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INTERNATIONAL LOGISTICS

Study guide

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In this study guide the essence, the basic conceptions and the role of international logistics in economic development, the international and organizational aspects of procurement logistics, international warehousing, conceptual foundations of distribution logistics and inernational transport logistics are examined. This study guide is intended for students of specialty "International Economic Relations".

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PREFACE

«Getting the right product,
to the right place,
at the right time,
in the right quantity,
with the right quality,
at the right cost,
for the right customer»

(«7Rules» of Logistics)

One of the important phenomena of our time is globalization. It has affected all aspects of our lives, influencing not only business but also cultural, social and political aspects in every country in the world. International logistics could not stay away from this process. The international division of labor and cooperation have led to the creation of a large number of multinational companies and financial-industrial groups using international logistics chains in business. The development of international logistics is facilitated by the large scale international transport and logistics companies, insurance companies using global information and telecommunication networks.

The term "International Logistics" refers to the process of planning, implementing and controlling the cost-effective flow of raw materials, work in progress, finished products, services and related information from the point of origin to the point of consumption with participation in the process of delivery of two or more states.

Deregulation procedures carried out by many countries to remove trade, customs, transport and financial barriers are essential for international logistics. The development of the Ukrainian economy requires the search for new opportunities for growth. One of such opportunities is the formation of international logistics systems at the macroeconomic level.

International logistics systems are a powerful means of saving scarce national resources. Active implementation of *international logistics* is one of the strategic ways to increase the competitiveness of domestic business.

Therefore *the aim* of the manual is to systematize, generalize and develop knowledge and practical skills of conceptual bases and aspects of international logistics activities, as well as methods, means of forming

international logistics systems, transport support of international business and trends in its development.

The proposed training manual represents an attempt to describe the issues of the organization and regulation of international logistics, including the modern trends and technologies in the international logistics operations.

The consideration of the main issues of functioning and development of the international logistics determines the structure of the proposed manual.

Chapter 1 is devoted to the describing the essence and value of international logistics in the system of international economic relations and the features of its development. In this chapter the basic concepts of international logistics are discussed.

Chapter 2 is devoted to the conceptual foundations of international logistics: international logistics systems, logistics cycle, organization of logistics flows. And the notion of "Supply Chain Management" as a strategic business concept.

In *chapter 3* the considerable attention is paid to the peculiarities and the main instruments of international aspects of procurement logistics.

Chapter 4 concerns the organizational aspects of inventory logistics and its management. It describes the forms and types of inventories. Also it defines the performance of "ABC-XYZ" analysis in the inventories' management.

Chapter 5 provides an opportunity to get acquainted with the basics of international warehouse logistics.

Chapter 6 describes the general characteristics of production logistics. The main focus is on the essence and forms of micrologistics concepts; modern logistics trends and technologies.

Chapter 7 is devoted to the fundamentals of distribution logistics; the notion of logistics intermediaries in distribution channels and distribution centers in logistics chains.

Chapter 8 concerns the fundamentals of international transport logistics; international forwarding services and development of transport Eurologistics strategy.

We hope that this training manual will enable students to make the maximum use of international experience of research in international logistics.

Chapter 1. Basics of International Logistics

1.1. The Notion of International Logistics and its Historical Periodization

Logistics was originally a military term. The term *"logistics"* (in French *"logistique")* was popularized by military officer and writer *Antoine-Henri Jomini*, who defined it in his "Summary of the Art of War" ("*Précis de l'Art de la Guerre"*) (McGinnis, 1992).

The Oxford English Dictionary defines logistics as "the branch of military science relating to procuring, maintaining and transporting material, personnel and facilities". However, *the New Oxford American Dictionary* defines logistics as "the detailed coordination of a complex operation involving many people, facilities, or supplies", and *the Oxford Dictionary defines* it as "the detailed organization and implementation of a complex operation" (Oxford Dictionary, 2015).

Logistics is a process of planning, execution and control of the movement and placement of people and/or goods and of supporting activities related to such movement and placement, within a system organised to achieve specific objectives (Fundamentals, 2018).

Unification and standardization of logistics terminology abroad currently mainly engaged in two organizations: Council of Logistics Management (CLM) and European Logistics Association (ELA).

The international logistics community is actively using network structures and modern information technologies, with the help of which research cooperation between scientists from different countries is developing. The most well-known body that develops common methodological approaches in logistics training is *the Council of Supply Chain Management Professionals* (CSCMP), a forum for researchers and logistics professionals in the United States. The organization holds annual logistics conferences to discuss many issues related to the development of

international logistics. Another organization is *the European Logistics Association* (ELA), organized on the basis of leading European universities.

The Community of European Business Schools (CEMS) is an organization consisting of one leading business school representing the participating country. CEMS is developing curricula for international logistics and supply chain management. The Northern Logistics Research Network (NOFOMA) operates in the Northern Europe, uniting researchers from Denmark, Norway, Finland and Sweden.

Periodization of logistics development:

Fragmentation period (1920-1950) is related to the idea of *cost-cutting logistics*. During this period, only the preconditions for the future implementation of the logistic concept have been formulated such as (McGinnis, 1992):

- increase of stocks and freight costs in the distribution system of goods;
- increase in freight rates;
- the emergence of marketing;
- development of the military logistics theory and practice.

Formation (conceptualization) of logistics (1950 - 1970s) is characterized by the rapid growth of the theory and practice of logistics. The marketing philosophy has quickly spread, and at the same time, it has been understood that there was necessity need to develop and to improve distribution, primarily from the point of view of cost reduction. One of the key factors in the rapid expansion of logistics was the emergence of a total costs concept in physical distribution.

Integral logistics (1980 - 1990) is characterized by the rapid development of modern marketing and integrated logistics. The logistics function is formed: *"Procurement - production - sales"*.

This period can be called *personalization.* With the development of new trade relations and the elimination of state monopoly, the principle of business logistics became widely used.

Factors that have influenced the commercial logistics formation.

- 1950*s* - the overproduction crisis in the United States;
- 1970*s* - the global energy crisis;
- 1980*s* - development of information technologies;
- 1990*s* - decoupling of transport enterprises.

The concept of logistics is based on a total system view of the multitude of functions in movement of materials and goods from sources of supply to users. Accordingly, it forces management to think in terms of managing the total system; rather than just one part of it.

According to the *Council of Supply Chain Management Professionals*

(previously the Council of Logistics Management), **logistics** is the process of planning, implementing and controlling procedures for the efficient and effective transportation and storage of goods including services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements and includes inbound, outbound, internal and external movements (Material Handling, 2018; Business Dictionary, 2018; James F. Cox et al.,1995).

The most famous definition cited by most overseas university textbooks, is the definition of logistics given in the USA in 1985: "Logistics is the planning, executing and controlling process in terms of reducing the cost of raw materials stocks flow, unfinished production, finished products, service and related information from the point of its origin to the point of consumption (including import, export, internal and external movements) to fully meet customers' requirements" (Corporate Logistics, 2005).

According to Phillip Kotler: "Market logistics involves planning, implementing and controlling physical flow of material and final (finished) goods from the point of origin to the point of use to meet customer requirements, at a profit" (Corporate Logistics, 2005).

The term **"international business logistics"** has evolved since the 1960s (McGinnis, 1992) due to the increasing complexity to supply businesses with materials and to ship out products in an increasingly globalized supply chain, leading to a call for professionals called "supply chain logisticians". From a business point of view: "Logistics is a tool for integrated management of material and related information, financial flows, as well as ancillary services that contribute to achieving the goals of a business organization with the optimal cost of resources" (Corporate Logistics, 2005).

In the international business, logistics may have either an internal focus (inbound logistics) or an external focus (outbound logistics), covering the flow and storage of materials from point of origin to point of consumption. The main functions of a qualified logistician include inventory management, purchasing, transportation, warehousing, consultation, and the organizing and planning of these activities. Logisticians combine a professional knowledge of each function to coordinate resources in an organization (Ronald H. Ballou and Samir K. Srivastava, 2007; Business Dictionary, 2019).

The object of logistics is the flow processes, their structure and elements to achieve general and local goals and the implementation of their functions.

The main task of logistics is to achieve of the maximum adaptability of economic entities (enterprises, associations) to market conditions with optimal expenses; to increase the market share and to obtain competitive

advantages (Berzhanir et al., 2009). In this regard, *the subject of logistics* is the logistic processes associated with changes in the parameters of placement, time, the form of material and their accompanying flows at the enterprises, and the object-logistic flows (material, informational, financial, information, service and other flows).

The level of development of logistics in the world is assessed by several international organizations. The most well-known ratings are *the Logistics Performance Index*, also known as *the Logistics Perception Index*, published by the World Bank and *the Liner Shipping Connectivity Index*, and developed by the United Nations Conference on Trade and Development (UNCTAD).

1.2. The Main Objectives, Functions and Activities of International Logistics

The main objective of logistics is to adapt the firm to the market situation with the minimum costs, to increase its own presence in the market and to gain competitive advantages by creating an integrated effective system of regulation and control of material and information flows (Coyle J.J. et al., 1992).

Objectives of the International Logistics (Introduction, 2019; Logistics Management, 2019)**:**

1) Cost reduction and profit maximization: Logistics management results in cost reduction and profit maximization, primarily due to:

- improved material handling.
- safe, speedy and economical transportation;
- optimum number and convenient location of warehouses etc.

2) Efficient flow of manufacturing operations: Inbound logistics helps in the efficient flow of manufacturing operations, due to on-time delivery of materials, proper utilisation of materials and semi-finished goods in the production process and so on.

3) Competitive edge: Logistics provide, maintain and sharpen the competitive edge of an enterprise by:

- increasing sales through providing better customer service;
- arranging for rapid and reliable delivery;
- avoiding errors in order processing; and so on.

4) Effective communication system: an efficient information system is a must for sound logistics management. As such, logistics management helps in developing effective communication system for continuous interface with suppliers and rapid response to customer enquiries.

5) Sound inventory management: sound inventory management is a by-

product of logistics management. A major headache of production management, financial management etc. is how to ensure sound inventory management; which headache is cured by logistics management.

Key logistics functions include (Berzhanir et al., 2009)**:**

1) Maintaining the quality standards of subsidiary and associated services production.
2) Transportation.
3) Inventory management.
4) Management of orders procedures.
5) Support of production procedures.

Logistics may be broadly classified into two categories (Figure 1.1), (Introduction, 2019):

1) *Inbound logistics;* which is concerned with the smooth and cost effective inflow of materials and other inputs (that are needed in the manufacturing process) from suppliers to the plant. For proper management of inbound logistics, the management has to maintain a continuous interface with suppliers (vendors).

2) *Outbound logistics* (also called physical distribution management or supply chain management); is associated with the flow of finished goods and other related information from the firm to the customer. For proper management of outbound logistics, the management has to maintain a continuous interface with transport operators and channels of distribution.

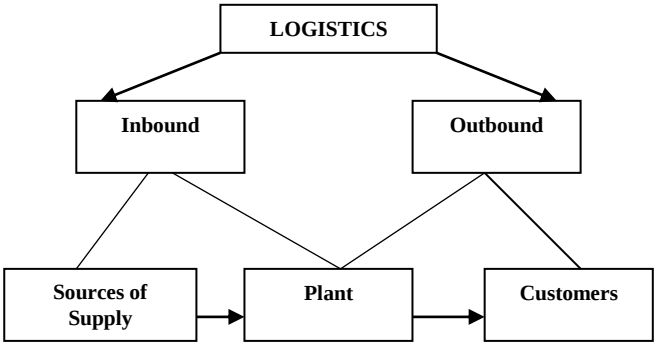

Figure 1.1 – Scope of logistical activities (Introduction, 2019).

Depending on the services performed by logisticians, the main fields of logistics can be broken down as follows (Pierre A. David et al., 2010):

1) Procurement logistics.
2) Distribution logistics.

3) After-sales logistics.
4) Disposal logistics.
5) Reverse logistics.
6) Green logistics.
7) Global logistics.
8) Domestic logistics.
9) Production Logistics.
10) Construction Logistics.
11) Capital Project Logistics.
12) Digital Logistics.

According to *the Council of Logistics Management*, **logistics** is the management process of planning, implementing and controlling the physical and information flows concerned with materials and finished goods from the point of origin to the point of usage (Figure 1.2). **International logistics** involves the management of object-logistic flows in a company's supply chain across at least the one international border (Pierre A. David et al., 2010).

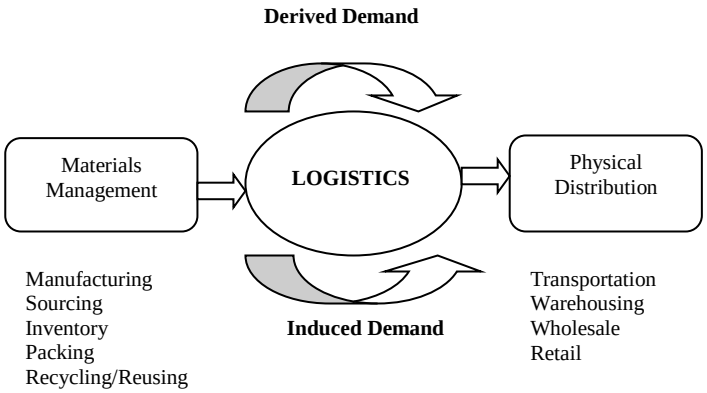

Figure 1.2 – "Driven by demand" Logistics activities (Pierre A. David et al., 2010).

Example

Let us look at a simple example. Just pretend for a moment that you work as a logistics manager for a large American jewelry company based out of New York. Your company has an extensive international supply chain. We will walk through a simplified logistical process for a diamond

ring.

Your diamond supplier is in South Africa. You get your gold from a supplier in China. The jewelry itself is assembled in Switzerland. Your job is to manage the supply chain from acquisition of a resource through its transformation into a finished product and until it is sold to a customer. Your responsibilities may include the following:

1) Oversight of diamonds purchase in South Africa and gold necessary from China to fulfill the company's production demands.

2) Arranging for the temporary warehousing of the purchased diamonds and gold at local storage facilities.

3) Arranging for the international shipping of the gold stored in China to a subsidiary in a small Eastern European country, where the gold will be refined and prepared for the jewelers in Geneva.

4) Arranging for the international shipping of the diamonds stored in South Africa to the company's facilities in Geneva for cutting and polishing.

5) Arranging for the international shipping of the refined gold to the company's Geneva facility to create rings and settings.

6) Once the rings are finished, arranging for their warehousing at the company's central warehouse until they are needed to fill orders, keeping meticulous computerized inventory records, and ensuring the facility is adequately secured.

7) Arranging for the shipment of an order of diamond rings to the company's flagship Manhattan retail store.

8. Continued monitoring of the inventory at the retail store until the product is sold to a customer (Business Management, 2019).

Key activities involved in the International Logistics (Introduction, 2019; Pierre A. David et al., 2010):

1) Network design: network design is one of the prime responsibilities of logistics management. This network is required to determine the number and location of manufacturing plants, warehouses, material handling equipment's etc. on which logistical efficiency depends.

*2) Order processing***:** customers' orders are very important in logistics management. Order processing includes activities for receiving, handling, filing, recording of orders. Herein, management has to ensure that order processing is accurate, reliable and fast. Further, management has to minimize the time between receipt of orders and date of dispatch of the consignment to ensure speedy processing of the order. Delays in execution of orders can become serious grounds for customer dissatisfaction; which must be avoided at all costs.

3) Procurement: it is related to obtaining materials from outside

suppliers. It includes supply sourcing, negotiation, order placement, inbound transportation, receiving and inspection, storage and handling etc. Its main objective is to support manufacturing, by providing timely supplies of qualitative materials, at the lowest possible cost.

4) Material handling: it involves the activities of handling raw-materials, parts, semi-finished and finished goods into and out of plant, warehouses and transportation terminals. Management has to ensure that the raw-materials, parts, semi-finished and finished goods are handled properly to minimize losses due to breakage, spoilage etc. Further, the management has to minimize the handling costs and the time involved in material handling. Material handling systems, in logistics management are divided into three categories: mechanized systems; semi-automated systems; automated systems.

5) Inventory management: the basic objective of inventory management is to minimize the amount of working capital blocked in inventories; and at the same time to provide a continuous flow of materials to match production requirements; and to provide timely supplies of goods to meet customers' demands.

6) Packaging and labeling: packaging and labeling are an important aspect of logistics management. Packaging implies enclosing or encasing a product into suitable packets or containers, for easy and convenient handling of the product by both, the seller and specially the buyer. Labeling is a strong sales promotion tool. The consumer who is persuaded to read the label may, in fact, try to buy the product; even though he/she had no such premeditation (advance idea).

7) Warehousing: storage or warehousing is that logistical activity which creates time utility by storing goods from the time of production till the time these are needed by ultimate consumers. Here, the management has to decide about: the number and type of warehouses needed and the location of warehouses. It depends on the desired level of customer service and the distance between the supply source and final destination i.e. markets.

8) Transportation: transportation is that logistical activity which creates place utility.

The main participants (elements) of the supply chain of International Logistics may be as follows: producers, supplier (venndor), exporter of goods and services; customs broker, importer of goods and services, end - user, freight forwarding companies, warehouse complexes, distributors, wholesalers, retailers, companies or individuals who are the final consumers of a product.

There are some peculiarities of International Logistics such as (Pierre A. David et al., 2010)**:**

1) Specificity.

2) Export-import operations.

3) Passage of customs formalities.

4) Regulation of delivery orders, delivery point, delivery schedule and terms, under contracts of purchase on the basis of Incoterms and international rules of carriage conditions.

5) Registration of transport, goods and accompanying documents.

6) Insurance.

The peculiarities and complexity of international logistics are defined by *the formula «four D»*: differentiation of means of transport; documentation; differentiation of cultures; dictatorship of consumer's demand.

1.3. Logistics in the Enterprise Management System

Logistics is the management which synchronizes such providing activities as procurement, production, sales, and distribution with demands. It aims to enhance corporate competitiveness and increase corporate value by realizing fulfillment of customers' satisfaction, cutback of unprofitable inventory and minimization of its transfer, and reduction of supply costs (Logistics Concept, 2006; Logistics Management, 2019; Stock R. James and Lambert M. Douglas, 2001).

Logistics management consists of the process of planning, implementing and controlling the efficient flow of raw-materials, work-in-progress and finished goods and related information-from point of origin to point of consumption; with a view to provide satisfaction to the customer (Logistics Management,2019).

The concept of logistics is defined as a system of views to improve the production and economic activity of the enterprise through the streamlining of management of flow processes.

The modern concept of logistics is considered through study of its properties, based on categories of thinking, oriented on value and utility; system approach; total (full) expenses; service and efficiency (Figure 1.3).

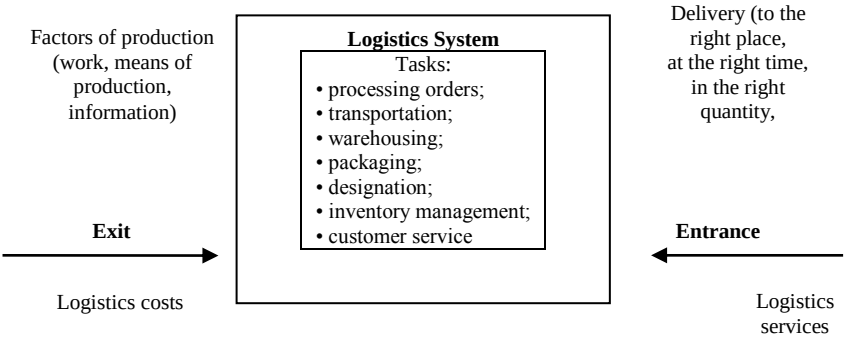

Figure 1.3 – Properties of the logistics system (Berzhanir et al., 2009)

Such providing actions as procurement, production, sales, and distribution were managed based on sector-specific evaluation indicators in the past. These optimum activities for individual sectors resulted in significant managerial losses including stock shortage, and excessive or bad inventory. Under the circumstances where synchronization of providing actions with trends for demands was required in order to eliminate such losses, logistics as management optimizing the entire providing actions developed. In logistics, all the providing actions function to synchronize with trends for demands (Logistics Concept, 2006).

For management, logistics is required to contribute to gain in profits by cutting down supply costs, and the reduction of assets by lowering inventory.

During the process of formation and development of logistics there was a consistent change in the perceptions about the essence of its concept and methodology, as a response to the change of priorities and the consumer market needs (Figure 1.4).

