical area of operation and weight/value ratio of products and materials. Logistics typically accounts for one of the highest costs of doing business, next only to materials in manufacturing or cost of goods sold in wholesaling or retailing. Therefore, it may be inferred that **"*Logistics while vital to business success, is quite expensive*"**.

Inspite of its costs, the true excitement of logistics comes from its benefit to organisations to position their ***logistical competency*** to gain ***competitive advantage*** by providing customers with superior service (value for money).

Benefits gained by firms having good logistics management include:

(i) Capability to identify potential operational break-downs and taking corrective action prior to failure of service to customers. In situations where timely corrective action is not possible, customers can be notified in advance and offered alternatives. This will remove the forthcoming surprise or shock to customers, out of forthcoming service failures.

(ii) Performance above industry average in terms of inventory availability as well as speed and consistency of delivery to customers.

(iii) Capability to monitor logistical performance on a real-time basis through efficient information systems.

(iv) High delivery performance (near **perfect orders**).

(v) Commitment to continuous improvement.

(vi) Firms having world-class logistical competency can become attractive suppliers and ideal business partners.

Logistical management includes the design and administration of systems to control the flow of material, work-in-process and finished goods inventory to support business unit strategy. Its overall goal is to achieve a targeted level of customer service at the lowest possible total cost. Logistics managers are responsible for planning and administration of detailed and complex work involved in logistics management.

1.12 LOGISTICAL FUNCTIONS/LOGISTICS MIX

According to the Council of Logistics Management, the components of a logistics system are: customer service, demand forecasting, distribution communications, inventory control, material handling, order processing, parts and service support, plant and ware-house site selection, purchasing, packaging, return goods handling, salvage and scrap disposal, traffic and transportation and ware-housing and storage.

These components or activities are divided into key activities and support activities ***Box 1.3*** **lists these components or activities along with some of the decisions associated with each activity.**

Box 1.3 : Components or Activities of a Typical Logistics System

Activities	Associated Decisions
Key Activities	
1. Customer service standards co-operate with marketing	1. *(a)* Determination of customer needs and wants for logistics customer service. *(b)* Determination of customer response to service. *(c)* Establishing customer service levels.
2. Transportation	2. *(a)* Selection of mode and transport service. *(b)* Freight consolidation. *(c)* Carrier routing. *(d)* Vehicle scheduling. *(e)* Equipment selection. *(f)* Claims processing. *(g)* Rate auditing.
3. Inventory management	3. *(a)* Raw materials and finished goods stocking policies. *(b)* Short-term sales forecasting. *(c)* Product-mix stocking points. *(d)* Number, size and location of stocking points. *(e)* Just-in-time, push and pull strategies.
4. Information flows and order processing	4. *(a)* Sales order-inventory interface procedures. *(b)* Order information transmittal methods. *(c)* Ordering rules

Support Activities	
1. Ware-housing	1. *(a)* Determining ware-house space. *(b)* Stock layout and dock design. *(c)* Ware-house configuration. *(d)* Stock placement.
2. Materials handling	2. *(a)* Selection of materials handling equipments. *(b)* Equipment replacement policies. *(c)* Order-picking procedures. *(d)* Stock storage and retrieval.
3. Purchasing	3. *(a)* Selection of sources of supply. *(b)* Purchase timing. *(c)* Purchase quantities.
4. Protective packaging design for:	4. *(a)* Handling. *(b)* Storage. *(c)* Protection from loss and damage.
5. Co-operating with production/operations to	5. *(a)* Specify aggregate quantities. *(b)* Sequence and time production output. *(c)* Schedule supplies for production/operations.
6. Information maintenance	6. *(a)* Information collection, storage and manipulation. *(b)* Data analysis. *(c)* Control procedures.

1.13 THE CHANGING LOGISTICS ENVIRONMENT

Business environments change constantly. As the ***competitive environment*** of business continues to change, bringing with it new complexities and concerns for management generally, these changes have significant impact on the design and management of a logistics system. Logistics managers must implement significant modifications to the logistics systems managed by them on a quick response basis. **Four forces drive business environment change: *the market, competition, technological evolution* and *government regulation***. These four factors cause companies to adjust their logistics strategies and tactics on a continuous basis. Infact, of the many strategic issues that business organisations confront today perhaps the most challenging are in the area of logistics. **The most pressing challenges at present are:**

(i) The customer service explosion

(ii) Time compression

(iii) Globalisation of industry

(iv) Organisational integration

These challenges are briefly discussed in the following paragraphs:

(i) **The Customer Service Explosion :** Customer in today's market is more demanding, not just of product quality, but also of quality service.