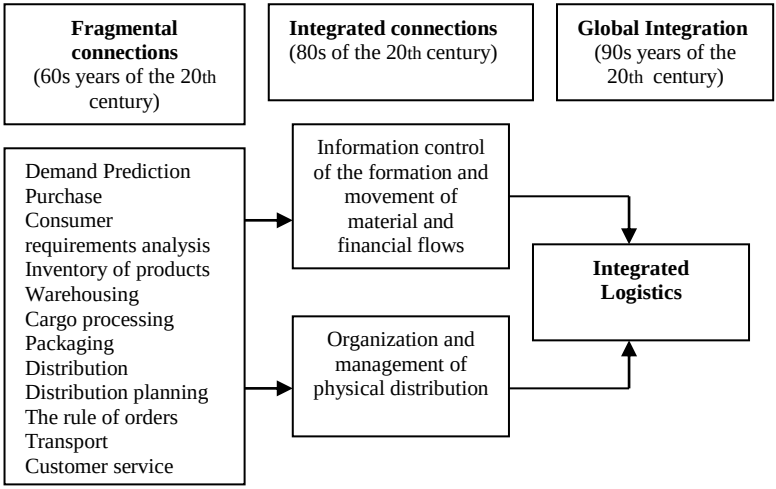

Figure 1.4 – The main stages of logistics formation as a concept of enterprise management (Berzhanir et al., 2009)

Logistics in the enterprise management system:

1) supports the market orientation of the company, aims at offering the best service to the customers (level and quality of service);

2) contributes to increasing the transparency of the market, as well as the elasticity and ability of enterprises to adapt to changing market conditions;

2) focuses on the promotion of sales and services;

3) aims to use synergies and effects;

4) provides the opportunity to solve problems arising at the junctions of movement of goods and information with other spheres in the enterprise (marketing, production, finance, personnel, etc.);

5) generates and stimulates the management efficiency (Logistics Management, 2019).

The main logistics strategies in the enterprise management system are considered in Table 1.1.

Table 1.1 – The main logistics strategies

Strategy	Ways of realization
Minimizing total logistics costs	Reduction of logistics costs in separate logistic functions; Optimization of stock levels in the logistics system; Choosing the best options for "warehousing - transportation" (switching from one logistic function to an alternative); Optimization of solutions in selected functional areas and / or logistic functions on the criterion of minimum logistic costs; 3PL approach, etc.
Improving the quality of logistics operations and functions (transportation, warehousing, cargo handling, packaging, etc.);	Support for pre-sale and after-sales service; Value-added service; Use of logistic technologies to support the product life cycle; Creation of a quality management system for logistics services; Certification of the firm's quality management system in accordance with national and international standards and procedures (in particular ISO 9000); Benchmarking etc.
Minimizing investment in logistics infrastructure	Optimize the configuration of the logistics network: direct delivery of goods to consumers, bypassing warehousing; use of warehouses of general use; use of logistic intermediaries in transportation, storage, cargo processing; the use of logistics technology "Just in Time"; optimization of the location of logistics infrastructure objects, etc.
Logistics outsourcing	The decision to "make or buy"; Concentration of the company in its key areas of competence, search of logistic intermediaries to perform non-key functions; Optimize the choice of sources of external resources; Optimal disposition of production capacities and objects of logistic infrastructure; Application of innovations of suppliers; optimizing the number of logistic intermediaries and fixing their functions.

Source: (Stock R. James and Lambert M. Douglas, 2001; Coyle J.J. et al., 1992; Jonson J.C. and Wood D.F, 1990)**.**

The relationship between Logistics and Management can be presented as follows (Logistics Management, 2019; Martin Christopher, 2010; Alan Harrison et al., 2019):

1) Creation and evaluation of logistics business management indicators. For management, logistics contributes to an increase in cash flow and Return On Assets (ROA) by reducing inventory assets through appropriate inventory and supply costs and by improving the total asset turnover. It is necessary to reorganize businesses from a logistics point of view in the relationship with each sector such as procurement, production, sales, and distribution as well as business partners, and to create, manage, and operate evaluation indicators such as KPI (Key Performance Indicator).

2) Training for a Chief Logistics Officer (CLO) and restructure of organization functions. In order to plan and establish optimization of a supply chain as a managerial strategy, training and assignment of a CLO who integrates and manages performances using business management indicators and Key Performance Indicator (KPI) are important issues. At the same time, it is essential to reorganize functions to make logistics work well in management organization.

3) Establishment of appropriate service levels such as conditions of transactions. In order to build a win-win relationship between each company comprising supply chains, it is important to establish appropriate service levels by reviewing conditions of transactions and others, and to minimize costs and environmental load.

Self-control Questions:

1. How did the term “logistics” originate and what are its dictionary definitions?
2. Is there a generally accepted (standard) definition of logistics?
3. What is a contemporary interpretation of logistics from the position of business?
4. What is the object of research in logistics?
5. What is the subject of research in logistics?
6. What are the logistic functions and how are they classified?
7. Why are the logistic functions divided into the key and supporting ones?
8. What parameters characterize the key logistic functions?
9. What is the role of logistics in the enterprise management system?
10. What is the main distinction between the national and international logistics?

Chapter 2. Conceptual Foundations of International Logistics

2.1. Supply Chain Management as a Strategic Business Concept
2.2. International Logistics System and Logistics Cycle
2.3. Organization of Logistics Flows

2.1. Supply Chain Management as a Strategic Business Concept

Supply Chain Management (*SCM)* is the integration of key business processes that begin with the final end user and cover all suppliers of goods, services and information that add value to consumers and other stakeholders (Handfield R. et al.,2013).

Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities.

Supply Chain Management (SCM) is the integration of eight key business processes such as (V. Misra et al., 2010):

1) Management of relations with consumers.
2) Customer service.
3) Demand management.
4) Management of orders execution.
5) Support of production processes.
6) Supply management.
7)Management of product development and its derivation for commercial use.
8)Management of material flows.

Logistics management as a part of the supply chain management includes plans, implements, and controls the efficient, 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 customers' requirements.

The Supply Chain is defined as the unification of all types of business processes (design, production, sales, service, procurement, distribution, resource management, supporting functions) necessary to meet the demand for products or services - from the initial point of raw materials' receipt or information to the delivery point (Bowman Glossary, 2019). (Figure 2.1).

Supply Chain Management includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers (Professional English, 2015). In essence, supply

chain management integrates supply and demand management within and across companies.

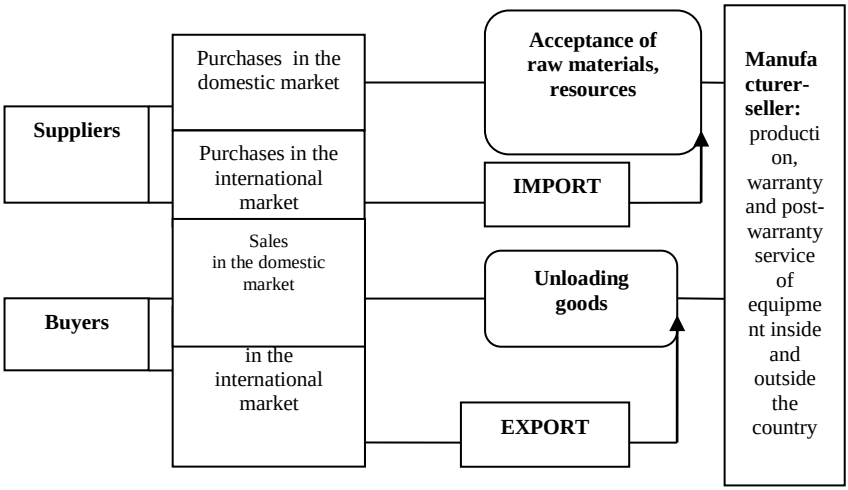

Figure 2.1 – Supply Chain Management as a Strategic Business Concept (Ballou, 1992)

Typical tasks for the SCM:

1) Formation of the network structure of raw materials and finished products to reduce operating logistics costs;

2) Optimization of the scheme of transport operations / routes (in terms of costs);

3) The choice made by the manufacturer of the goods for delivery to a specific regional market (Mallik et al., 2010).

Logistics chain is a linearly ordered number of individuals or legal entities (producers, intermediaries, warehouses, etc.) that perform logistics operations aimed at bringing the external material flow from one logistics system to another or to the end user. In any given supply chain there is some combination of companies who perform different functions (Figure 2.2). There are companies that are producers, companies that are distributors or wholesalers, companies that are retailers, and companies or individuals that are the customers who are the final consumers of a product (Michael H. Hugos, 2018).

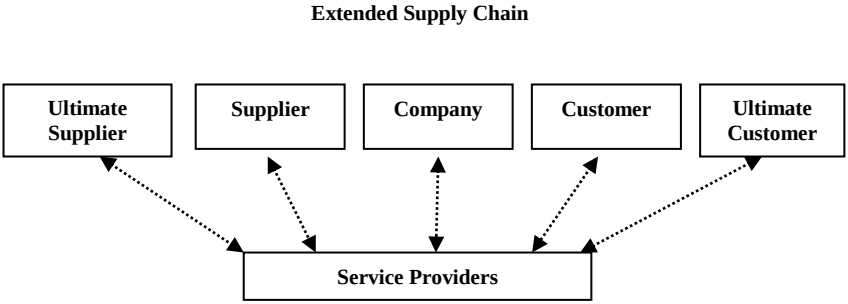

Figure 2.2 – Extended Supply Chain (Michael H.Hugos, 2018)

Producers or manufacurers are organizations that make a product. This includes companies that are producers of raw materials and copmanies that are producers of finished goods (raw materials and sub-assemblies made by other producers to create the products).

Distributors are companies that take inventory in bulk from producers and deliver abundle of related product lines to customers. Distributors are also known as wholesalers. They typically sell to other businesses and they sell products in larger quantities that an individual consumer would usually buy. Distributors buffer the producers from fluctuations in product demand by stocking inventory and doing much of the sales work to find and service customers. A distributor is typically an organization that takes ownership of significant inventories of products that they buy from producers and sell to consumers.

Retailers stock inventory and sell in smaller quantities to the general public. This organization also closely tracks the preferences and demands of the customers that it sells to. It advertises to its customers and often uses some combination of price, product selection, service, and convenience as the primary draw to attract customers for the products it sells.

Customers or consumers are any organization that purchase and use a product. A customer organization may be an organization that purchases a product in order to incorporate it into another product that they in turn sell to other customers. Or a customer maybe final end - user of a product who buys the product in order to consume it.

2.2. International Logistics System and Logistics Cycle

International logistics system involves process of planning and coordinating all aspects of the physical movement of materials, components and finished products to minimize costs and provide the desired level of service across at least one international border. *The logistics system* is a network of organizations, people, activities, information, and resources involved in the physical flow of products from supplier to customer (Figure 2.3).

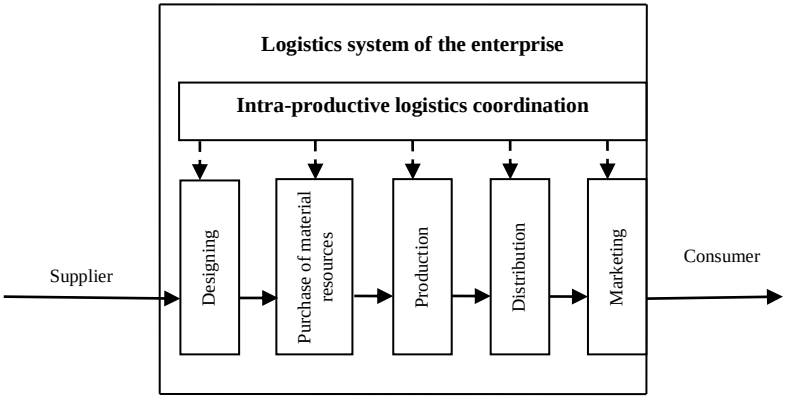

Figure 2.3 – Logistic approach to the formation of enterprise production activity (Berzhanir et al., 2009)

The purpose of international logistics system is to ensure the delivery of goods, services to a given place in the required quantity and assortment, maximally prepared for production or personal consumption at the certain level of costs across at least one international border.

Subjects of the logistics system are industrial and trading enterprises, a set of industrial and infrastructure elements, as well as the links between them at different levels.

Elements of the logistics system are functionally separate objects that are not subject to further division within the framework of the task of analysis and synthesis of the logistic system that fulfill their local target function related to the execution of certain logistic procedures (Kisly et al., 2010).

The objects of logistics system management are the processes, operations and corresponding procedures, which are subject to the forecasting, analysis and management in time and space, which are realized in the logistic system in order to minimize costs, productive inter-system interaction, etc.

Macrologistics system is a large economic system of flow management, which includes enterprises and organizations of industry, supply and marketing, transport and other intermediary structures of different departments and forms of ownership, not limited to the territorial location.

Micrologistics system is an economic system that covers the internal logistics area of one enterprise or a group of enterprises united on corporate foundations.

The logistics channel is a partially ordered set of various intermediaries that implement the proof of the material flow from a particular manufacturer to its customers.

Logistic networks are logistic entities of interconnected units, which combine several logistic chains.

The length of channel determines the number of levels. The level of the distribution channel is any intermediary performing one or another work on the approach of the product and ownership of it to the final end user.

The width of channel - the number of intermediaries at each level of the distribution channel. It is worth knowing that between the participants of the same channel, as well as between different channels, can be observed different degrees of cooperation; conflicts; competition (Terminology, 1994).

The key to improve supply chain management is in making accurate forecasts to customer demand and managing the interactions betweenproducers, distributors and retailers so as to meet customer demand. And to do so at the lowest operating costs and lowest amounts of on-hand inventory at facilities across the supply chain (Bowersox, 1996; Christofer Martin, 1998).

Logistics cycle is a repeating, completed and related process that transforms the purpose (satisfaction of the end user's needs) into a certain intended result of the demand (product, object and object). *The logistics cycle* essentially defines the structural basis of the logistics system (Table 2.1). It is determined by such main functional resources of logistics as supply, production support and distribution (Jonson J.C. and Wood D.F., 1990; Gorbenko, 2014).

Table 2.1 – The main elements of logistics cycle

Element	Content of the element
Supply cycle	• Determination of production needs in material and technical resources • Collect information about suppliers • Choice of suppliers • Implementation of the planned timetable for the delivery of materials
Production support cycle	• Minimization of the parties size and unconditional execution • Equalizing the loading of production • Rational placement of production equipment • Statistical quality control of the technological process • Preventive elimination of production problems • Team approach
Distribution cycle	• Planning the order • Transfer of the order • Choice of goods and ordering • Delivery of the order

Source: (Berzhanir, 2009; Corporate Logistics, 2005)

2.3. Organization of Logistics Flows

Flow is a set of objects that exists in a certain period of time, perceived as a whole, and measured in absolute units for a certain time. Each flow has the following parameters: a) initial and final items; b) geometry (trajectory) of the path; c) path length; d) movement speed and time; e) intermediate points; f) traffic intensity.

Material flows form the basis of logistics flows. *Material flows* are material resources (MR), incomplete production (IP) and finished products (FP), to which the logistic activities related to their physical movement in space are applied: loading, unloading, docking, crossdocking, transportation, sorting, consolidation, divestment, etc.

The *material flow* is characterized by a certain set of parameters and can be classified according to different criteria (nomenclature, assortment and quantity of goods items; weight properties (total weight, gross weight, net weight); physical and chemical characteristics of the cargo; characteristics of the container (packaging), commodity carrier, vehicle (loading capacity, cargo capacity); terms and conditions of sale and purchase agreements (transfer to ownership, delivery);conditions of transportation and insurance; financial (cost) characteristics).

In logistics processes, there are two types of services flows: 1) logistics service of material flow in production; 2) flows in service industries.

The quality of services is determined on the basis of evaluation of such

parameters as: a) tangibility; b) responsibility; c) reliability; d) competence; e) accessibility; f) security; g) correctness; g) sociability. All these parameters are quite difficult to measure and quantify. It is associated with the difficulties of forming the logistics of services. Despite this a special direction of logistics - SRL (Service Response Logistics - services logistics, has beendeveloped, which differs from CRL (Commodity Response Logistics).

Service flows are the service flows (intangible, special type of product or activity) generated by the logistics system as a whole or its subsystem (link, element) in order to meet external or internal consumers of business organization.

Organization of Logistics Flows can be presented as follows (Figure 2.4).

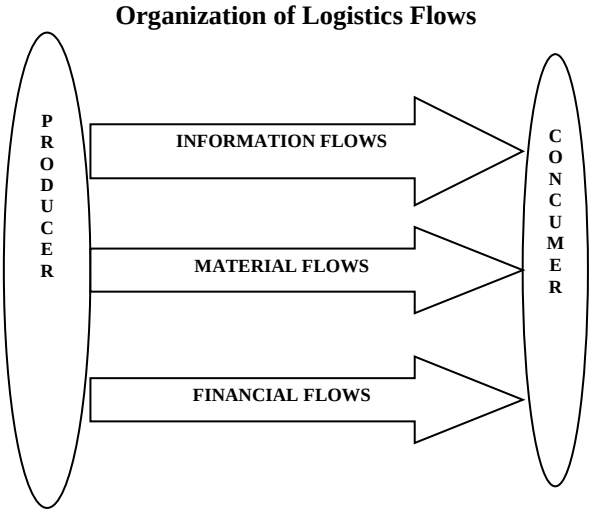

Figure 2.4 – Logistics flows (Balabanova and Germanchuk, 2012).

Financial flows are the directed flows of financial resources associated with material, informational and other flows both within and outside the logistics chain. Financial flows arise from the reimbursement of logistic costs and expenses.

Financial flows are classified according to seven characteristics:

1) in relation to the logistics system: a) internal; b) external; c) incoming; d) outcoming;

2) by purpose: a) the scope of supply; b) sales areas; c) investment;

d) material costs in the production process; e) labor reproduction;

3) by the method of transfer of the advanced cost: a) flows related fixed assets of the enterprise; b) flows due to the movement of circulating funds of the enterprise;

4) by the form of transactions: a) cash (currency); b) information and financial;

5) by types of economic relations: a) horizontal; b) vertical;

6) by source of receipt: a) own; b) borrowed;

7) by the direction of movement: a) coincided with the material flow; b) by reverse direction.

Information flows must accompany material flows. *Information flows* are messages in oral, document (paper and electronic) and other forms, the accompanying material or service flows (Gadzhinsky, 2004). The main features of information flows are the nomenclature of transmitted messages, data types, documents; intensity and speed of data transmission; specific properties.

Self-control Questions:

1. What is the essence of a «Supply Chain Management» concept?
2. What is a logistics system?
3. What is a logistics chain?
4. What is a logistics channel?
5. What is a logistics network?
6. What is a logistics process?
7. What is a logistics cycle?
8. What is a material flow and what are its main characteristics?
9. How to classify the material flows?
10. What are the services flows from the position of logistics, what are their main characteristics?
11. What is a financial flow?
12. What main characteristics define financial flow?
13. How to classify the financial flows?
14. What are information flows in logistics and their characteristics?

Chapter 3. International Aspects of Procurement Logistics

3.1. Theoretical Foundations of Procurement Logistics

Procurement Logistics is the management of material flows in the process of providing the company with the material resources.

International Procurement Logistics is associated with the processes of purchasing raw materials, components and semi-finished products outside the country (Peter Baily et al., 2006).

The main purpose of Procurement Logistics is to meet the needs of production in raw materials, semi-finished products with the maximum possible efficiency.

The basic tasks of Procurement Logistics are (Peter Baily et al., 2006; Learn about, 2018):

- to establish the optimal terms for raw materials and component parts for supplying;
- to ensure the exact relationships between the number of deliveries of the finished products and needs in them;
- to comply with production requirements for quality of raw materials and component parts.

The main questions:

- what to buy;
- how much to buy;
- for whom to buy;
- on what conditions to purchase.

List of the key tasks:

- how systematically to associate purchases with production and sales;
- how systematically to link enterprise activities with suppliers.

3.2. Basic Approaches to Choosing a Supplier

There are two ways to choose a supplier:

1) Selection of a supplier from among the companies that were already your suppliers and with which business relationships have already been established.

The main stages of this task:

- to collect the information about suppliers;
- to analyze the information based on the selection criteria of the supplier;
- to make decisions about choosing a supplier.

2) Selection of a new supplier as a result of search and analysis of the market: a market with which the company has already been working or a completely new market (Kalchenko, 2006; Kisly et al., 2010).

Search for potential suppliers.

- announcement of the competition;
- study of promotional materials: corporate catalogs, advertisements in the media, etc.
- visiting exhibitions and fairs;
- correspondence and personal contacts with potential suppliers.

Selection criteria of potential supplier analysis

- remoteness of the supplier from the consumer;
- terms of execution of current and extra orders;
- availability of reserve capacities;
- organization of quality management with the supplier;
- psychological climate of the supplier;
- ability to ensure the supply of spare parts throughout the life of the supplied equipment;
- financial position of the supplier.
- There are several common methods to choose a supplier: cost-ratio; dominant characteristics; preference categories; rating assessment of factors, etc (Kalchenko, 2006; Kisly et al., 2010).

In most cases, rating system is used to select suppliers' assessment of their compliance with the criteria / factors, such as (Kalchenko, 2006):

1) Reliable delivery.
2) Quality assurance.
3) Production capacity.
4) Prices.
5) Location.
6) Technical potential.

7) Financial position.
8) The possibility of compromise.
9) Availability of an information system for communication.
10) After-sales service.
11) Reputation and role in the industry.
12) Business initiative.
13) Management and organization.
14) Process control.
15) Attitude to the buyer.
16) Image.
17) Registration of goods (packaging).
18) Labor Relations.
19) Business experience and relationship history.
20) Supporting documents and instructions.

As a result of the analysis of potential suppliers, a list of specific suppliers is being formed with which the work on concluding contractual relations is carried out.

The supplier's rating *R* can be defined as (Leenders et al., 1989):

$$R = \sum_{i=1}^{n} c_i \times k_i, \qquad (3.1)$$

Where n - the number of indicators of the supplier's rating; k_i - the significance of the indicator; ci - point assessment of the value provided by the supplier.

Economic Order Quantity (EOQ) is the quantity of a product that should be ordered so as to minimize the total cost that includes ordering costs and inventory holding costs. The basis to determine the supplier in the procurement logistics is to use the indicator of the economic (optimal) order quantity (William C.Copacino, 1993).

Economic Order Quantity (EOQ) is determined by the formula obtained by F.U. Harris. However, in the theory of inventory management, it is more commonly known as the *Wilson's formula*:

$$\mathbf{EOQ} = \sqrt{\frac{2 \times \mathbf{C_o} \times \mathbf{S}}{\mathbf{C_i} \times \mathbf{U}}} \qquad (3.2)$$

Where EOQ – economic order quantity, units;
C_0 - cost of the order execution, UAH;
C_i - purchase price per unit of goods, UAH;

S - annual sales, units;
U - a share of storage costs in a unit's price.

This is deduced by differentiating and finding the minimum for the equation for the total annual cost, which comprises of the variable purchase cost, the ordering cost and the inventory holding cost. But the EOQ does not depend on the purchase cost as it remains constant for the same annual demand whatever be the order quantity (Kalchenko, 2006)

With increasing order quantity, the number of orders to be placed in the year decreases and thus the ordering cost decreases but at the same time the inventory holding cost goes on increasing. At the EOQ value, the total cost comprising of both these costs is at its minimum value.

3.3. The "Just-in-Time" Logistics

JIT stands for **Just in Time**, is system in operation management under which the production is made as per the demand at a particular moment. There is no prior production for any anticipated demand. This was pioneered by *Toyota* at their facility (Just-in-Time, 2019; C. Carl Pegels, 1984).

The aim is to reduce non profitable activities and make the manufacturing system more flexible, eliminating the associated costs of carrying and maintaining the inventory. There is no scope for Inventory what so ever. The *Just-in-Time (JIT)* methodology owes its name to the philosophy of doing only what is necessary when it is necessary and in which the amount is necessary.

The JIT delivery system is a delivery system that is based on synchronizing the delivery of material resources in the required quantity and at a time when the logistics system needs them, in order to minimize the costs associated with inventory creation.

There are various methods in which JIT can be achieved. However, all these methods are important but not exhaustive (Just-in-Time, 2019):

1) Elimination of defects and waste.
2) Balancing the flow and scheduling the output.
3) Multi-skilled labor force to carry out specific operations.
4) Maintenance of equipment and machinery for flawless operations.
5) Cellular manufacturing i.e. making in small batch sizes.
6) Streamlined design and process flows & layouts

One of the core ideas of *the Just-in-Time management system* is the elimination of unnecessary tasks.

There are several advantages which have been beneficial for

organizations who have adopted JIT. Some of the **advantages of JIT** are mentioned below as follows (Just-in-Time, 2019):

1) Reduced setup time and low wastage.

2) The flow of goods from warehouse to shelves improves.

3) Employees with multiple skills are used more efficiently.

4) Increased emphasis on supplier relationships.

5) Minimizes storage space needed thereby saving warehousing costs.

6) Smaller chance of inventory breaking/expiring.

Disadvantages of JIT System (Just-in-Time, 2019)**:**

1) Low stocks make any failures in the critical logistics system.

2) The introduction of the system may require major changes, which are difficult to achieve in practice.

3) High transport costs.

4) High dependence on one supplier (non-compliance with delivery terms may be loss of production).

5) High dependence on material quality (incoming control costs, claims).

6) A permanent information exchange is required (the obligation to confirm the financial status of the supplier and the producer).

7) The need for suppliers to move production and warehouses closer to the consumer.

8) Large losses from suppliers from specialization in crisis situations.

Historical facts. The origin of the "Just-in-Time" system.

During the 50s and most part of the 60s and 70s, Japan was developing and perfecting production systems which allowed greater efficiency, a faster response in the market and less need to store a large amount of inventory in the factory. Outstanding was the system promoted by the Toyota car manufacturing plants which came to be known as the TPS (Toyota Production System) or simply Just-in-Time. It was not until the 80s that this system spread to Western factories.

In its origins, the norm is that the factories follow a push system in which each phase in the manufacturing process accumulates its production which would then be removed by the following phase (Just-in-Time, 2019; C. Carl Pegels, 1984). The great revolution of the Just-in-Time system as a system was that it followed a pull system in which each phase of the production asked the previous phase for what it needed when it needed it. In this way, they only produced what was necessary when it was really necessary and in necessary amounts, reducing the accumulation of inventory to a minimum. The Kanban system, based on cards, was created

to communicate the demands of one phase to the previous phase. It was necessary to optimise all the production phases as well as a coordinated operation with suppliers and customers (Just-in-Time, 2019).

Example

In Japanese plants of automobile manufacturers' inventory measured in days of production ranges from three to four days. Second, the lead time required to produce a part or subassembly is reduced considerably. The benefit of this is considerable in case of necessary design changes or modifications because of design errors or weaknesses. It has been reported that in one of the Japanese automobile engine plants the engine block that is cast early in the morning appears in a finished and functioning automobile engine at night. Third, with just-in-time production there is no surplus parts production, and no lost parts, which even if they are found later may have to be scrapped. Fourth, just-in-time production requires that all parts are in-process and "visible" at all time. Hence, there is no need for parts or subassembly expeditors. Finally, the low inventory level significantly lowers the cost of holding inventory, including the storage space required to store in-process inventory (C. Carl Pegels, 1984).

One of the *core ideas* of *the Just-in-Time management system* is the elimination of unnecessary tasks comparing with traditional delivery approach (Table 3.1).

Table 3.1 – Comparative peculiarities of traditional delivery and «JIT» delivery

Factors	JIT Conception	Traditional delivery approach
Stocks	All efforts should be directed to eliminate stocks. There are no insurance reserves.	Majority of stocks - obsolete stocks.
Procurement of material resources	The lot (order) size covers only the current need. The purchase is carried out in small lots with the parts of the supplier.	Procurement is carried out in large batches with frequent suppliers.
Suppliers	Considered as partners. Relations with only suppliers. The cooperation is a character of a long-term national communications based on long-term contracts. A small number of suppliers.	A large number of suppliers.
Choosing a shipping (delivery) method	The main objective is to ensure the reliability of the delivery time.	The main objective is ensuring the low transport costs. The delivery schedule is assumed by the supplier.

Continuation of the Table 3.1

Production quality	The main purpose is the absence of defects in products. The controlling quality process is made and assumed by the supplier.	A small number of defects (up to 2%) is allowed. Quality control is carried out by the seller, who bears responsibility for it.

Source: (Handfield et al., 2013; Kisly et al., 2010).

The international experience has shown that the JIT strategy is not universal and is not always used. Its implementation is hampered by such important factors as poor quality of products, violation of the terms of delivery and payment for goods, errors and failures in the transfer of information between the customer and suppliers.

Example

The well-known American motorcycle manufacturer, Harley-Davidson, faced worsening competition with Japanese companies in the 1970s: Honda, Yamaha, Suzuki and Kawasaki. Most of the previously stable companies in this area went bankrupt. Four Japanese companies could supply their motorcycles to virtually anywhere in the world with higher quality and at a lower price than their competitors. In 1978 Harley-Davidson tried to prove to the court that Japanese companies are selling motorcycles at dumped prices, which is lower than their cost. But during court hearings it became clear that operational expenses from Japanese companies were 30% lower than that of Harley-Davidson. Therefore, in 1982, Harley-Davidson began developing and implementing the "materials as needed" program, an analogue of JIT. At first, the company faced difficulties, but over the past 5 years, it reduced the time needed to change equipment by 75%, reduced warranty costs and waste related expenses by 60%, and reduced inventories of work in progress by $ 22 million. During the same period, the company's productivity has increased by 30%, and now the company is successful in the market.

Successful implementation of the JIT strategy also depends on their number and territorial location of suppliers, the level of their irresponsibility when performing contractual obligations. Therefore, the huge costs associated with the implementation of the procurement method precisely in time, effective only in stable operating economies, subject to long-term economic relations.

An important requirement of just-in-time production is the production of defect free parts, subassemblies and finished goods. Just one defect in a long chain of parts can create havoc in a production system that depends on

just-in-time production.

The method to control quality and eliminate defects is called autonomation. It is a term coined by the Japanese and refers to the autonomous and automatic or manual inspection of all parts, components, and assemblies (C. Carl Pegels, 1984).

Self-control Questions:

1. What is “procurement” and what terms describe these activities?
2. What are the goals of logistics management in the procurement process?
3. What are the features of purchase process at an industrial enterprise?
4. What are the specific features of procurement process for trading companies?
5. What are typical objectives of procurement at an industrial company?
6. How should an industrial firm establish the relationships between the spheres of management within the procurement?
7. How do a procurement department and other company's functional subdivisions cooperate among themselves?
8. What does constitute a process of choosing a supplier in a company's procurement activity?
9. What factors have to be taken into account in choosing a supplier for an industrial company?
10. What does constitute a general procedure (algorithm) of choosing a supplier?
11. What is Economic Order Quantity?
12. Advantages and disadvantages of the “Just in Time” Logistics.

Chapter 4. Logistics of International Stocks

4.1. Theoretical Fundamentals of Inventory Logistics

Projects and campaigns have occurred in some businesses concerning reduction of inventories. But overall, the investment in inventories within a supply chain does not disappear. So, to manage inventories in the organisation is a key responsibility of logisticians; in association with other supply chain professionals in procurement and operations planning. It is unfortunate that within a business, the accounting system considers inventories an asset, while logisticians consider inventories as a necessary liability - to be minimised. These different views may help to explain why more enterprises do not have Inventory Management as a core consideration within their supply chain structure and strategy (Tersine R.J., 1987).

Stocks in one form or another are present throughout the length of the logistics chain, both in the sphere of production and in the sphere of product turnover.

Material stocks are products of industrial and technical purpose, which are at different stages of production and circulation, consumer goods and other products that are expected to enter the process of production or personal consumption (Corporate Logistics, 2005).

Inventory is the term used for a status variety of materials (Table 4.1).

The role of a logistician is to meet availability objectives by reducing uncertainty and increasing strategic advantage, through understanding the range of external complexity, variability and constraints affecting the organisation and reducing internal uncertainties caused by the conflicting objectives of corporate functions (Stock R. James and Lambert M. Douglas, 2001).

Table 4.1 – Inventories' types

Inventory function	Inventory form	Driver of Demand
Final goods (FG) for sale (new and refurbished)	Cycle stock, safety stock, in-transit inventory, pre-build inventory to support market launches	Customer and consumer demand
Service parts (spare parts)	Service level based on criticality	Mean time between failure
Work in progress (WIP)	Sub-assemblies awaiting further production. Postponement; assemble to order	FG inventory; production capacity; customer orders
Raw materials (RM)	Dependent demand items. Component parts; packing materials	Purchased items required for production
Maintenance, repair and overhaul (MRO)	Service level based on criticality	Mean time between failure
Consumables	Support production. Two bin replacement system	Based on production
General supplies	Office and technical items. Two bin replacement	As required by the enterprise

Source: (James F. Cox et al., 1995; Corporate Logistics, 2005; Gadzhinsky, 2005)

Inventory Management includes:

1) *Inventory policy*: measured at the corporate level, to identify the money which the enterprise is willing to invest in inventory, based on an evaluation of the physical options. Development of the policy is the responsibility of the senior supply chain executive, for approval by the Board.

2) *Inventory planning*: measured at the product or family group level and undertaken by Operations Planning (or similar titled group). The Inventory Policy is used as the control function in Planning.

3) *Inventory control*: the measure of actual against planned inventory, counted at the stock keeping unit level and undertaken at each location of these, it is Inventory Policy that establishes the rules and limits of managing inventory (James F. Cox et al.,1995).

The three core sections of analysis are to identify where inventories:

1) *Should be held – the Location:*

The basic tasks of Procurement Logistics are (Peter Baily et al., 2006; Learn about, 2018):

- centralised or decentralised locations (the latter is more likely for an enterprise offering on-line ordering and quick home delivery);
- customers and demand channels that could be served from each location;

- company owned and leased premises;
- customer locations;
- supplier distribution centre or warehouse;
- Third-party managed location.

2) *In what form*: raw and packaging materials, part and semi-finished goods, finished goods.

3) *For what function*: cycle stock, safety stock, in-transit inventory, pre-build inventory to support market launches, slow and obsolete inventory required by sales (Learn about Logistics, 2019).

The main functions of inventories include:

1) *Process control function*. Some stocks are necessary because it takes time to finish one production operation and more or less long time to switch to another operation.

2) *Economic function*. Some types of stocks at any level provide independence to individual workplaces, polling stations, shops; simplify production and / or distribution processes. But reducing these stocks to a minimum requires some changes in the organization and financing (quality management, maintenance, upgrade material resources, personnel training, etc.).

3) *Protection functions* against accidents.

4.2. Inventory Management

The main purpose of *inventory management* is to prevent a production deficit.

In the presence of stock shortages, there are three types of possible costs listed below in order of increasing their negative impact (Sadeghi et al., 2016):

1) Costs in connection with the non-fulfillment of the order (delayed sending the ordered product) - additional costs for promotion and dispatch of goods that order, which can not be performed at the expense of available inventory.

2) Expenses due to loss of sales - in cases where a regular customer applies for a given purchase to some other organization (such costs are measured in the indicators of revenue lost due to non-implementation of the trade agreement).

3) Costs due to the loss of the customer - in cases where the lack of stocks turns not only the loss of a trade agreement, but also the fact that the customer begins to constantly search for other sources of supply (such costs are measured in the indicators of total revenue, which can it would be obtained from the implementation of all potential customer contracts with

the company).

According to statistics, the shortage of goods is one of the most acute problems both the seller and the buyer and is often estimated at about 8% of the total turnover. According to another, not less sad statistics, in large stores the surplus of goods (often called "illiquid") is up to 20% of the entire range (Rebstock M. and Hildenbrand K., 2001; Slack Nigel et al., 1998).

Deficit is an excess demand over supply. The deficit indicates a difference in demand and supply and a lack of balancing prices. The deficit may be temporary or permanent. But in any case, its consequences are quite obvious - the company loses profits. However, not everything is so simple. If the deficit is a constant protracted nature, then the consequences may be sadder than it seems at first glance:

- lack of profit due to the too low price;
- direct losses due to lack of sales;
- the deteriorating image of the store in the buyers' eyes: “There have not been never any necessary products here”;
- loss of potential and real customer;
- expenses due to actions aimed at eliminating the deficit - moving goods on shelves, urgent search for a substitute product.

The consequences of the shortage are more related to the environment of the store and are especially dangerous for a company that is in a stage of growth and development, when the conquest of buyers and their loyalty is a strategic goal.

Excess of goods (Surplus of goods) implies: unbalanced price, end of expiration or sale, mistakes in sales forecasts, excess purchase, commodity cannibalism, changing the consumers' mood or taste, legislative acts, incompleteness of the goods. To determine the rational amount of stock traditionally used models of optimal order size (*Economic Order Quantity models - EOQ*), were first proposed back in 1913 (William C. Copacino, 1993). The optimization criterion in all these models serves a minimum of total costs associated with the size of the order. The most famous and widely used models have a common name - Wilson's formula. All these models are focused on constant nature of consumption. With an intensive change in consumption Wilson's models do not provide sufficient accuracy for order size estimates. Therefore, in recent years, new methods for calculating the optimal order size, focused on the modern dynamics of consumer markets.Yet Wilson’s models continue to be a necessary tool to obtain information on the status of inventory management in organizations.

There are several Wilson’s models: the main is to determine the optimal size of the order; with gradual replenishment; taking into account the losses from the deficit; the optimal size of the order in the presence of wholesale

discounts (A. Rushton et al., 2010).

The moment of placing an order is a time when it is necessary to make an order for replenishment of the stocks. It depends on the economic size of the order, the time of execution of the order, the consumption of supplies during the period of execution of the order.

The "Minimum-Maximum" system is oriented to a situation where inventory and booking costs are so significant that they are comparable to losses from inventory shortages. Therefore, in this system ordering does not arise at predetermined intervals of time, but only provided that the stocks in the warehouse at that moment were equal or lower than the established minimum level. In the case of issuing an order, its size is calculated so that supplies are replenished stocks to the maximum level. Thus, this system works only with two levels of stocks - the minimum and maximum, which is determined by its name (Kalchenko, 2006; Kisly et al., 2010).

4.3. "ABC-XYZ" Analysis in the Inventories' Management

ABC analysis is a method by which the degree of distribution of a specific characteristic between the individual elements of a plurality is determined. It is based on the assumption that a relatively small number of types of goods, which must be repeatedly procured, accounts for a large part of the total cost of goods procured.

The basis of the *ABC method* lies in the so-called Paretto rule. In accordance with the method of Pareto, the set of controlled objects is divided into two different parts (80/20). Widely used in logistics, the *ABC method* offers a deeper division - into three parts (Kalchenko, 2006; Kisly et al., 2010).

In terms of inventory management, *the ABC method* is a way to standardise and controlling stock, which consists in dividing the nomenclature (N), realized inventories into three unequally powerful subsets of A, B and C based on a certain formal algorithm.

In order to conduct ABC *analysis* it is necessary:

1) to establish the value of each product (at purchasing prices);

2) to arrange goods at a reduced price;

3) to find the amount of data on the amount and cost of the purchase;

4) to break down the goods into groups depending on their share in total acquisition costs.

Depending on the cost commodity stocks are divided into three groups - A, B, C for their share in total acquisition costs. However, the distribution does not necessarily occur in three groups, the number of groups and their boundaries are chosen arbitrarily. The most common is the following

classification (Kisly et al., 2010):

Group "A": the most expensive and expensive commodities, which account for about 75-80% of the total value of stocks, but they account for only 10-20% of the total amount of goods that are in storage.

Group "B": the average value of goods. Their share in the total amount of reserves is about 10-15%, but in quantitative terms, these stocks make up 30-40% of the stored products.

Group "C": the cheapest. They represent 5-10% of the total cost of stored products, and 40-50% of the total storage.

The *ABC analysis* shows the value of each product group. Usually 20% of all goods that are in stock accounts for 80% of all costs. Therefore, for each of the three product groups, a different level of detail is planned for planning and control. *ABC analysis* allows classifying the assortment of units by their cost. A typical ABC analysis classifies the inventory based on the Table 4.2.

Table 4.2 – A typical ABC analysis

Type of Inventory	Type of Importance	Type of Control
A Items	Very Important	Accurate records, very tight control
B Items	Little less important	Decent records, a little less tight control
C Items	Marginally important	Only essential records, light controls

Source: (Kalchenko, 2006).

Typically “A items” consist of minimum amount of items but these items account for a major proportion of value for the organization and so on with the other items.

The principle of differentiation of the assortment in the process of *XYZ analysis* is different - here the whole range is divided into three groups depending on the uniformity of demand and the accuracy of forecasting.

The group "X" includes goods, the demand for which may slightly fluctuate. The volume of sales for goods included in this group is well anticipated.

The group "Y" includes goods that are consumed in volatile volumes. In particular, products with a seasonal nature of demand may be included in this group. Possibilities to predict demand for goods in this group are average.

The group "Z" includes goods, the demand for which occurs only occasionally, any trends are absent. It is difficult to predict sales volumes of this group.

An indication on the basis of which a particular position of the range is assigned to the group X, Y or Z is the demand variation factor (v) for this position.

4.4. Vendor Managed Inventory

Vendor Managed Inventory (VMI) is a theory based inspired by integration in supply chain management regarding the system dynamics. In recent years, various partnerships like "Vendor Managed Inventory" (*VMI*) approach have been used in inventory management. In *VMI* the vendor (supplier) (someone who is selling smth. to retailer network, especially one kind of goods, materials, etc.) manages the stock levels and availability in his customer's warehouse, based on forecast demand (Learn about Logistics, 2019; Logistics Vocabulary, 2008).

In the *traditional inventory management*, a retailer makes its own decisions regarding the order size while in *VMI*; a retailer shares its inventory data with a vendor (supplier) such that the vendor is the decision-maker who determines the order size for both. Thus, the *vendor* is responsible for the retailer's ordering cost, while the retailer has to pay for their own holding cost. This policy can prevent stocking undesired inventories and hence can lead to an overall cost reduction. Moreover, the bullwhip effect is also reduced by employing the *VMI* approach in a buyer – supplier cooperation (Sadeghi et al., 2016).

Thus, *VMI* is a family of business models in which the buyer of a product provides certain information to a supplier (vendor) of that product and the supplier takes full responsibility for maintaining an agreed inventory of the material, usually at the buyer's consumption location (usually a store). A third-party logistics provider can also be involved to make sure that the buyer has the required level of inventory by adjusting the demand and supply gaps (What Is Vendor, 2019).