In today's 'commodity' markets, customer perceives little technical difference between competitive offers (product differentiation) and hence there is a need for the creation of differential advantage through added value. ***Customer service*** is one prime source to create the added value. **"*Customer service is defined as a process for providing significant value added benefits to the supply chain in a cost-effective way"***. Customer service may also be defined as the constant provision of ***time*** and ***place utility***. It involves on-time delivery and after-sales-support. Its role is to enhance **'value-in-use'** meaning that the product becomes worth more to the customer because service has added value to the core product. While the core product of competitive firms do not have significant differences, a firm can add value to its core product by significantly differentiating its total offer (*i.e.,* core product plus the service package) from that of its competitors.

Companies giving high priority for their ***logistics performance*** can achieve recognition for ***service excellence*** and thus establish a differential advantage over their competition (Xerox, DMW and Dell computers are some of the examples of such companies). Such competitive advantage can be achieved through service resulting from a combination of strategy for service, the development of appropriate delivery systems and total commitment from all the employees of the company-right from the Chief Executive down to the lowest level employee.

Service excellence can only be achieved through a closely integrated ***logistics strategy***. The ability to become a world-class supplier depends upon the effectiveness of the firm's operating systems, the presentation of its products, the creation of its images and the influencing of customer perceptions. In this context, managing the logistics of service delivery on a consistent basis becomes the crucial source of differential advantage.

(ii) **Time Compression : Time has become a key issue in management today because of the following reasons:**

(a) Product life-cycles are shorter than ever.

(b) Industrial customers and distributors require just-in-time deliveries.

(c) End users are more willing to accept a substitute product if their choice is not readily available.

(d) New product introduction to the market should be done in the minimum possible lead time.

In addition to all these initiatives which are necessary for a business to survive, the issue of the problem of ***extended logistics lead times*** is given more importance along with the concern with the process of creating and managing innovation.

The scope of logistics lead-time management includes a number of complex activities that must be managed in order to gain and retain customers. These activities are related to decisions taken on the sourcing and procurement of materials and components through the manufacturing and assembly process to the final distribution and after sales service/support.

Logistics is basically concerned with the provision of ***'availability'*** of materials to the manufacturing units and the finished products to the customers. To carryout this logistics function (both in-bound and out-bound logistics) it is necessary to integrate the marketing and manufacturing planning functions. Because of extended supply and distribution 'pipelines', there is limited co-ordination of supply decisions with the changing requirements of the market place resulting in restricted visibility that purchasing and manufacturing have of final

market demand. Hence a new and different approach to the management of lead time is required to establish enduring competitive advantage by ensuring timely response to volatile market demand.

(iii) **Globalisation of Industry :** In the current era of globalisation, changes in customers' expectations or geographical locations continually transform the nature of markets and in turn, generate constraints that modify the flows of goods within companies.

Technological break-through and emerging markets open up new ways of reorganising, adapting and optimising the flow of raw materials, semifinished goods, products, spare parts and recycle materials. In the global business, materials and components are sourced world wide, manufacturing is outsourced off shore and finished products are sold in many different countries perhaps with local customisation. Therefore, for global companies, the management of logistics process has become an issue of central concern. The global company is compelled to seek to achieve competitive advantage by identifying global markets for its products/services and then developing a manufacturing and logistics strategy to support its marketing strategy.

(iv) **Organizational Integration :** In traditional organisations functional departments such as materials management, production, marketing etc., function rather independently without systems approach and integration among various functions. But in today's competitive environment, to achieve a position of sustainable competitive advantage, organisations have to dispense with the out-moded functional organisational structures and instead have managers who are broad-based integrators and are oriented towards the achievement of market place success based upon managing processes and people that deliver service. *For example,* materials management must be integrated with production management which in turn must be integrated with marketing management. Hence, knowledge of systems theory and behavioural science will be a key prerequisite for managers of today. Also the managers need to be market-oriented with a sharp focus upon customer service as the primary source of competitive advantage.

1.14 REVIEW QUESTIONS

1. Define the terms logistics and logistics management.
2. What are the various types of logistics?
3. Briefly discuss the concepts of logistics.
4. What is "Logistics performance cycle"?
5. Discuss briefly *(a)* Inbound logistics *(b)* In-process logistics and *(c)* Outbound logistics.
6. What is meant by "Logistical competency"?
7. What is "Integrated logistics"?
8. What is "Reverse logistics"? Give an example.
9. What is "Green logistics"? Discuss the Green logistics initiatives undertaken by Dell computers.
10. Discuss the significance of Green logistics.
11. State the objectives of logistics management.
12. Discuss the scope and importance of logistics management.

13. Discuss the benefits gained by having good logistics management.
14. Briefly discuss the various logistical functions.
15. "In fact of the many strategic issues that business organisations confront today, perhaps the most challenging are in the area of logistics" – explain.

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