One of the keys to make *VMI* work is *shared risk*. In some cases, if the inventory does not sell, the vendor (supplier) will repurchase the product from the buyer (retailer). In other cases, the product may be in the possession of the retailer but is not owned by the retailer until the sale takes place, meaning that the retailer simply houses (and assists with the sale of) the product in exchange for a predetermined commission or profit (sometimes referred to as consignment stock). A special form of this commission business is scan-based trading, where VMI is usually applied but its use is not mandatory (Vendor Managed, 2016). This is one of the successful business models used by Walmart and many other big box retailers. Oil companies often use technology to manage the gasoline

inventories at the service stations that they supply. Forexample, Home Depot uses the technique with larger suppliers of manufactured goods. *VMI* helps foster a closer understanding between the supplier and manufacturer by using electronic data interchange formats, Electronic Data Interchange software and statistical methodologies to forecast and maintain correct inventory in the supply chain (The Benefits, 2019).

Vendors benefit from more control of displays and more customer contact for their employees; retailers benefit from reduced risk, better store staff knowledge (which builds brand loyalty for both the vendor and the retailer), and reduced display maintenance outlays.

Consumers benefit from knowledgeable store staff who are in frequent and familiar contact with manufacturer (vendor) representatives when parts or service are required. Store staff has good knowledge of most product lines offered by the entire range of vendors. At the goods manufacturing level, *VMI* helps prevent overflowing warehouses or shortages, as well as costly labor, purchasing and accounting. With VMI, businesses maintain a proper inventory, and optimized inventory leads to easy access and fast processing with reduced labor costs (Spiro, Rosann L. et al., 2003).

Self-control Questions:

1. What is the reason for inventory creation?
3. Are there general concepts of inventory management and what are they?
4. What stock is better - maximal, optimal or minimal?
5. How to classify the stocks?
6. What is the structure of costs related to inventory management?
7. What does constitute the risks of creation and maintenance of inventory?
8. What are deficiency costs and how to calculate them?
9. What is the logistic approach to inventory management?
10. What is the model of inventory management, and what are its parameters?
11. How to determine the Economic Order Quantity (EOQ) necessary for stock formation?
12. What is a «minimum-maximum» inventory management system?
13. What is the ABC method of analysis?
14. What is a rationing approach for inventory management?
15. What is a XYZ method?
16. What is the essence of the Vendor Managed Inventory theory?
17. How to balance a cross inventory management between suppliers / sellers and consumers / vendor managed inventory?

Chapter 5. International Warehouse Logistics

5.1. Warehousing: Definition, Functions and Classification

Warehouse is a place or a building specially designed for receipt, storage, material handling, reconditioning and shipping of products.

Warehouse can be defined as a storage place for products. Warehouse activities include receipt of products, storage, shipment and order picking (Logistics Vocabulary, 2008).

The warehouse area consists of storage zones, mass zone, rack zone, commonzone, bulk zone and distribution zone, reception and shipment docks, etc (Logistics Vocabulary, 2008).

The main function of a warehouse is to store products or goods before moving them to another location.

Warehouses can be considered as follows (Warehousing, 2019)**:**

1) Shipment Hub (when warehouses are placed in averystrategic location, theses can become shipping hubs that receive shipments until theycan be moved to other storage facilities across the country).

2) Assembly Line (where products aredelivered bythe manufacturer in severalpieces, companies can allot areas within their warehouse to assemble products for retailers or customers).

3) Rental Storage Space (whether sales are down or you possess a warehouse that is too big for your stock at the moment, renting space in your warehouse to other businesses is a good option for you if you have space).

Functions of warehouses (Warehousing, 2019)**:**

1) To convert the production assortment to consumer in accordance with demand and in order to fulfill customer orders.

2) To store the products.

3) To consolidate and unload of cargoes.

4) To provide services.

The purpose to create warehouses in logistics systems is not the conservation of material resources, but the transformation of material flow parameters for their most effective use.

Warehouse Management Systems (*WMS*) are the systems used in effectively managing business processes and direct warehouse activities, including receiving, putaway, and picking, shipping and inventory cycle counts. Also includes support of radio-frequency communications, allowing realtime data transfer between the sustem and warehouse personnel. They also maximize space and minimize material handling by automating putaway process (Glossary of warehouse, 2019).

Warehouse map can be printed from WMS system or it can be displayed on the system screnn-schemeof warehouse zone and zone's cell with their indication (where the user can see type and quantity of goods in this area - on location map) (Glossary of warehouse, 2019).

Warehouse management systems (*WMS*) can differ significantly from *warehouse control systems* (*WCS*). *WMS* is a weekly activity forecast based on such factors as statistics and trends, whereas a *WCS* acts like a floor supervisor, working in real time to get the job done by the most effective means.

Stock-keeping unit (SKU) is a category of unit with unique combination of form, fit and function (i.e., unique components held in stock) (Logistics Vocabulary, 2008). For instance, a WMS can tell the system that it needs five of stock-keeping unit (*SKU*) A and five of *SKU* B hours in advance, but by the time it acts, other considerations may have come into play or there could be a logjam on a conveyor. A warehouse control system can prevent that problem by working in real time and adapting to the situation by making a last-minute decision based on current activity and operational status. Working synergistically, WMS and WCS can resolve these issues and maximize efficiency for companies that rely on the effective operation of their warehouse or distribution center. Warehouses are buildings, structures and various devices intended for receiving, placing and storing the goods received on them, preparing them for consumption and release to the consumer (Glossary of warehouse, 2019; Warehousing, 2019).

The main tasks of the warehouse economy:

- to organise the continuous and uninterrupted supply of production appropriate material resources;
- to ensure the quantitative and qualitative stock;
- to reduce the costs associated with the execution of warehouse operations.

The types of Warehousing (Warehousing, 2019)**:**

1) Public warehouses: owned by a government and semi-state body. They are available for rent by private firms to store goods.

2) Private warehouses: owned by private entities to store their own products or equipment.

3) Co-operative warehouses: owned by a co-operative where private firms can rent space for storage.

4) Distribution centers (DC): a short-term storage center located closer to the major market to facilitate the rapid processing of oreders and shipment o goods to customers. Unlike a warehouse, the emphasis is on the moving of goods rather than on long-term storage. DC usually proposes a set of different value adding processes (co-manufacturing) such as customization, final assembly, packing, sorting etc. Not all warehouses are distribution centers, but all distribution centers are warehouses. Warehouses act as storage hubs for products, while distribution centers store and fulfill orders in the same space (Logistics Vocabulary, 2008).

Warehousing can be much more than the storage of goods. It can be fulfillment center, an assembly line, and so much more. So, **the main elements of the warehouses** can be as follows (Warehousing, 2019):

1) Storage systems to ensure maximum storage of goods and easy access at all times (climate control for goods that reuire cooler or warmer environments).

2) Inventory management software to keep track of inventory coming in and out of your warehouses. The information system that takes into account the location of all goods received from suppliers, shipments to consumers and other necessary information.

3) Transportation and moving equipment to deliver and transport goods to and from the warehouse.

4) Ample security to keep the warehouse safe even at downtimes.

The advantages of Warehousing (Warehousing, 2019)**:**

1) Improved inventory accuracy: knowing how much inventory you have and how much you have moved means you can plan for the future more precisely.

2) Reduced stuffing levels.

3) Protection of goods: having a storage facility that fits the needs of your goods it is so important to a business.

4) Central location: when you source a warehouse close to a customer or manufacturing hub, you can ensure better transit of goods, decreasing the time it takes to move products between places.

5) Superior flow of goods: the better flow of goods from manufacturer to end consumer is brought about by understanding the best layout of your warehouse and how to store goods optimally to move them fast.

5.2. International Warehouse Logistics

International Warehouse logistics is the management, planning and organization of operations across at least the one international border within a warehouse. This includes managing space, planning shipments, and organizing information so that the warehouse operates to the best of its abilities. It is important to strive for better warehouse logistics so that you can offer customers better delivery times, and drive down costs where possible (Gorbenko, 2014; Kalchenko, 2016).

Rational implementation of the logistics process in the warehousing is a key to its profitability. Therefore, the organization of the logistics processes is expected to achieve (Gorbenko, 2014; Kalchenko, 2016; Kisly et al., 2010):

1) Rational planning of the warehouse in the determination of working areas, which helps to reduce costs and improve the processing of cargo.

2) Efficient use of space when installing equipment, which makes it possible to increase the capacity of the warehouse.

3) The use of the universal equipment, which performs various warehousing operations, which leads to a significant reduction in the park of lifting vehicles.

4) Minimizing the routes of inland freight transportation in order to reduce operating costs and increase the capacity of the warehouse.

5) Implementation of the shipment parties' unification of and the centralized delivery use, which makes it possible to significantly reduce transport costs.

6) Maximizing the use of information system capabilities, which significantly reduces the time and costs associated with document circulation and information exchange.

Sometimes the reserves of a rational organization of the logistics process, even not quite significant, derive from simple things: clearing of barriers, improvement of the lighting system, and organization of the workplace. Searching the reserves of the efficiency of the warehouse functioning are no trivial things, everything should be analyzed, and the results of analysis - used to improve the organization of the logistics process (Gorbenko, 2014; Kalchenko, 2016).

There are some problems to ensure the effectiveness of warehouse processes (Table 5.1):

· the choice between own warehouse or general use;
· the number of warehouses and the location of the warehouse network;
· the size and location of the warehouse;
· the choice of storage system.

Table 5.1 – Private Warehouse vs Public Warehouse

Advantages of the private warehouses	**Advantages of warehouses for the general use**
· high degree of control over operations, which gives absolute authority for the adoption of all business decisions; · ensuring the integration of warehouse operations with other elements of the internal logistics process of the enterprise; · facilitating communications; · intangible benefits associated with the image of the enterprise, since their own warehouses have a stronger impression of the reliability and long-term stability of the enterprise; · the possibility of greater control over the product	· flexibility, allowing to take into account the changing demand, for example, seasonal; · access to qualifications and experience that the company does not own; · use of state-of-the-art equipment and the latest methods of carrying out warehouse operations; ·the absence of a need for large investments in the development of warehousing; · facilitating access to a wider geographic region; · economies of scale to reduce storage costs; · reduction of transportation costs by combining goods with goods of other enterprises; · a guarantee of high quality and efficient service.
A critical factor in the profitability of the company's own composition is a stable high turnover. Therefore, in a stable high turnover in a well-known market with constant sales, it is more appropriate to have its private warehouse.	

Source: (Gorbenko, 2014; Kalchenko, 2016).

5.3. Packaging and Barcoding

Packaging is a process of wrapping goods or putting them in boxes readtto besent somewhere and it is one of the means to increase the efficiency of logistic processes in the warehousing.

Types of packaging (Gadzhinsky, 2004):

- *internal, or customer***,** which is addressed to the final consumer of the product and carries out marketing functions;
- *external, or industrial*, which provides the convenience of logistics operations.

One of the most important concepts of packaging related to the logistics processes of storage and cargo processing is the *concept of a standard consolidated cargo unit.* The creation of a consolidated cargo unit is reduced to the physical unification (consolidation) of individual industrial packages into one standardized "package", this is the so-called *containerization*. Such an aggregate cargo unit can be formed both at production sites and in warehouses.

For containerization, the following can be used:

- rigid containers - devices containing industrial packaging or disassembled ware for storage and transportation;
- non-rigid containers - do not create a closed protective shell for

stored and transported products.

The cargoes standardization improves the efficiency of logistic processes - shortens the time of loading and unloading operations, facilitates cargo handling and transport operations, improves the safety of products on the road, simplifies cargo control, increases storage density, speeds up the selection of orders thanks to a more rational distribution of stocks. All these factors contribute to the reduction of logistics costs (Ballou R.H., 1992).

For packaging, a barcode printer is used to generate a label to identify part numbers, serial numbers, and shipping information. This labeling can be used to automatically sort packages for shipment, automate receiving, and greatly enhance package tracking.

Barcode is a series of lines printed on products sold in shops that can be read by a machine connected to a computer to give the price, keep a record of sale, etc. Barcode is a graphical representation of a digital product number in a form suitable for automatic reading with a scanner. It is a visual, machine-readable representation of data; the data usually describes something about the object that carries the barcode (ActiveBarcode. 2019). Traditional barcodes systematically represent data by varying the widths and spacings of parallel lines, and may be referred to as linear or one-dimensional (1D). Later, two-dimensional (2D) variants were developed, using rectangles, dots, hexagons and other geometric patterns, called matrix codes or 2D barcodes, although they do not use bars as such. Initially, barcodes were only scanned by special optical scanners called barcode readers. Later application software became available for devices that could read images, such as smartphones with cameras (ActiveBarcode. 2019; Logistics Vocabulary, 2008).

Barcodes became commercially successful when they were used to automate supermarket checkout systems, a task for which they have become almost universal. Their use has spread to many other tasks that are generically referred to as automatic identification and data capture (AIDC). The very first scanning of the now-ubiquitous Universal Product Code (UPC) barcode was on a pack of Wrigley Company chewing gum in June 1974. QR codes, a specific type of 2D barcode, have recently become very popular. So, the following are just a few of the many ways bar codes are being used to improve the profitability and efficiency of a variety of company types (Nyhuis P. and Wiendahi Hans-Peter, 2009; ActiveBarcode. 2019).

Point of sale is one of the most common segments of the bar code market. Everyone is familiar with the scanners in grocery and department stores. Point-of-sale systems can be used in any retail setting.

Benefits of bar coding in point-of-sale systems include (Nyhuis P. and Wiendahi Hans-Peter, 2009):

1) Cost savings: This is the most obvious benefit. A medium-to-large store can save enough checker time to significantly reduce payroll. You also save direct labor costs through less time spent taking inventories and ordering product.

2) Customer satisfaction: A proper bar code system will speed customer checkout. This will improve customer satisfaction enough to directly increase revenue over time.

3) Reduced inventory costs: Immediate access to inventory information on a real-time basis can be used to reduce inventory levels. This will reduce costs for a company in a number of ways, including interest, labor for handling excess inventory, and facility overhead.

4) Automated reordering: Accurate stock levels allow for automated replenishment of low inventory.

5) Better decision making: With bar code data-collection you can tell not only what the customers are buying, but when they are buying it and in what combinations. This can improve business management by suggesting better locations for goods in the store and identifying advertising targets.

Many manufacturing and other industries have work that must go through several steps to completion. Bar code systems can track material through each step of the work and keep detailed records on each piece or batch. When a problem occurs in the output, supervisors and managers can track the work back and quickly resolve the issue. This is one of the best ways to improve both quality and yield in virtually any multi-step process (Mallik, 2010).

Self-control Questions:

1. What are basic problems of warehousing logistics?
2. What kinds of warehouses does the material flow go through from sources of raw materials to the final consumer?
3. What is a warehouse network, warehousing of a wholesale trade enterprise and what are the methodological principles of their formation?
4. What are the basic complex tasks of warehouse network formation of a wholesale trade company?
5. What is the algorithm of warehouse network formation?
6. What kinds of warehouses do exist and how to determine their sizes?
7. What are the methods of a warehouse system analysis as an element / unit of a logistics system?

8. How to describe a warehouse as an element / unit of a logistics system?

9. What are the advantages of warehousing and principal causes to use warehouses in a logistics system?

10. What are basic functions of the warehouse in a logistics system?

11. What are the major functions of a warehousing in a logistics system?

12. How to classify the warehouses in logistics?

13. What is the main role of packing and barcodes to increase the efficiency of logistics processes in the warehousing?

Chapter 6. Production Logistics

6.1. General Characteristics of Production Logistics
6.2. Logistics Concepts: "MRP" vs "ERP" Systems
6.3. Lean Production System
6.4. Kanban as a Micrologistics System
6.5. Optimized Production Technology

6.1. General Characteristics of Production Logistics

The term "Production Logistics" describes logistic processes within a value adding system. Production logistics aims to ensure that each machine and workstation receives the right product in the right quantity and quality at the right time (Robincon, 2003; Nyhuis P. and Wiendahi Hans-Peter, 2009).

Production logistics can operate in existing as well as new plants: since manufacturing in an existing plant is a constantly changing process, machines are exchanged and new ones added, which gives the opportunity to improve the production logistics system accordingly (Nyhuis P. and Wiendahi Hans-Peter, 2009).

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 efficiently. Track and tracing, which is an essential part of production logistics due to product safety and reliability issues, is also gaining importance, especially in the automotive and medical industries.

Production Logistics is one of the functional areas of logistics that explores the processes that take place in the field of material production (Table 6.1).

Table 6.1 – Concepts of production organization at the enterprise

Traditional concept	Logistics concept
• constant and intensive use of equipment; • main production in large batches; • maintenance of the maximum insurance stocks of material resources.	• refusal from unprofitable stocks; • refusal of excessive time to perform basic and transport and warehouse operations; • refusal to manufacture those products for which there is no demand from customers; • elimination of irrational internal productive movements of raw materials, materials, semi-finished products; • transforming suppliers from rivals into full partners.

Source: (Robincon,2003; Nyhuis P. and Wiendahi Hans-Peter, 2009; Logistics, 2010).

Tasks of production logistics:

- operational calendar planning with a detailed timetable for the production of finished products;
- general quality control;
- strategic and operational planning of supply of material resources;
- organization of internal production warehousing;
- forecasting, planning and valuation of material resources costs in production;
- control and inventory management;
- physical distribution of material resources and finished products;
- information and technical support of processes of management of internal productive material flows, etc.

6.2. Logistics Concepts: "MRP" vs "ERP" Systems

Manufacturing companies generally require a complex organizational system to keep track of production, inventory, and sales. How manufacturers manage this varies with company size, complexity of production processes, industry vertical, and many other factors.

Most manufacturers use an organizational system called **material requirements planning (MRP)**. The meaning of **MRP** is exactly what its acronym represents - planning (P) the required (R) materials (M) needed for the manufacturing process (Pierre A. David and Richard D. Stewart, 2010; MRP vs ERP, 2020).

The **MRP** software takes additional information - inventory and components from the bill of materials - to determine not only the details for the master production schedule but also the net requirements of the manufacturing operations.

Materials requirements planning (MRP) is an essential part of any modern manufacturing operation. It makes sense for any manufacturer looking to update their IT portfolio to include the company's MRP requirements in the overall technology requirements planning. But before making any decisions (or even beginning the search for a suitable software system), it is important to be aware of what other technology is available for the manufacturing enterprise (MRP vs ERP, 2020).

MRP is software that allows for the planning, scheduling, and overall control of materials used in the manufacturing process. Others use an **enterprise resource planning (ERP)** system instead. In addition to meeting material requirements, ERP systems integrate organizational needs such as accounting, marketing, human resources, and supply chain management (MRP vs ERP, 2020).

Generally, if manufacturing companies choose a software system other than an MRP to take care of material planning and to help manage the manufacturing process, it will be an ERP system. **MRP/ERP** systems help to manage inventory, orders, and production scheduling.

The main objectives of the MRP system:

• to satisfy the materials, components and products for production planning and delivery to customers;

• to maintain the low level of material resources inventory, unauthorized production, finished products;

• to plan the production operations, delivery schedules, purchasing operations.

Advantages of the MRP system (MRP vs ERP, 2020)**:**

- guarantee of timely receipt of materials and components;
- optimization of warehouse stocks and acceleration of their circulation;
- reduction of the number of cases of non-fulfillment of contractual obligations for the supply of finished products;
- ordering production as a result of controlling the status of each material, from the formation of an order for this material to its implementation in the finished product.

Disadvantages and limitations of the MRP system (MRP vs ERP, 2020)**:**

- a considerable amount of computing, preparation and pre-processing of a large amount of source information, which increases the length of the production period and the logistics cycle;
- the growth of logistics costs for processing orders and transportation provided the company seeks to reduce the level of stocks or switch to the release of finished products in small volumes with high frequency;
- insensitivity to short-term changes in demand, because they are based on the control and replenishment of stock levels at fixed points of the order;
- a large number of failures in the system due to its large dimension and overload.

The **MRP I** system is an integral part of the **MRP II** system. In addition to it, the **MRP II** system includes:

- forecasting and demand management unit;
- calculation of the production schedule (timetable for the output of finished products);
- calculation of production capacity loading plan, block placement of orders and control of procurement of material resources and other units that make up the software package.

MRP II stands for manufacturing resource planning, which evolved from its predecessor, materials replacement planning. **MRP II** creates detailed production schedules and coordinates component materials with machine and labor availability. **MRP II**, essentially, addresses the shortcomings of the original MRP, and actually expands on what MRP does. It doesn't just manage materials requirements, but it also addresses operational planning, helping with processes such as the following (MRP vs ERP, 2020):

1) Shop floor control.
2) Capacity and demand management.
3) Sales and predictions.
4) Item master data.

An important place in the MRP II system is algorithms for forecasting demand, material resource requirements, and inventory levels. In addition, in comparison with the MRP system, the complex of tasks of control and regulation of the level of inventories of material resources, the volume of work in progress and finished products on the computer is solved.

The reason ERP systems are so much like MRP systems is that they originated from MRP technology and usage. In the 1960s, when MRPs were first created and used, computers were just becoming widespread in the manufacturing industry. MRPs took advantage of this computing technology to be able to manage cost reporting and materials in the manufacturing process. The technology continued to develop, and in the 1980s, MRP evolved to include master scheduling, rough-cut capacity planning, capacity requirements planning, sales and operations planning, and other concepts. This new generation of manufacturing solution was termed the MRP II (MRP vs ERP, 2020).

In the 1990s, solutions began to be produced that extended the capabilities of material requirements planning and MRP II solutions. While ERP systems didn't replace these solutions, they offered more breadth in functionality and integration. They extended the use of MRP solutions beyond manufacturing to include other types of companies and even government and not-for-profit organizations.

Thus **ERPs**, like MRPs, are also management software systems, but they offer a much broader coverage of a company's functioning than MRP systems. **ERP systems** are composed of a collection of integrated modules that cover many disparate departments within a company.

Typical modules in ERP systems include (Pierre A. David and Richard D. Stewart, 2010; MRP vs ERP, 2020)**:**

- accounting/finance;
- sales and marketing;

- human capital management;
- customer relationship management;
- purchasing management;
- inventory management;
- distribution management;
- quality management.

ERP systems integrate standardized record keeping like their ancestor solutions, but their main function is to permit information sharing among many disparate areas of an organization. This allows for a cohesive view of an organization's functioning at an overall level without information silos or repetition of analyses.

Enterprise Resource Planning (ERP):

- supports various types of production and activities of enterprises;
- supports planning of resources in different directions of the enterprise activity;
- ERP-focused virtual enterprise management, reflecting the interaction of production, suppliers, partners and consumers, may consist of autonomous enterprises, corporations or represent a geographically distributed enterprise or a temporary association of enterprises working on individual projects or a state program;
- the advanced tools for system configuration to specific operating conditions (more attention is paid to financial subsystems);
- has mechanisms to manage transnational corporations, including support for several time zones, languages, currencies, accounting and reporting systems (Pierre A. David and Richard D. Stewart, 2010).

ERP software incorporates different core processes within a business, such as finance and human resources. Traditionally, these different processes used their own separate software (MRP vs ERP, 2020). **ERP systems** help to integrate management, staff, and equipment into a single system in order to assist with a business's operations. Modern ERP systems also allow for data to be viewed in real time, increasing a company's efficiency, as tasks are completed much more quickly. Users can then focus on other tasks (Table 6.2).

Table 6. –. "MRP" vs "ERP"

Functionality	MRPII	ERP
Management of material resources	Formation of orders to suppliers based on the production program, inventory and delivery terms. Release of materials into production, receipt of finished goods	Planning a production program based on demand, sales of finished products, payments to suppliers and buyers
Management of productive resources	Planning the loading of production equipment to run the production program	Investment planning for the production equipment, accounting for its use
Human Resources Management	Planning man-hours in terms of specialties for the production implementation	Manage the traffic and staff costs
Financial Resources Management	-	Management of consolidated budgets for the financial resources distribution

Source: (MRP vs ERP, 2020).

6.3. Lean Production System

Lean Manufacturing is a term that has been around now for many years, originally spawned within the study that led to the book "The Machine That Changed the World" by Womack and Jones in 1990. However if you search through the many publications and web sites looking for a lean manufacturing definition you will find a myriad of differing definitions for "Lean", partly because lean is a continuously developing philosophy and because it's application is different for each and every company (Lean Manufacturing, 2019).

Purpose of the Lean Production System is to provide customer satisfaction and to do so profitably. Everything within Lean focuses on these two main points, with customer satisfaction taking the fore at all times. Everything that you do should provide value to the customer, anything else is waste. If the customer does not explicitly want it "why are you doing it"? This is why when you look at any process your first question should always be "WHY?" Too many practitioners of lean jump straight into applying principles to a process without even questioning why the process exists; often they make a wasteful process more efficient and you end up getting better at doing something the customer does not even want. Your customer satisfaction however comes down to just three main areas, normally *Quality, Cost and Delivery* (QCD). Understanding the customers' needs is vital in being able to keep them fully satisfied and everything you do in the way of services that provide and products should be geared to meeting those needs. It means giving them the best quality, the right

delivery time (which is not always immediate) and the right price (Lean Manufacturing, 2019).

Lean is also about Delivery; *Just in Time* is about providing flow using *kanban systems* to ensure that the customer gets what they want when they want it. Lean is not "Just" a cost cutting machine to help improve profits without any thought of the customer.

The main Lean Production Tools can be classified and presented as follows (Figure 6.1).

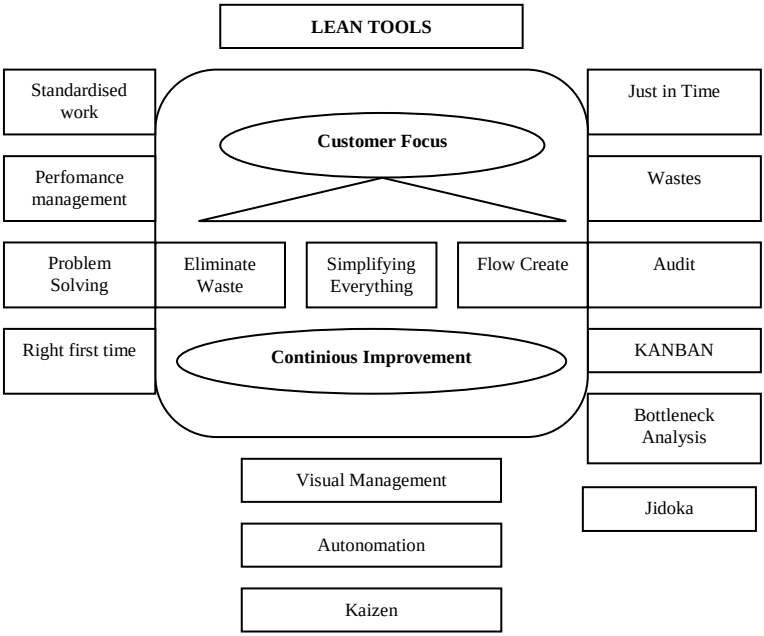

Figure 6.1 – Manufacturing Tools (Lean Manufacturing, 2019)

Historical facts. *Lean has had a number of names over the years, developed primarily from the Toyota Production System (TPS) it has been called World Class Manufacturing (WCM), Continuous Flow Manufacturing, and Stock-less production to name a few. Today you will even here Lean Sigma and Agile Manufacturing. Although developed mainly within manufacturing, Lean is equally applicable within your office based administrative functions or within service industries such as healthcare where it is seeing a huge amount of attention.*

The history of Lean Manufacturing goes back many centuries, well

before Ford's famous production lines for the model T ford; however it really starts to begin to be the philosophy that we know today with Toyota and the development of the Toyota Production System (TPS).

Toyota set out to be far better than Ford and the rest of the US Automobile Industry, an ambition that they quickly achieved despite a lack of resources and infrastructure. They achieved this through the application of Lean Principles and the many Lean Manufacturing Tools. Toyota are far from perfect by their admission, they are only part way on their never ending journey of Lean Manufacturing (Lean Manufacturing, 2019).

6.4. Kanban as a Micrologistics System

Kanban is a mechanism to organise a continuous flow of production capable of flexible restructuring, which operates almost in the absence of reserves' insurance (Lean Manufacturing, 2019).

The essence of the ***Kanban system*** consists in the fact that all production units of the plant, including the final assembly lines, are provided with material resources only in the amount and in such terms, which are necessary for the fulfillment of the given subsection-consumer order (Lean Manufacturing, 2019).

Kanban is a visual method to control production as part of Just in Time (JIT) and Lean Manufacturing. As part of a pull system it controls what is produced, in what quantity, and when. Its purpose is to ensure that you only produce what the customer is asking for and nothing more. It is a system of signals that is used through the value stream to pull product from customer demand back to raw materials. Its literal meaning is that of a flag or sign, when you see that flag you know that it is time to manufacture the next part. Kanbans can take many forms but in most production facilities they will use Kanban cards or bins to control the process, although there are no limits to how you can control and design kanbans; only your imagination (Lean Manufacturing, 2019).

"Kanban" is the Japanese word for tag or card which is attached to a container of inventory or to a group of parts or subassemblies on a conveyor. Kanban also meansbillboard, or if you like, the term "Kanban" is a means of communication. As used in Japanese manufacturing plants, the Kanban cards or tags do contain a considerable amount of information for the employees in the plant. Kanban cards come basically in two kinds. One is called the production order Kanban or production Kanban. The other is called the withdrawal or conveyance Kanban. The production Kanban authorises the preceding process to produce the number of parts or subassemblies that are listed on the Kanban. By using standard containers,

the authorised production is usually determined by the capacity of the used container. The conveyance Kanban is attached to a parts container when it is removed from the preceding operation and transported to the next operation. As the conveyance Kanban is attached to the container, the production Kanban is removed from the container and it becomes authorisation for the preceding process to produce another container of parts or subassemblies (C. Carl Pegels, 1984).

As with Just in Time manufacturing the idea behind kanbans comes very much from Toyota and their observation of a supermarket (Piggly Wiggly) operated in the US. The supermarket would only replenish what was taken by the customers from the shelves; this meant that shelves never overflowed with excess stock or ran empty. This pull was transferred from the customers all the way back to the various suppliers (Just in Time, 2019).

Just in Time was implemented and designed at Toyota by Taiichi Ohno who took over 15 years to perfect their system. During the 1970's many western visitors would bring back Kanban cards and want to implement the systems within their own manufacturing facilities; often with little real understanding of how they worked. It was not until the 1980's that Kanban control really started to be understood in the West (C. Carl Pegels, 1984).

The production flow and inventory control system used in Japanese automobile manufacturing plants, in the plants of parts and component suppliers to the automobile manufacturers, and also in other industries is usually called the "Toyota Production System". The designation "Toyota Production System" is used because the system was developed by a vice president of Toyota Motor Company, Mr Taiichi Ohno. Toyota implemented the Toyota production system under Mr. Ohno's guidance and direction over a period of 15 years. The system has now been in operation for over 20 years and has been widely adopted by other Japanese manufacturers.

The Toyota production system is more than just a production and inventory planning and control system analogous to the ubiquitous material requirements planning (MRP) systems being widely discussed, analysed and implemented in the United States. The Toyota production system pervades all aspects of the production and inventory flow process. It covers such areas as process design, job design, and job standardisation, economic lot sizes and accelerated setup times, just-in-time production, autonomation, Kanban, Jidoka, Andon, and Yo-i-don.

Just-in-time production refers to the smoothing of production such that the production operations on a part, component or subassembly are balanced analogous to the assembly line balance. Autonomation is a Toyota coined word that refers to the automatic or manual stopping of a production

operation if a defective or abnormal part is produced. Kanban refers to the use of a card system to control, not only in-process inventory, but also production flow and inventory flow from parts and component suppliers. Jidoka is the Japanese term for a production problem warning system that alerts everyone to the source of the problem through a battery of lights mounted high above the production or assembly line floor. The battery of lights is called Andon. When a problem occurs at a production operation, the lights will turn to yellow or red. Yellow indicates a problem or slight delay. A red light means an actual production or assembly line stoppage because of a more serious problem. Yo-i-don is the Japanese term used for co-ordinated production of parts or subassemblies that simultaneously are produced for assembly into a next stage subassembly. The Jidoka/Andon light method is used to identify problems in any of the co-ordinates of the co-ordinated production operations (C. Carl Pegels, 1984).

Push Production vs Pull Production

Traditionally production processes are scheduled, raw materials ordered, and then manufactured to create stock based on a forecast of what the customer is expected to order. This is push production and is driven very much by the materials being fed into the start of the process and all processes being controlled through a schedule or MRP. This typically produces products in large quantities or batches and ties up a huge amount of your capital in stock and Work in Progress (WIP).

Just-in-time production is accomplished by a "pulling" system instead of a "pushing" system which is used in traditional production systems. In the traditional production system, including the previously cited MRP system, the production schedule of the final product is "exploded", to determine the requirements of all subassemblies and component parts that make up the final product. Allowing for adequate production time, the production schedules for all subassemblies and component parts are developed. As the component parts are produced they "push" on or up to the next production stage and eventually are "pushed" to the final product assembly stage. If everything goes well, all component parts and subassemblies will be completed or delivered on time and final assembly can take place as scheduled (Lean Manufacturing, 2019; Nyhuis P. and Wiendahi Hans-Peter, 2009).

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The "push" system (Figure 6.2) is not only the traditional way of producing products; it is also the current method of production in all American manufacturing plants. The method is, however, traditional for most Japanese firms which have adopted the just-in-time production process that is a "pull" process of production control. In the "push" process, the

inventory buildup is considerable and whereas in Japanese firms inventory is measured in days of inventory (three or four days in the automotive firms), in the United States it is measured in weeks of inventory (Lean Manufacturing, 2019; Nyhuis P. and Wiendahi Hans-Peter, 2009).

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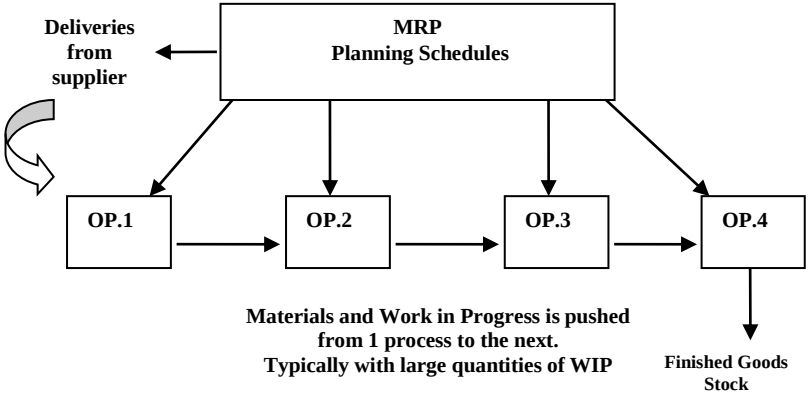

Figure 6.2 – Push production **(**Lean Manufacturing, 2019; Nyhuis P. and Wiendahi Hans-Peter, 2009)

In the *"pull" system* of production contro (Figure 6.3), also called just-in-time production, the more advanced stage of production draws just the right amount of inventory from the preceding process in order to keep going. Each preceding process has, of course, its respective preceding process, and the practice of drawing just the right amount of inventory from each respective preceding process continues right down to the raw material stage, or in the case of purchased parts or subassemblies, down to the parts or subassembly delivery stage.

Pull production however works in reverse, when a customer takes a product from the end of your production process a signal is then sent back down the line to trigger the production of the next part. Just as a supermarket will fill the empty shelf each preceding process in the flow will request the parts that it needs from its preceding process (Lean Manufacturing, 2019). This process is controlled through the use of a Kanban.

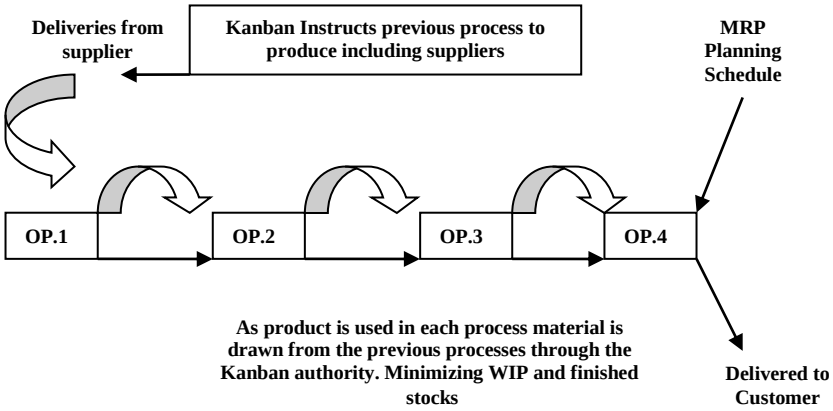

Figure 6.3 – Pull production (Lean Manufacturing, 2019; Nyhuis P. and Wiendahi Hans-Peter, 2009).

Implementing a Kanban System means (Lean Manufacturing, 2019; Nyhuis P. and Wiendahi Hans-Peter, 2009):

1) Earlier processes never push production onto later processes
2) Nothing is ever made without Kanban authority
3) Nothing is made if there are no Kanbans
4) You have to be able to identify defects as close to the source as possible
5) You cannot operate with large batches or lots of plan changes
6) Where possible demand should be smoothed

Kanban Rules:

1) The later process collects product from the earlier process
2) The later process informs the earlier process what to produce
3) The earlier process only produces what the later process needs
4) No products are moved or produced without Kanban authority
5) No defects are passed to the later process

Decreasing the size or number of kanbans within the system will increase the systems sensitivity to changes or problems. This is often the best way to highlight issues within the process and to drive improvements

Ideal Environment for Kanban Implementation

The main conditions for Kanban Implementation (Lean Manufacturing, 2019; Handfield R. et al., 2013):

1) *Regular demand from the customer;* if your customer demand is highly irregular and difficult to predict it can be hard to hold Kanban stocks in the traditional supermarket style. You may end up holding larger than

necessary stock and work in progress levels without some careful thought about organizing your system.

2) *Low product variation;* if you make many hundreds or even thousands of different products then you will not want to hold stocks of them all as this could easily increase the amount that you hold. You will want to reduce this burden by ensuring that there are many commonly used parts between products and that you make the product unique as late in the process as possible.

3) *Clear flow;* facilities that are organized in a silo style with all similar processing being done in one location are hard to control with a kanban system; although not impossible by any means. A better arrangement is one in which all processes are organized together to provide a flow line or cell.

4) *Small dedicated machines*; many companies will invest in large all singing all dancing machines that will service all products that they make. Often these machines will drive the use of large batches and will be a bottleneck for the facility.

5) *Quick changeovers*; many machines and processes can take a long time to set up to run a new product or variant. This again drives large batches and can create significant bottlenecks within your production.

6) *Repeatable and reliable processes*; if machines are prone to breaking down and processes are not repeatable then it will be hard to control any form of production system let alone Kanban.

7) *Reliable suppliers*; your suppliers are a vital part of your process and you will need to ensure that they are able to support the kanban processes that you wish to implement reliably (A. Rushton et al., 2010).

6.5. Optimized Production Technology

Optimized Production Technology (OPT) is a production system that takes into account capacity constraints in the production process and does not attempt to continuously operate at full capacity. *The aim* is not to produce as many units as possible, but to raise throughput while keeping inventory and production costs low, thereby achieving an efficient, continuous workflow (What is Optimized,2019; Nyhuis P. and Wiendahi Hans-Peter, 2009).

Optimized Production Technology (OPT) is a production improvement concept used to reduce bottlenecks, increase throughput, reduce inventories and hence reduce overall manufacturing costs. It is mostly used in manufacturing assembly companies and first introduced by Eliyahu M. Goldratt as “Theory of Constraints” (*TOC*) in his book “The Goal” (What is Optimized, 2019; OPTi Solutions, 2019).

The fundamental theory is that the manufacturing assembly line can only produce at the rate of its bottlenecks.

The three key performance indicators are used to monitor the results of performance in an assembly line (What is Optimized, 2019):

1) Throughput.
2) Inventory.
3) Operating Costs.

There are 9 implementation rules in OPT (Handfield R. et al., 2013):

1) To balance the production flow to a consistent rate, to a drum beat. The benefit of this is to minimize the work-in-process inventory. Use "Takt Time" to determine this rate. "Takt Time" is the rate at which a product produced in order to meet with the market demand rate for the product.

2) Optimal rates that the assembly line produces, the drum beat, should be at the rate the bottleneck rate is at. The non-bottleneck assembly stations should not be running at 100% their operating rate/speed. These non-bottleneck assembly stations should be rescheduled for less operating hours or their extra capacity redeployed for other uses or shutdown.

3) Effectiveness (activation) and wfficiency (utilization) are not the same. "What Should We Do" and "What We Can Do" are not the same? Hence, optimal production scheduling should be done based on the constraints of the total assembly system's bottle-necks. The benefit from this is reduction in work-in-progress inventories and tied up money in non-moving parts.

4) Production downtime at bottlenecks reduces the total production rate of the assembly line. Hence, by improving the rate of productivity of bottleneck stations improves the total production rate of the assembly line. And vice versa, downtime at bottlenecks stations reduces total productivity rate of the assembly line.

5) Improving productivity at non-bottleneck stations is useless effort unless; as this does not make the total productivity rate better. Instead it increases more ideal time and/or Work in Progress (*WIP*) inventory.

6) Work in Progress inventory should be maintained for the bottleneck workstations to process. This is to ensure bottleneck workstations have enough material to process and prevent it from shutting down due to lack of material to process. The transfer batch size should be smaller than the process batch size. Reduced in work-in-process inventory and better throughput is obtained when this is practiced.

7) The process batch size should not be fix size. The process batch size at bottleneck workstations should be larger and the process batch size at non-bottleneck workstations should be smaller.

8) Production scheduling should plan both on capacity and priority at

the same time.

It is found that it would be best for small/medium size assembly companies to embark on using *OPT* to improve their assembly throughput, inventories and operating costs before deciding to implement *Lean Manufacturing* or Lean Six Sigma. It will also help the company to embark on getting certified to ISO 9001 to put in place a document system and have a reliable quality system in place to ensure the benefits of *OPT* is properly documented and realized (Bin, 2000; Pierre A. David and Richard D. Stewart, 2010). Implementing OPT without proper quality management processes and documentations in place can lead to the failure implementation (OPTi Solutions, 2019).

Self-control Questions:

1. What is the essence of production logistics?
2. Define the main tasks of the production logistics.
3. How does the MRP I module operate?
4. What is a MRP II system?
5. What are the ERP class systems?
6. What is a JIT (Just-in-time) logistics technology?
7. What is a Kanban system?
8. What is the essence of "Lean production" logistics technology?
9. What are the main tools and concepts of the "Lean Production"?
10. Optimized Production Technology (OPT) as an effective tool of the "Lean Production".

Chapter 7. International Distribution Logistics

7.1. Fundamentals of Distribution Logistics

Distribution Logistics is a set of interrelated functions implemented in the process of distributing the material flows between different wholesale customers, that is, in the process of goods wholesale (Bin, 2000; A. Rushton et al., 2010; McGinnis, 1992).

Distribution Logistics has, as main tasks, the delivery of the finished products to the customer. It consists of order processing, warehousing, and transportation. Distribution logistics is necessary because the time, place, and quantity of production differ with the time, place, and quantity of consumption.

Distribution Logistics is the management of transportation, warehousing and other tangible and intangible operations that are carried out in the process of finished products' delivery the to the consumer in accordance with the interests and requirements of the latter, as well as the transfer, storage and processing of relevant information. Otherwise, it is also called marketing or *marketing logistics*. It is advisable, however, to use the term "distribution logistics" as one that most accurately reflects the presence of a controlling influence in the logistics system when final products are delivered to final users (A. Rushton et al., 2010; McGinnis, 1992). Distribution logistics can be internal and external (Table 7.1).

The tasks of the distribution logistics at the micro- and macro levels are different (Spiro, Rosann L. et al., 2003).

At the enterprise level (micro level) it can be:

- optimization of the orders' portfolio formation;
- conclusion of contracts with customers for the products' supply;
- ensuring the rhythm and compliance with planned product sales;
- studying and satisfying the needs of the logistics service;
- rationalization of parameters, structure and promotion of dynamic material flows;
- optimization of parameters and conditions of commodities storage;
- formation and improvement of the information support system.

Table 7.1 – Internal and external distribution logistics

Tasks of internal distribution logistics	Tasks of external distribution logistics
1) to organise the receipt and to process the order; 2) to plan the implementation process; 3) to choose the type of packaging, acceptance the decision on the complete set, as well as the organization of the execution of other operations; 4) to organise the shipment of products; 5) to organise the delivery and to control the transportation; 6) to organise the after-sales service.	1) the choice of the architecture of the commodity channel; 2) organization of work with channel participants; 3) choice of the strategy of distribution of finished goods; 4) choice of pricing strategy; 5) organization of measures for promotion of products on the market; 6) control of the state of the enterprise's product market and analysis of product positions in the target segments.

Source: (A. Rushton et al., 2010; McGinnis, 1992).

At the macro level, distribution logistics tasks include:

- choice of the scheme of material flow distribution;
- determination of the optimal number of distribution centers (warehouses) in the territory being served, etc.

Therefore, the main *distribution functions* include:

1) Determination of consumer demand.
2) Accumulation, sorting and placement of finished product stocks.
3) Establishment of economic relations with regard to the supply of goods and the provision of services to consumers.
4) Choice of rational forms of product promotion and trade organization.

In turn, the planning functions include:

1) Development of perspective and operational sales plans.
2) Analysis and evaluation of market conditions.
3) Determination of consumer demand.
4) Formation of an assortment production plan for the order by buyers;
5) Selection of channels and goods.
6) Planning of advertising campaigns and development of stimulus-sales.

Among the functions of the organization it is necessary to distinguish:

1) Organization of warehousing and packaging for the finished products.
2) Organization of sales and delivery of products to consumers.
3) Organization of after-sales service for consumers.
4) Organization of channels of commodity circulation and distribution networks.
5) Organization of training of sales staff and management activity of trade representative offices.

The set of functions concerning control and regulation can be attributed as follows (A. Rushton et al., 2010): performance appraisal; control over the plans implementation; operational regulation of sales activities of the enterprise with taking into account the influence of external and internal factors; statistical, accounting and operational accounting of sales activities.

7.2. Distribution Logistics Channels

Logistics Channel refers to a network that involves the participants of supply chain engaged in functions like transportation, receiving, handling, warehousing, information sharing, etc (Logistics Vocabulary, 2008). An efficient logistics channel is pre-requisite for acquisition and retaining of customers as it helps companies to deliver their goods to their customers at right time in right condition. Increase in product variety has also led to need of improved logistics channel.

The various goals of logistics channel are as follows (Logistics Channel, 2019)**:**

1. Meeting customer service level.
2. Minimize cost.
3. Increased sales.
4. Building relationship forbetter logistics execution.

Hence, for designing a logistics channel, customer needs are analyzed in order to fix channel objectives. The different kinds of constraints in setting up of channels are identified. Then, various alternatives of logistics channel are identified and evaluated. There are many third party logistics companies that provide complete solution related to logistics channel. They partner with the suppliers and help them meeting their objectives at least cost. Suppliers also evaluate their logistics partners at regular interval.

The media through which goods or services flows from the producers to the consumers is known as a **distribution channel**. It involves a series of individuals and organizations who act as intermediaries in the system. Distribution channels are also called marketing channels or marketing distribution channels.

Distribution Channels accommodate bidirectional flows such that they allow the flow of goods and services from the vendors to the consumers and at the same time facilitates the flow of payment for the goods/services in the opposite direction from the consumers to the producers. A set of distribution channels is called a ***distribution network.***

A simple international logistics channel can be presented as follows (Figure 7.1):

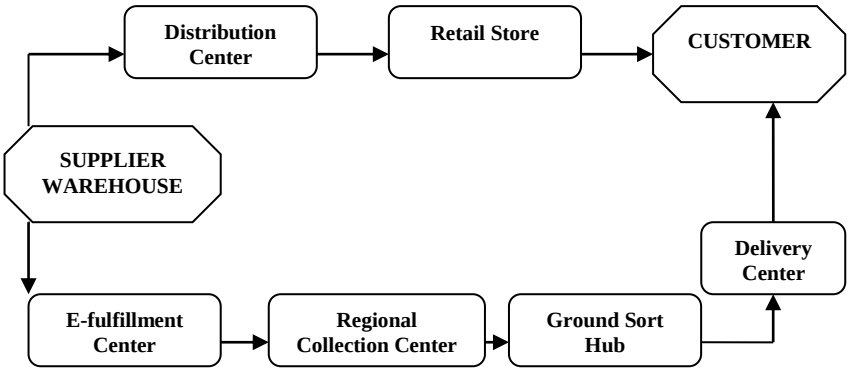

Figure 7.1 – Logistics Distribution Channel (Logistics Channel, 2019)

A distribution channel can have several stages depending on how many organisations are involved in it (Logistics Channel, 2019):

1) Multistage Channel - a wholesaler buys and stores goods in large quantities and supplies the same to retailers in smaller quantities (for example: apparel is first goes from producer to the wholesaler and retailer and then finally to the consumer (Wal-Mart, Big Bazaar, etc.)

2) Singlestage Channel - channel contains only one intermediary, which is typically the retailer in consumer markets (for example: perishable goods such as foods, etc).

The use of distribution channels gives manufacturers some benefits as follows:

- cost savings for product distribution;
- the possibility to invest savings in the main production;
- the sales in more efficient ways;
- the high efficiency to ensure wide availability of goods and to bring it to the target markets.

Selected channels directly affect the speed, time, efficiency of movement and preservation of products during its delivery from the producer to the final user.

In this case, enterprises or individuals who form a channel, perform a number of important functions such as:

1) to carry out research work on the collection of information necessary for planning the distribution of products and services;

2) to stimulate sales through the creation and dissemination of

information about goods;

3) to establish contacts with potential buyers;

4) to adapt the goods to the requirements of buyers;

5) to conduct negotiations with potential consumers of products;

6) to organise goods (transportation and warehousing);

7) to finance the movement of goods by the distribution channel;

8) to assume the risks associated with the operation of the channel.

During the formation of logistics channels, it must be remembered that the involvement of intermediaries, as a rule, extends logistics chains.

Generally, in the distribution logistics channels can be characterized by the number of components of their levels. The level of distribution of the logistics flow is any mediator - a logistics system participant that performs distribution functions, transforming material flows in the process of their movement to the final destination. The length of the channel is determined by the number of intermediate levels between the producer and the consumer.

The logistics channel of the zero level includes the producer and the consumer, the distribution of the material flow is carried out directly by the producer. Such channels are often used for supplying products of industrial and technical purpose, especially if large batches are purchased, as well as unique products. They provide for strict regulation of the supply schedule and therefore allow shortening production cycles and warehouse space (Gadzhinsky, 2004; Logistics, 2010).

One-, two- or more-level logistics channels include one or more intermediaries. For example, a channel that includes a wholesaler, a wholesaler and a retail intermediary is a three-level one. In multilevel channels, the distribution of material flows at an initial stage is carried out by the manufacturer, and then by the intermediary structures (Gadzhinsky, 2004).

From the standpoint of producers that generate material flows, the more levels the logistics channel has, the more difficult it is to coordinate the functioning of all links to promote material flows to consumers.

Distribution channels can be **horizontal** and **vertical**.

Horizontal distribution channels are traditional channels and consist of an independent manufacturer and one or more independent intermediaries. Each member of the channel is an individual company that seeks the ways to maximize its profit. The maximum possible profit of a single member of a channel may harm the system as a whole, as none of the channel members has full or sufficient control over the activities of the other members.

Vertical distribution channels are channels that consist of a

manufacturer and one or more intermediaries that act as one single system. One channel member, as a rule, either owns the other, or gives them certain privileges. Such a member may be a manufacturer, wholesale or retail intermediary. Vertical channels arose as a means of controlling the behavior of the channel. They are economical and exclude duplication by members of the channel of the functions performed.

7.3. Logistics Intermediaries in Distribution Channels

The bodies involved in transacting the product from the producer till the time it gets purchased by the ultimate consumer can be termed as the **market intermediaries** (Logistics Vocabulary, 2008).

Market intermediaries can be individuals or firms. The products keep changing the possession at each level where subsequent transporting and inventory costs get added. Finally the product gets available at the retail outlet at a certain price. Though intermediaries pose a challenge to firms when they compete on the prices yet they are indispensable as a vast distribution network cannot be handled by the company alone (Jonson JC, Wood DF, 1990; Business Dictionary, 2018).

A *marketing intermediary* is the link in the supply chain that links the producer or other intermediaries to the end consumer. The intermediary can be an agent, distributor, wholesaler or a retailer. These parties are used in the selling, promotion or the availability of the goods/services through contractual agreements with the manufacturer. They receive the products at a particular price point, add their margins to it and move it to the next link in the supply chain at the higher price point. They are also known as middlemen or distribution intermediaries.

Logistics intermediaries are a party who arranges shipping, warehousing, distribution and other goods movement on behalf of goods providers and shipping companies (Logistics Intermediaries, 2019). The term third-party logistics, or 3PL, is widely used in logistics circles as also referred as a *logistics intermediary*. They outsource the firm logistics activities to another firm that then manages the activities, without taking an ownership position in the inventories (Logistics Intermediaries, 2019).

The most common intermediaries in International logistics are freight forwarders; after the sale is completed a freight forwarder can handle nearly of all the logistical aspects of the transaction. Indeed, large forwarders may assume responsibility for managing the firm's international distribution and supply channels.

Logistics intermediaries in the distribution channels perform certain functions that can be split up into:

• functions (operations) of physical distribution;

• exchange functions (purchase and sale);

•supporting functions (standardization of distribution quality, financing, information support, risk insurance, etc.)

Export Management Companies (EMCs) are intermediaries that market another firm's products overseas. They have three to five-year exclusive representation contracts, investigate potential customers' credit standing, and can handle complementary, non-competitive products. EMCs are professional exporters. An EMC does not manufacture. The business of the EMC is finding and servicing markets overseas on behalf of domestic manufacturers. Forexample, *export packers* are the specialized intermediary. They assis the export with special packaging requirments needed to reach some export markets.

The types of logistics intermediaries are as follows (Logistics Intermediaries, 2019):

1) Wholesalers purchase product in bulk and resell it. They own the products that they sell. They usually sell these products to retailers at a profit. **A retailer** can be independent, like small kirana stores, or they can be supermarket chains, like Big Bazaar or Reliance Fresh. They own the products that they stock. The retailer is usually the last link of the supply chain, reaching products to the end consumer for a profit.

2) Dealers are the individuals or firms which buy goods from a producer or distributor for wholesale and/or retail reselling. Unlike a distributor, a dealer is a principal and not an agent (Business Dictionary, 2018). *Dealers* – are mostly wholesale broker that operates on its own behalf and at own expense; he buys the goods under the contract delivery; the relationship between the seller and the dealer are interrupted after execution of all terms of the agreement. There are two types of dealers. *Exclusive dealers* are the only representatives of the producer in the region and have exclusive rights to sell their products. Dealers who co-operate with the franchisee manufacturer are called - *authorized*.

3) Distributors are wholesale and retail intermediaries who carry out operations on behalf of the manufacturer and at their own expense. An entity that buys noncompeting products or product lines, warehouses them, and resells them to retailers or direct to the end users or customers. Most distributors provide strong manpower and cash support to the supplier or manufacturer's promotional efforts. They usually also provide a range of services (such as product information, estimates, technical support, after-sales services, credit) to their customers (Business Dictionary, 2018). In the logistics chain, distributors usually occupy a position between the manufacturer and dealers. *Distributors* are different from wholesalers in that

the wholesalers carry many product lines, say Tide and Surf Excel, but distributors carry only one of complementary lines, either tide or Surf Excel products. Distributors will carry these products to points of sale and they maintain very close working relationships with suppliers and buyers (Marketing,2019).

4) Commission agents are wholesale and retail intermediaries who carry out transactions on their behalf and at the expense of the manufacturer. The commissioner is not the owner of the product and works on its behalf and at the expense of others.

5) Agents are intermediaries who act as representatives or assistants of another person (principal) who is the principal of him. Typically, agents are legal entities. The agent concludes transactions on behalf and at the expense of the principal. By the scope of authority agents are divided into two categories. *Universal agents* carry out any legal actions on behalf of the principal. *General agents* only invest in the contracts specified in the order. Agents receive remuneration for their services both in terms of tariffs and in agreement with the principal. The most widespread form of agency remuneration is the percentage of the amount of the concluded agreement. So, the **agent** is an independent entity that acts as the manufacturer's representative for the buyer. Agents have possession of the products without actually owning them. They work on commission basis.

6) A broker is an independent party, whose services are used extensively in some industries. A broker's prime responsibility is to bring sellers and buyers together and thus a broker is the third-person facilitator between a buyer and a seller. An example would be a real estate broker who facilitates the sale of a property. Brokers are expected to have the tools and resources to reach the largest possible base of buyers and sellers. They then screen these potential buyers or sellers for the perfect match. An individual producer, on the other hand, especially one new in the market, probably will not have the same access to customers as a broker. Another benefit of using a *broker* is cost - they might be cheaper in smaller markets, with smaller accounts, or with a limited line of products (Spiro, Rosann L.et al., 2003). Some types of brokers, such as real estate brokers, often have strict state requirements for using the term, while others, such as aircraft brokers, typically have no formal licensing or training requirements. Some brokers, known as discount brokers, charge smaller commission, sometimes in exchange for offering less advice or services than full service brokerage firms. A *broker-dealer* is a broker that transacts for its own account, in addition to facilitating transactions for clients (Johnston, Kevin B., 2019; Marketing, 2019).

The number and type of intermediaries in the distribution channel is

determined by the type of *distribution system*. Marketing has developed three approaches to solving this problem: intensive distribution, exclusive distribution and selective distribution.

An intensive distribution involves providing as much inventory as possible to a large number of trading enterprises.

The exclusive distribution involves a deliberately limited number of intermediaries that sell this product within sales territory.

The selective distribution is a bit between methods of intensive and exclusive distribution. The selective distribution allows the manufacturer to reach the required market coverage under more stringent controls and at lower cost than with the organization of intensive distribution (Marketing, 2019).

In order to increase the efficiency of product sales and to save money, organizations often use *multi-channel distribution systems*.

A significant number of various intermediaries in the distribution channel causes major problems in taking effective decisions. The main problem concerned the coordination of local tasks and objectives of intermediaries with the strategic goals of the manufacturer. In addition, each functional group of mediators also has their complicated relationships. In general, the relationship between the mediators that are formed around this issue can be divided into cooperation, conflict and competition.

Cooperation is manifested in the fact that intermediary firms performing the same or a different logistic operations in distribution, join forces to achieve a common goal. *Conflicts* arise when intermediaries have conflicting goals, which concern one and the same area of distribution logistics (Fundamentals, 2018).

7.4. Distribution Centers in Logistics Chains

Distribution Center is a warehouse complex, which receives goods from manufacturing companies or from wholesale companies (for example, located in other regions of the country or abroad) and distributes them to smaller parties to customers (small and medium-sized enterprises and retailers) through their own or their commodity network (Logistics Vocabulary, 2008).

A **distribution center** can be understood as a facility that is usually smaller than a firm's main warehouse and is used for receipt, temporary storage, and redistribution of goods according to the customer orders as they are received. They are also called as “branch warehouse” or “distribution warehouse”. It should be duly noted that here the emphasis is on processing and moving goods on to wholesalers, retailers, or consumers rather than on storage (Logistics Vocabulary, 2008; A. Rushton, et al., 2010).

The key feature of a distribution center is that it is usually *"demand-driven"*. Hence distribution centers are the foundation of a supply network, as it is the single location to stock a vast number of products.

The main tasks of distribution centers include (A. Rushton, et al., 2010)*:*

1) round-the-clock, comprehensive service of the logistic product;

2) the provision of various services in the field of warehousing, including the procedures for the completion and decomplex of cargoes, packaging, designation, phytosanitary control, as well as the principle of "the first one went, the first came out";

3) ensuring the possibility of overloading goods from one means of transport port to another; provision of services by repair agencies, gas stations, car wash and specialized shops;

4) provision of financial and consulting services in the choice of forms and methods of service of cargo, legal and customs services.

In a centralized commodity network, the distribution center directs goods produced by the enterprise-producer, end-users or intermediate consumers in different regions of the country (wholesale or wholesale intermediaries or directly to the retail chain). The advantage of this option is that it is possible to reduce storage stocks in the warehouse of finished products by the manufacturer, sending immediately all the manufactured products to distribution centers. The disadvantages of this option are large transport costs for the delivery of goods to numerous consumer customers.

With a decentralized distribution system, the total inventory and the cost of several distribution centers will be more expensive than in the previous version. However, the cost of delivering goods to consumers will be lower because distribution centers are in the commodity markets, near consumers. In addition, local distribution centers are easier to explore their regional markets, and they can flexibly respond to the situation in these markets. At the same time, in small regional warehouses it is difficult to achieve the same low cost of processing of goods as in a large automated distribution center, which can be observed in a centralized system of organization of the commodity network.

7.5. Distribution Requirement Planning

Distribution Requirement Planning (DRP) is a system of management and planning is used, which allows not only to take into account market conditions, but also to actively influence it. This system ensures a stable relationship between supply, production and marketing of products using MRP elements (Logistics Vocabulary, 2008).

Distribution Requirements Planning (DRP) is the process in which

goods are delivered in a more efficient manner. These include considering the aspects of establishing a good, quantity of the good, and the direct location that it is needed to arrive at in a given time. So, DRP is a process which is used to determine which goods or materials will be required at which location and at what time to meet the anticipated demand.

Distribution Requirements Planning will benefit the operation as a whole through the increase in efficiency through the following benefits (DRP, 2018):

1) Faster decision making.
2) Utilization of demand forecasting.
3) Planning initiation accuracy.
4) Cost - awareness.
5) Customer service enhancement.
6) Push or pull method.

The pull or push method is utilized by *DRP* distribution, with pull and push differing from each other. The pull method includes goods shifting upward throughout the system and obtaining customer order achievement. Although management controls the amount of goods available, distribution inventory management is challenging because all orders are considered new to the supplying location as the demand is flowing upward, which is otherwise known as the "Bullwhip Effect" ("Bullwhip Effect" is a phenomenon observed in forecast driven distribution channels where the amplification of the demand variance up the supply chain, from the customer to factory, as demand information passes back through the supply chain. It is also known as whiplash effect. In Simple words, Bullwhip effect is the small variation or fluctuation in customer demand resulting in fairly large variance for other stakeholders as we move up the supply chain i.e. distributors, wholesalers, retailers and manufacturer) (DRP, 2018).

The push method differs from the pull method by doing the opposite of pull - sending the goods downward through the system. This method has advantages of lower cost, but also is at a disadvantage of central planning and demand not necessarily being on the same page at all times. As distribution requirements planning is gradually being implemented into the production facilities and manufacturing operations, there is a drastic increase in production efficiency, accuracy, and order fulfillment.

DRP-II includes maintaining the provision for major non-inventory items and resources such as labour, material handling systems, and storage space. It may include other resources such as finances, trucks, freight cars, etc. This information is then entered into an MRP-II (Manufacturing Resource Planning) as gross requirements for estimating and calculating input flows and preparing the schedules of production activities (DRP,

2018).

The main goal of DRP-II is to eliminate or at least minimize the shortages and at the same time, reduce the costs incurred during ordering, transporting and storing or holding goods. It is also called as *Distribution Replenishment Planning*. It is a time based approach which estimates when inventory is expected to be depleted and accordingly replenishes the same on time (DRP, 2018).

DRP Table forms an important constituent of the DRP-II mechanism. It includes several elements like (DRP, 2018):

1) Forecast demands
2) Current inventory levels
3) Safety stock
4) Expected Replenishment Quantities
5) Replenishment Lead Times

DRP-II works either with the pull or push approach. In the pull method, goods are moved up the network by fulfilling the customer orders. This is a localised approach and as such, customer demands are met in a better way. However, managing the inventory is an issue in this method. In the push method, goods are sent down through the network. It incurs lower costs due to centralised planning and storage of goods. Disadvantage of the push method is service levels can be affected if central planning is unaware of the actual demand. DRP-II ideally envisages combining the efficiency of push with the service levels of pull (DRP, 2018).

The DRP system is the basis to plan logistics and marketing functions, their coordination. It allows to predict market situation with a given degree of probability, to optimize logistics costs by reducing transport costs and expenses on goods, allows to plan supplies and stocks at different levels, the distribution chain, facilitates the implementation of information provision of different levels of the distribution chain (DRP, 2018):

Complex tasks:

1) to plan and to coordinate the logistics and marketing;
2) to predict market conditions;
3) to plan the supply;
4) to optimize the logistic costs of conservation;
5) to shorten the time of deliveries of finished products.

Micrologistic sales management systems are based on the DRP scheme (Table 7.2).

Table 7.2 – Advantages and disadvantages of the DRP distribution system

Advantages	Disadvantages
1) improvement of the level of service by reducing the time of delivery and meeting the expectations of consumers; 2) improvement of the new products promotion to the market; 3) the ability to predict and prevent marketing decisions about the promotion of finished products with a low stock level; 4) improved coordination of inventory control of finished products with other functions of the firm; 5) high ability to meet customer requirements at the expense of the service; 6) reduction of expenses related to preservation, transportation, processing of cargoes; 7) determining the optimal size of warehouse space; 8) the choice of the optimal mode of transport; 9) improvement of coordination between logistics functions in distribution and production.	1) the need for a properly coordinated forecast and replenishment of funds for each center and channel in the network of goods; 2) the need to determine the insurance reserves in distribution centers in order to avoid a possible mistake in distribution (forecasting and prediction of time of change in demand, improper forecasting of demand affecting warehouse placement or stock size); 3) the need for high reliability of logistics cycles between distribution centers and other parts of the logistics system for inventory planning; 4) an immediate reflection of the uncertainty of any cycle (order, transportation, production) on the efficiency of the solution; 5) frequent changes in production schedules.

Source: (Berzhanir et al., 2009; Logistics, 2010, DRP, 2018).

Self-control Questions:

1. What is distribution?
2. How do the types and attributes of a product influence the logistic decisions in distribution?
3. What factors do determine the structure of logistics channels in distribution?
4. How to classify distribution systems and structures of logistic channels in distribution?
5. What are the types of intermediaries in distribution and what functions do they perform?
6. What are the functions and what is the classification of trade agents in distribution?
7. What does determine a choice of a number and specialization of intermediaries in distribution and what are the advantages associated with them?
8. What types of relationships do exist between intermediaries in distribution?
9. Describe the role of distribution centers in logistic chains.
10. What are the advantages and disadvantages of the “DRP” distribution system?

Chapter 8. Fundamentals of International Transport Logistics

8.1. Transport Logistics: Definition and Objectives

Transport is a sphere of material production, which carries out transportation of people and goods. Transportation can be defined as a key complex activity associated with the movement of material resources, work-in-progress or finished products by a particular vehicle in the logistics chain, which in turn consists of complex and elementary activities, including forwarding, cargo handling, packaging, transmission property rights to cargo, insurance, etc (Logistics Vocabulary, 2008).

In business, at its most basic level, **transportation** is simply moving products and materials from one place to another. This includes shipment of raw materials to the manufacturer and movement of finished product to the customer (Transort Logistics, 2019). Transportation also includes the movement of parts to assembly areas as they are assembled (Pierre A. David and Richard D. Stewart, 2010; Logistics Management, 2019)

Main tasks of Transport Logistics (Pierre A. David and Richard D. Stewart, 2010)*:*

• to choose of vehicle type;

• to optimize the transport process during mixed transport;

• to define the rational delivery routes;

•to ensure the technological unity of the transport and warehouse process;

• to coordinate the transport and production process.

Transportation is the driver of logistics, but logistics is the race car driver in the seat of transportation. But, in fact, logistics requires planning; transportation is just the mode to execute the planning, when getting freight from point A to point B. Clearly, they are not the same thing, but transportation is just simply a part of logistics (Ballou R. H., 1992).

Transportation is needed for (Bin Wu, 2000):

1) Movement of raw-materials from suppliers to the manufacturing unit.
2) Movement of work-in-progress within the plant.
3) Movement of finished goods from plant to the final consumers.

When it comes to logistics, logistics executives must make further decisions beyond the mode of transportation to include (Transort Logistics, 2019):

1) Packaging
2) Containerization
3) Documentation
4) Insurance
5) Storage
6) Importing and exporting regulations
7) Freight claims management
8) Working & collaborating with other executives within the supply chain
9) Managing vendors and partners
10) Responsible for mitigating risk and mitigating expenditures

Transportation is that logistical activity which creates place utility.

Major transportation systems include (Logistics Management, 2019)**:**

1) Railways
2) Roadways
3) Airways
4) Waterways
5) Pipelines.

The choice of a particular mode of transportation is dependent on a balancing of following considerations (Logistics Management, 2019)**:**

1) Speed of transportation system
2) Cost involved in transportation
3) Safety in transportation
4) Reliability of transportation time schedules
5) Number of locations served etc.

For most companies, the key to transportation and logistics is finding the right balance between efficiency and cost. Perhaps one of the most successful companies at doing this is Amazon, which has dozens of distribution centers across the United States and spends billions in developing state-of-the-art fulfillment centers to get its products to customers quickly while managing to make a profit (Logistics Management, 2019).

Transport is essential in ensuring the efficient operation of the logistics system of the enterprise. During the production cycle, all cargoes are moved, which is accompanied by numerous logistics operations. It greatly increases the volume of transport work. For each logistics transaction, there are several transport operations, which leads to significant transport costs (10-30% of indirect costs in the cost of production) (Bowman Logistics

Glossary, 2019).

Based on the goals and objectives of logistics, the company can use automotive, rail, water, air or pipeline transport. The economic feasibility of using one or another type of transit is determined by the following groups of factors (Rebstock M. and Hildenbrand K., 2001):

1.General economic factors: the location and scale of production and consumption of products, which determines the volume and direction of transportation and freight traffic; the nomenclature of produced goods, which determines the type of rolling stock and the rhythm of its work; the state of material values, stocks which define the urgency of the delivery of goods, etc.

2.Specific transport factors: placement of the communication network (in-house transport routes); conditions of transport operation, including seasonality and rhythmicity of work; throughput and carrying capacity; technical equipment; system of organization of the transport process.

In the structure of social production transport refers to the sphere of material services production. The cost of transport operations is up to 50% of the total amount of logistics costs.

8.2. International Forwarding Services

Enterprises, solving problems regarding transportation of goods, under certain conditions, can transfer some of these functions to specialized transport enterprises. Focusing on the main activities, the manufacturer agrees to pay high-quality services of independent firms for the implementation of logistics operations, in order to increase its efficiency (Stock R. James and Lambert M. Douglas, 2001).

Forwarding services is a kind of activity of specialized intermediaries (freight forwarder or forwarding agent**)** to provide the sender of cargo with additional services related to the preparation of products for movement (Logistics Vocabulary, 2008).

A **freight forwarder** or **forwarding agent** is an individual or a company which organizes shipments for organizations to source goods from the manufacturer to the final point of distribution or consumer (Logistics Vocabulary, 2008). It may move a wide range of products as cargo, ranging from manufactured goods to raw agricultural products, owing to its expertise in the logistics network. The freight can be taken through a variety of shipping providers, such as ships, trucks, railroads and airplanes. International freights are handled by **international freight forwarders**, who have expertise in preparing and processing of documentation, customs and shipment.

Carrier is a legal entity or an individual entrepreneur, having the right and having assumed the obligation to carry out transportation on the basis of the relevant contract (Prokofieva, 2009).

Forwarder is a legal entity or an individual, having the right and undertaking obligations to perform or organize the provision of services related to the carriage of goods on the basis of a contract of transport expedition.

Shipper is a legal or natural person presenting a cargo for transportation to a forwarder or carrier.

Terminal technologies - complex forwarding services for consignors and consignees, carried out through a network of terminal complexes and distribution centers (Logistics Vocabulary, 2008).

A terminal is a complex of engineering and technical devices and structures intended for the reception, accumulation, processing, dispatch and delivery of goods (Prokofieva, 2009).

A multimodal terminal is a cargo storage, cargo handling, transshipment and storage complex, built at the nodes of the transport network and served by several types of trunk transport while combining cargo handling technologies.

A multifunctional terminal complex is a freight forwarding enterprise that acts as a transport and distribution logistics center with a wide range of services provided for transportation, cargo processing, storage, service and commercial, business services for the customers and representing a complex of engineering devices and structures with modern technological equipment.

International multimodal transport of goods is characterized by the movement of goods from one country to another by at least two different modes of transport and under one contract.

Intermodal transportation of goods is based on a combination of two or more modes of transport, a sequentially centralized interaction scheme of the transport chain links, the presence of an intermodal transportation operator, the formation of integrated unified cargo units, door-to-door delivery of goods with a single transport document and a single responsibility for the entire transportation process (Prokofieva, 2009).

The main tasks of forward services (Berzhanir et al., 2009)**:**

- registration of necessary transport documents;
- conclusion of a contract of carriage with transport enterprises;
- settlement payments for cargo transportation;
- organization of loading and unloading works;
- providing information to participants in the transport process;
- insurance of transported goods;
- consolidation of small cargo units;

• simplification of customs formalities, etc.

The freight forwarder does not moves the products itself, rather it acts as an intermediary between shipper and transportation services like cargo shipping, expedited shipping by air and moving goods by truck or rail.

The most economical route is selected out by bids, on the basis of cost, speed and reliability. The freight forwarder establishes relationships with all kinds of carriers, from trucking companies to air freighters, in order to be able to negotiate best possible price for shipment. Freight forwarders have expertise in handling international shipments from one destination to another, which would pose a formidable burden on the client.

The advantages of deploying a freight forwarder are as folllows (Alan Harrison et al., 2019)**:**

1) Reliable transportation of products at competitive rates.

2) Time saving.

3) Relief from burden of international shipping procedures.

4) Ancillary services like insurance, customs documentation, non-vessel operating common carrier documentation, bills of lading, warehousing, risk assessment and management, methods of international payment.

The attractiveness of forwarding services is defined by the fact that it is inefficient to keep the state of this category of workers and the appropriate fleet of vehicles requiring special premises and repair facilities for each enterprise. Specialized logistics structures perform the necessary work more qualitatively, faster and significantly cheaper, optimizing freight flows and efficiently using existing vehicles.

The main advantages to use the services of freight forwarding companies are as follows (Fundamentals, 2018; Pierre A. David and Richard D. Stewart, 2010):

1) Each consignment lot can be transported at the least cost (consolidation of goods).

2) In the forwarding company there is a large range of possible sizes and types of vehicles. It is possible to choose the most suitable for this load of the vehicle.

3) Customers can prepare the departure without taking into account the presence of the return cargo.

4) The problem of idle, empty rides and incompleteness of vehicles during the period of decline of business activity of the enterprise and the shortage of such means during the periods of its increase is excluded.

5) Forwarding services allow customers to reduce the need for vehicles and maintenance staff to a minimum.

6) Cargo flows are streamlined and optimized at all levels.

7) The quantitative parameters are lowered and the structure of scales is

improved by increasing the frequency of deliveries (Berzhanir et al., 2009; Logistics, 2010).

Table 8.1 presents a comparative description of the services provided by various types of forwarding companies. Depending on the nature of the work and the performed operations, transport and forwarding services are divided into *three groups* (Fundamentals, 2018):

1) Direct transport services.

2) Loading and unloading work.

3) Forwarding services. There are two types of forwarding services: complex and local. Complex forwarding services cover all types of services from the moment when loads are accepted and until they are unloaded by the customer. They include:

- acceptance of goods for carriage in the consignor's warehouse;
- preparation of cargo for transportation;
- organization of loading on vehicles;
- organization of transportation;
- organization of cargo security;
- organization of unloading of goods and their warehousing on the territory of the client;
- transfer of goods and registration of necessary documentation for this purpose;
- execution of payments for all types of services rendered;
- report to shippers.

Table 8.1 – Comparative characteristics of logistics services provided by various types of forwarding companies

Type of enterprise, kind of transport-expeditionary service	**The main services**
Large enterprises with the powerful automobile fleet, an efficient communication system, an extensive network of branches and offices. Providing a wide range of transportation services and warehousing.	1) Organization and carrying out of transportations at greater distances in interaction with others forwarder or other types transport . 2) Placement of distribution centers in all industrial areas. 3) Transportation services with the involvement of qualitative subcontractors of small transport firms. 4) Maintenance of production warehouses in different industries 5) Warehousing and transportation of dangerous goods with the help of special carriage conditions which are set up on a certain route and depend ongoods and materials (i.e. dangerous, fragile) and on the pack type. 6) Transfer can be carried out using specific transport equipment (trailr, truck, aircraft, etc) according to safety rules.

Continuation of the Table 8.1

Small enterprises with a flexible management system and organization of technological process. Specialization in certain types of services, which, as a rule, exceed the average level in the market	1) Transportation over long distances, or organization of linear transportations 2) Placement of distribution centers at the end lines of transport 3) Mediation in the organization of transportation 4) Transportation of liquid cargoes
A small business or a separate entrepreneur with limited resources. Narrow specialization, providing some low-cost types of services	1)Cargo transportation 2) Shipment for small distances 3) Transportation at larger distances by one or by several machines 4) Special carriage conditions 5) Intermediary activities

Source: (Berzhanir et al., 2009).

8.3. Transport Eurologistics Strategy

Particularly significant successes in the coordination of transport and logistics strategies have been reached by EU countries. This strategy is called *Eurologistics* and is considered as an infrastructural basis and an important component of the European integration process. Course to create a single transport and logistics system is reflected in all major EU documents, starting with Treaty of Rome (1957), but as one of the basic strategies of European integration, Eurologistics received a special development in the late XX - early XXI centuries (Table 8.2).

The development of international logistics required the formation of **international transport corridors** (ITC), through which the main transit freight flows are carried out.

International transport corridors (ITC) are a part of a national or international transport system that provides significant international freight and passenger traffic between separate geographical areas, includes rolling stock and stationary devices of all types of transport operating in this direction, as well as a combination of technological, organizational and legal conditions for the implementation of these shipments.

Table 8.2 – Conceptual basis of Eurologistics

Conception	Document	Year
European transport axes concept	Declaration of the Committee on Transport of the European Community	1983
European concept of intermodal transport bridges	Declaration I of the Pan-European Conference on Transport, Prague (Czech Republic)	1991
Pan-European concept (Crete) transport corridors	Declaration II of the European Conference on Transport, Crete (Greece)	1994
Pan-European concept of transport zones (Helsinki transport corridors)	Declaration III of the Pan - European Conference on Transport, Helsinki (Finland)	1997
"Wider Europe" transport logistics system	The EU "White Paper" - European Transport Policy for 2010: time to decide	2001

Source: (Oliynyk, Y.B. and Smirnov, I.G., 2009).

The **ITC** organization aims to unify national laws, harmonize transport systems of East and West, create an international transport infrastructure that has common technical parameters and ensures the use of a single transportation technology as the basis for the development of international logistics. It is necessary to have the appropriate transport infrastructure (transport communications, terminals, freight and passenger stations, etc.), transportation means (railway and automobile rolling stock, fleet, freight units), a legal base that allows organizing international transportations, in particular multimodal transport, an information system that allows you to collect, store and process information about the transportations performed, transport operators that provide the necessary level of services to consumers of transport products.

The concept of European intermodal transport bridges (1991) found implementation in the scheme of nine European transport corridors to which the Cretan Conference (1994) added the tenth corridor, and the concept of Pan - European Transport Zones (Pan European Transport Areas, PETrA), which include the Black Sea, Mediterranean, Adriatic-Ionian, Barents Euro-Arctic.

The concept of an integrated transport and logistics system throughout Europe ("*Wider Europe"*) found expression in the EU's transport development policy document "Logistics Infrastructure" – "White Paper" on European Transport policy (2001).

At the Pan-European Transport Conferences in Prague, the Cretan Conference (1994), the concept of Eurologistics was extended to the whole Europe and its regional components.

TEN (Trans European Network) - Trans-European transport network on the territory of the EU.

TINA (Transport Infrastructure Needs Assessment) - needs assessment development of transport infrastructure of candidate countries for accession to the EU first turn (now - new EU members)

TIRS (Transport Infrastructure Research Study in South-East Europe) - study of the needs of transport infrastructure development in the countries of the South-Eastern Europe;

PEC (Pan European Corridor) - 10 Pan-European Transport corridors;

PETrA (Pan European Transport Area) - 4 Pan-European Transport Areas.

An important direction of the European transport policy is the development of international transport links, use and expansion of the country's transit potential and integration of the national transport system into the European one, as one of the ways to accelerate Ukraine's integration into the European Union.

One of the priorities of the state transport policy is the implementation of the provisions of the Pan-European Transport Conferences on the development of transport links between Ukraine and the Trans-European Network, with which our transport system is connected by routes of international transport corridors. Building a network of international transport corridors is one of the ways in which Ukraine has taken integration into the European Union (Oliynyk Y. B. and Smirnov I. G., 2009).

It should be noted that the main problems at the Pan-European Transport Conference must include:

- development and implementation of the Pan-European Transport Policy;
- integration of Central and Eastern European countries into the European transport market;
- special issues related to the development of railway, road and inland waterway transport, as well as combined transport;
- environmental problems of transport development;
- social "cost" of transport;

• trends in international transport and infrastructure.

Intensification of Ukraine's participation in Eurologistics processes should be aimed at ensuring the transit of the flow of goods has passed through the transport system of our country.

A regional "formula" of Eurologistics can be considered as follows (Oliynyk Y.B. and Smirnov I. G., 2009):

$$\mathbf{PEN} = \mathbf{(TEN} + \mathbf{TINA)} + \mathbf{TIRS} + \mathbf{PEC} + \mathbf{PETrA}, \quad (8.1)$$

Where PEN - Pan European Network;
TEN - Trans-European transport network on the territory of the EU;
TINA- Transport Infrastructure Needs Assessment;
TIRS - Transport Infrastructure Research Study;
PEC - Pan European Corridor;
PETrA- Pan European Transport Area.

Pan European Network (PEN), as well as the spatial "formula" of the Euro-Asian Transport Network (EATN), which is formed as follows (Oliynyk Y. B. and Smirnov I. G., 2009):

$$\mathbf{EATN} = \mathbf{PEN} + \mathbf{TCTC}, \quad (8.2)$$

Where EATN- Euro-Asian Transport Network;
PEN – Pan European Network;
TCTC – Transcontinental Transport Corridors;

In Eurologistics projects, an important place is given to Ukraine due to its extremely advantageous transit position. This is confirmed by the highest transit rating among European countries (3.15 points - calculations by the British Rendell institute). The following areas of Ukraine's participation in European transport and logistics integration are identified:
1) Pan-European International Corrodors (PEIC).
2) Transcontinental Transport Corridors (TCTC).
3) Pan European Transport Area (PETrA).
4) International Logistics Terminals (ILT).

The formula for Ukraine's participation in European transport and logistics integration can be considered as follows (Oliynyk, Y.B. and Smirnov, I.G., 2009):

$$\mathbf{PEIC + TCTC + Black\ Sea\ PETrA + ILT}, \quad (8.3)$$

Where PEIC - Pan-European International Corrodors;
TCTC- Transcontinental Transport Corridors;

PETrA- Pan European Transport Area;
ILT- International Logistics Terminals.

The interpretation is as follows: four fuel and energy complexes pass through the territory of Ukraine (№ 3, 5, 7, 9); four TCTC (Euro-Asian Transport Corridor, "Europe-Asia", "Baltic-Black Sea", Black Sea Transport Ring); Ukraine is a part of the Black Sea Pan-European Transport Area (Black Sea PETrA), which is identified as a priority in the EU.

There are some state documents such as "Program of creation and functioning of the national network of ITC in Ukraine" (1998), "Comprehensive program of establishing Ukraine as a transit state in 2001-2020" (2001), "Concept of transport and road development complex of Ukraine for the medium term and until 2020" (2001), "Action Plan: Ukraine - European Union. Neighbourhood Policy" (2005), as well as "Program for the formation of logistics centers network in the system of International Transport Corridors of Ukraine" are focused on the integration of Ukraine into the European transport and logistics system (Oliynyk, Y.B. and Smirnov, I.G., 2009).

The *"Wider Europe 2020"* concept, including first and foremost Ukraine, provides as an integral part of Eurologistics, ie creation a single European transport and logistics system, which through the network of international transport corridors and logistics centers will be connected with the transport and logistics systems of Asia and other continents and parts of the world that is currently being formed. Ukraine by virtue of its extraordinary (and possibly unique) advantageous transit position and developed transport logistics infrastructure should take a prominent place in this system (Oliynyk Y. B. and Smirnov I. G., 2009).

Self-control Questions:

1. Give the definition of "transport activity"
2. What are the main tasks of transport activities?
3. What are the technological schemes for the intra-product transportation of goods?
4. What is the content of the operating system of cargo delivery?
5. What is "consolidation of cargo"?
6. What are the main principles of the formation of intra-industry transport activities?
7. What is the conceptual basis of Eurologistics?
8. What is the documentary basis of the concept of Pan-European (Cretan) Transport Corridors?
9. What is the role of the European Conference of Ministers of Transport in the development of European transport and logistics strategy?

TESTS

1. The following definition characterizes "logistics" the most accurately in the economic field:

a) transport organization;

b) material and technical supply;

c) management of material and related information, financial flows;

d) the art of commerce;

e) entrepreneurial activity.

2. Logistics as an economic science was formed on the basis of ideas and methods of:

a) military affairs;

b) mathematical logic;

c) research of operations;

d) cybernetics.

3. The main object of the international logistics can be:

a) processes carried out during the trade;

b) material and related information and financial flows;

c) markets and conditions for specific goods and services;

d) economic relations in the process of goods and services delivery from production to places of consumption.

4. The founder of logistics is considered to be:

a) T. Levitta;

b) A.Jomini;

c) P. Drucker;

d) E. Mescon.

5. Such a principle does not conform to the modern concept of logistics:

a) construction of a logistics system based on a systematic approach;

b) the priority of goods distribution over their production;

c) establishment of the maximum level of customer's service;

d) keeping records of logistics costs along the entire logistical chain.

6. Logistics functions do not apply:

a) integrating;

b) stimulating;

c) regulated;

d) control.

7. The subject of logistics as a science is:

a) production relations;

b) material and information flows at the stages of supply, production and sales;

c) organizational and economic relations in the process of goods movement;

d) processes related to the operation of the products market.

8. The main types of logistics don't include:

a) procurement;

b) transport;

c) marketing;

d) informational.

9. "Logistics" in the Greek translation means:

a) logics;

b) the equilibrium of systems;

c) art to calculate and think;

d) to establish an identity.

10. By the nature of management areas, logistics is divided into:

a) macro- and micrologistics;

b) external and internal;

c) procurement, production and distribution;

d) commercial and non-commercial.

11. The global logistics task is:

a) the maximum reduction of the time of storage for products and the time of goods transportation;

b) creation of integrated systems of material, information and, if possible, other related flows;

c) rational distribution of vehicles;

d) operative information processing.

12. The direct logistics manager's function is:

a) choice of transport;

b) market research;

c)development of recommendations for the decommissioning of production;

d) advertising.

13. Example of a typical logistics task:

a) increase in labor productivity;

b) optimization of stock levels;

c) reduction of production costs;

d) improvement of management quality.

14. The "logistics" terminology includes:

a) power;

b) material flow;

c) profitability;

d) liquidity.

15. The main objective of international logistics is:

a) optimization of stock levels;

b) optimization of raw materials and resources supply;

c) minimizing logistics costs;

d) optimization of the production process.

16. A separate set of actions aimed at the transformation of material and related flows - is:

a) logistics function;

b) logistics operation;

c) logistics chain;

d) logistics system.

17. Targeted integration of logistics elements within a certain economic system in order to optimize the processes of transformation of the material flow is:

a) logistics chain;

b) logistics system;

c) logistics operations;

d) logistics function.

18. The properties of the logistics system include:

a) evolutionary development;

b) adaptability;

c) discreteness;

d) closure.

19. The functional components of the international logistics system include:

a) production reserves;

b) warehouses;

c) transport logistics;

d) marketing.

20. Which of the characteristics corresponds to the international logistics system:

a) the structural component of macrologistics systems;

b) logistics cooperation of meta-logistics systems, concerning the creation of a complete logistical chain;

c) the system of managing logistics flows on the scale of the whole economy of the country;

d) covers the sphere of inter-organizational cooperation?

21. Macrologistics system:

a) is a large logistics system for managing flow processes with the participation of several or more independent economic entities, not limited to the territorial location;

b) is created to ensure the interaction of diversified structures at the global level;

c) is a highly integrated infrastructure of the economy of a region, country or group of countries;

d) all of the above is true.

22. Significance of synergistic effect in logistics can be:

a) only positive;

b) only negative;

c) both options.

23. The most common criterion for optimization in logistics is:

a) minimum cost;

b) flow rate;

c) the maximum profit.

24. Logistics operations are:

a) a set of actions aimed at transforming only the material flow;

b) a set of actions aimed at transforming only the information flow;

c) a set of actions aimed at transforming the material and (or) information flows;

d) an enlarged group of logistics functions.

25. Bilateral logistics operations:

a) are performed within the logistics system;

b) change of the consumer properties of goods;

c) not related to the transfer of ownership of products and insurance risks;

d) associated with the transfer of ownership of products and insurance risks.

26. Logistics operations include:

a) forecasting of material flows;

b) control of material flows;

c) operational management of material flows;

d) all answers are correct.

27. Material flows can occur both between individual enterprises and within the same enterprise. This statement is:

a) correct;

b) wrong.

28. Material flow arises as a result of operations with:

a) raw materials;

b) cash;

c) securities;

d) semi-finished products;

e) finished products.

29. This type of logistics investigates the processes taking place at the regional, interregional, national and interstate levels:

a) macrologistics;

b) micrologistics;

c) external logistics;

d) internal logistics

30. The fundamental difference between the logistical approach and previous models of material resources management is:

a) management training system;

b) complete refusal to create and store the stocks;

c) the perception of material objects as a single flow;

d) full automation of management processes.

31. What doesn't meet the concept of "material flow":

a) loading of finished products into the vehicle;

b) warehousing of semi-finished products;

c) transportation of raw materials to the warehouse of the enterprise;

d) transfer of funds from the current account of the buyer to the current account of the seller.

32. Material flow:

a) is in constant motion;

b) can take a static form;

c) can take a dynamic and static form;

d) has no form at all.

33. Information flow, which corresponds to the material:

a) coincides with it in temporal and spatial aspects;

b) coincides with it in a temporary aspect;

c) coincides with it in the spatial aspect;

d) may not coincide with it in temporal and spatial aspects.

34. At the stage of logistics, the material flow has the form of:

a) raw materials, components, auxiliary materials;

b) semi-finished products;

c) finished products;

d) spare parts for products used by the consumer.

35. Material flow can be measured in the following units:

a) UAH;

b) t / m^2;

c) t / year;

d) UAH / t.

36. Low-turnover material flows include:

a) supply of raw materials;

b) long-term financial investments;

c) the movement of fixed assets.

37. Up to high-turnover material flows include:

a) supply of raw materials;

b) long-term financial investments;

c) the movement of fixed assets.

38. From the following definitions the term "logistics function" corresponds to:

a) the direction of economic activity, which consists of managing material flows in the spheres of production and circulation;

b) the set of elements that are in relations and connections with each other form a certain integrity and unity;

c) a set of different activities to obtain the required amount of cargo in the right place, at the right time, with minimal costs;

d) an integrated group of logistics operations aimed at the realization of the objectives of logistics systems.

39. Choose the definition that most fully describes the purpose of the logistics system:

a) ensuring the availability of the necessary goods in the required quantity and the given quality for the necessary consumer with the given expenses;

b) ensuring the availability of the necessary goods in the required quantity and the given quality in the right place and at the right time with the expense;

c) to ensure availability of necessary goods in the required quantity and the given quality in the right place and at the right time for the right consumer;

d) ensuring the availability of the necessary product in the required quantity and the given quality in the right place and at the right time for the right customer with specified expenses.

40. According to the principles of the system approach, the variability of the parameters of logistics systems under the influence of the external environment, as well as the decisions taken by the participants in the logistics chain, is the property of the systems:

a) complexity;

b) hierarchy;

c) mobility;

d) structuring.

41. Adaptability of the logistics system is:

a) a subordination of elements of the lower level to elements of a higher level in the context of linear or functional logistic control;

b) the presence of a certain organizational structure consisting of interconnected objects and management entities implementing a given objective;

c) the ability to change its structure and choose behavior patterns in accordance with new goals and under the influence of external environment;

d) the ability to perform a given target function, implemented only by the logistics system as a whole, rather than its separate links or subsystems.

42. The boundaries of the logistics system are determined by:

a) arbitrarily;

b) the basis of existing normative documents regulating the enterprises activity;

c) the cycle of means of production;

d) the enterprise's position in the international market.

43. "Outsourcing" means:

a) the process of paying to have part of a company's work done by another company;

b) the assignment of a project to a person or department within a company rather than to a third party.

44. "Insourcing" means:

a) the obtaining of goods or services using existing in-house resources or employees;

b) the process of paying to have part of a company's work done by another company.

45. Information flow is measured by:

a) the amount of processed information;

b) the amount of transmitted information;

c) the amount of processed and transmitted information;

d) the amount of processed and transmitted information per time unit.

46. The principles of organization of logistics information do not include:

a) completeness and suitability of information for the user;

b) accuracy;

c) timeliness;

d) free data format.

47. System in which the material flow reaches the consumer without participation intermediaries on the basis of direct economic relations, is called:

a) a system with direct connections;

b) flexible;

c) pulling;

d) pushing.

48. The system of organization of production, in which the central management body sets the task for the final production line, and the objects of labor are transferred from one division to another only after the corresponding request, is:

a) pushing logistics system;

b) pulling logistics system;

c) the exhausted logistics system;

d) integrated logistics system.

49. The main disadvantages of the operational system of supply are:

a) the criticality of any failures in the logistics system;

b) low quality of service;

c) the introduction of the system may require major changes that are difficult to implement in practice;

d) reduction of personal participation and decrease of motivation of employees.

50. When solving the problem of "make or buy" a decision in favor of own production it is expedient to accept in the following cases:

a) the need for a component product is small;

b) existing the suppliers guarantee compliance with the required quality standards of products;

c) it is necessary to keep a commercial secret in the field of production technology;

d) there are no necessary components for the production of power supplies.

51. The main purpose of procurement logistics is:

a) provision of necessary volume and assortment of material resources supply;

b) ensuring the exact relationship between the number of supplies and the need for them;

c) organization of efficient supply of job resources;

d) meeting the needs of production in material resources with the maximum possible efficiency.

52. The main criteria for choosing a supplier are:

a) proximity of location;

b) high quality;

c) creditworthiness;

d) the minimum price.

53. In relation to the functional basic areas of logistics distinguish the following:

a) supply, production, distribution;

b) raw materials, components, work in progress, finished products, containers, returnable waste;

c) market and logistics intermediaries;

d) narrowly specialized, limited range, wide range.

54. The functions of warehouses do not include:

a) consolidation of goods;

b) unbundling of goods;

c) transformation of the product range into consumer;

d) there is no correct answer.

55. **Does not apply to the benefits of using public warehouses:**

a) flexibility (to take into account changing demand);

b) no need for large investments in warehousing development;

c) a high degree of control over warehousing operations;

d) facilitating access to a wider geographical region.

56. The initial stage of the process of choosing a rational warehousing system is:

a) the choice of the general direction of the technical equipment of the warehouse system;

b) technical and economic assessment of each competitive option;

c) determining the place of the warehouse in the logistics chain and its functions;

d) the choice of elements of each warehouse subsystem.

57. Logistics process in the warehouse:

a) narrower than technological;

b) coincides with the technological;

c) wider than technological;

d) usually narrower than technological, but may coincide with it.

58. The logistics process in the warehouse does not include:

a) unloading and acceptance of goods;

b) warehousing and storage of goods;

c) providing services to customers;

d) there is no correct answer.

59. What does provide efficient intra-warehouse transportation?

a) minimum transportation time;

b) the use of end-to-end "direct-flow" routes;

c) the minimum number of transshipments from one equipment to another;

d) all of the abovementioned.

60. The factors that ensure a rational warehousing and storage organization do not include:

a) compliance of storage equipment with specific features of the cargo;

b) provision of equipment for storage of the maximum used height and area of the warehouse;

c) allocation of space for working passages in the minimum volume;

d) use of address storage system.

61. To streamline the execution of warehousing operations over a period of time develop:

a) technological maps;

b) technological schedules;

c) technological tasks;

d) technological passports.

62. Which of the following packaging decisions is made with the participation of the logistics service?

a) the package size;

b) advertising text on the package;

c) drawing on the package;

d) all answers are correct.

63. Marketing functions of packaging can be:

a) external;

b) internal;

c) industrial.

64. Sales stocks are managed:

a) to satisfy consumer demand;

b) to smooth fluctuations in the production process.

65. Material stocks are managed:

a) to satisfy consumer demand;

b) to smooth fluctuations in the production process.

66. For functional purposes, stocks are classified into:

a) aggregate;

b) insurance;

c) warehouse;

d) seasonal.

67. Which option contains the correct definition of the system with a fixed frequency of order?

a) orders in this system are repeated on the regular supply of products at identical intervals;

b) orders in this system are received with decreasing stocks;

c) the two answers are correct.

68. What are the regulatory parameters of a system with a fixed order size?

a) the order point (fixed level of stocks);

b) the size of the order (the value of the batch's delivery);

c) the maximum volume of delivery;

d) answers a) and b)?

69. What are the regulatory parameters of a system with a fixed frequency of order?

a) the maximum level of replenishment of stocks and the duration of the period from repetition;

b) order point and order size;

c) both answers are correct.

70. Warehouse slows movement of material flows:

a) yes;

b) no

71. The warehouse is created only for one functional type of logistics (procurement, sales):

a) yes;

b) no.

72. The warehousing strategy of operating synergy approaches towards which type of warehouse

a) private;

b) contract;

c) none of these;

d) public.

73. The summary of the staff's work is:

a) cargo turnover;

b) area;

c) the volume;

d) minimum storage costs.

74. The criterion for making a "make or buy" decision is:

a) costs;

b) revenue;

c) the volume of production.

75. The warehouses of firms are classified according to the following features:

a) by purpose, type and nature of stored materials;

b) by type of building, location and scale of action;
c) the degree of fire resistance;
d) all answers are correct.

76. What is the total warehouse area?

a) useful;
b) reception and vacation;
c) service and auxiliary;
d) all answers are correct?

77. Use of the "Just in Time" system allows to:

a) maximize costs;
b) regulate the duration of the operating cycle;
c) deliver material resources or finished products to a defined point of the logistics chain at the very moment when they have a need;
d) increase market share.

78. The Kanban system relates to the type of ... logistics systems:

a) pushing;
b) pulling.

79. The system MRP-1 refers to the type of... logistics systems:

a) pushing;
b) pulling.

80. The Kanban system is based on the following principles:

a) JIT;
b) MRP;
c) DRP;
g) Lean.

81. If the delivery rate is higher then, as a rule, the price:

a) is higher;
b) is lower;
c) does not affect.

82. A factor that can not serve as a reserve for cost reduction is:

a) material expenses;
b) labor costs;
c) other expenses;
d) deductions for social needs.

83. Waiting time is:

a) time spent on adjusting and specifying the standard order;
b) time of execution of the order;
c) time from the moment the order originates in the system until the beginning of service of this order;
d) duration of the operating cycle.

84. Distribution logistics is the management of material flows:

a) in the process of creating material goods or providing material services;

b) in the process of providing the company with material resources;

c) in the process of bringing the finished product to the consumer;

d) in the transport areas.

85. The principle difference of distribution logistics from the traditional understanding of sales implies:

a) methods of segmentation of the consumer market;

b) …because distributive logistics can not be applicable to certain groups of goods;

c) systems of the distribution, production and procurement processes in the management of material flows;

d) refusal to use the concept of marketing during the distribution.

86. Distribution channel, consisting of producer and consumer, is a … channel:

a) zero -level;

b) one-level;

c) two-level;

d) three-level.

87. The distribution channels, which consist of a manufacturer and one or more intermediaries acting as a single system, are:

a) horizontal;

b) vertical;

c) exclusive;

d) selective.

88. Logistics intermediaries in distribution channels that perform supporting functions include:

a) forwarding firms;

b) transport organizations;

c) cargo terminals;

d) insurance companies.

89. A mediator of type "on his own behalf and at his own expense" is:

a) the dealer;

b) the distributor;

c) the commissioner;

d) agent.

90. A mediator of type "from someone else's name and for someone else's account" is:

a) the dealer;

b) the distributor;

c) the commissioner;

d) a broker.

91. The commissioner belongs to intermediaries such as:

a) on its own behalf and at its own expense;

b) from another's name and at his own expense;

c) on its own behalf and at someone else's expense;

g) from someone else's name and for someone else's account.

92. The initial stage of the algorithm for selecting the optimal material distribution variance is:

a) calculation of the predicted value of the material flow passing through the distribution system;

b) comparison of the forecast of the required size of stocks in the system as a whole and on separate sections of the material-flow chain;

c) studying market conditions and defining strategic ones objectives of the distribution system;

d) studying the transport network of the region, drawing up a scheme of material flows within the distribution system.

93. The category "sales" in relation to the "product distribution" category is:

a) narrower;

b) wider.

94. It is necessary to strive for ... the level of satisfaction of consumer demand:

a) the most complete;

b) optimal;

c) as much as possible.

95. Logistics service exists:

a) at all stages of the chain;

b) only in sales.

96. Merchandiser at the enterprise:

a) manages the stocks of the entire enterprise;

b) manages stocks at specific workplaces;

c) studies demand.

97. Sales are subject to:

a) financial logistics;

b) procurement logistics;

c) marketing logistics.

98. The product distribution channel is:

a) the aggregate of intermediaries in the sales network;

b) the physical distribution;

c) a distributor.

99. An indicator characterizing the sale of products is:

a) output;

b) production capacity;

c) proceeds from sales of products;

d) commodity products.

100. Customer service cycle is:

a) the repetition of a closed process, which transforms the purpose (satisfaction of the consumer's needs) into a certain result (product, object);

b) the execution of the consumer's order;

c) the production process;

d) the process of warehousing of finished products.

101. The task of selling finished products solves:

a) distribution logistics;

b) production logistics;

c) transport logistics;

d) procurement logistics.

102. The total amount of concluded contracts for the supply of material resources with suppliers amounted to 4000 thousand UAH, of which directly with the supplier "Tourist" - by 2500 thousand UAH. This provider must be included in the …. group:

a) A-suppliers;

b) B-suppliers;

c) C-suppliers.

103. The response time of the supply chain is the theoretical time needed to detect and fix important changes in market demand, to make appropriate adjustments to operational plans and to increase the production of products to:

a) 5%;

b) 10%;

c) 15%;

d) 20%.

104. If the enterprise purchases the goods which deficit is inadmissible, among criteria of a choice of the supplier on the first place the criterion will be put:

a) price;

b) quality;

c) reliability;

d) payment terms.

105. Transport logistics solves a set of problems related to the organization of movement of goods by transport:

a) public use;

b) non-public use;
c) domestic;
d) all answers are correct**.**

106. Products on transport are:

a) movement of goods;
b) weight of cargo;
c) the volume of cargo;
d) cargo composition.

107. The peculiarities of transport products do not include:

a) a clear material form;
b) the impossibility of storage and accumulation;
c) attachment to a certain place;
d) embodiment in the additional costs associated with the relocation process.

108. The highest ability to deliver cargo: to a given point of the territory "from door to door" is owned by … transport:

a) automobile;
b) railway;
c) air;
d) pipeline;
e) water.

109. This type of transport provides the lowest cost of transportation:

a) automobile;
b) railway;
c) air;
d) pipeline;
e) water**.**

110. Provides the highest speed of delivery:

a) automobile;
b) railway:
c) air;
d) pipeline;
e) water.

111. The advantages of railway transport do not include:

a) high throughput and capacity;
b) high regularity of transportation;
c) high speed of delivery over long distances;
d) high availability to end users.

112. The disadvantages of maritime transport do not include:

a) low speed of delivery;

b) strict packaging requirements;

c) high cost of long-distance transportation;

d) low frequency of shipments.

113. Delivery by one mode of transport is typical for … transportation:

a) unimodal;

b) multimodal;

c) combined;

d) terminal.

114. Freight as a type of transport tariff is a characteristic of … transport:

a) automobile;

b) railway;

c) marine;

d) air.

115. Schematic tariffs for the railway transport:

a) record of the specific cost of cargo transportation;

b) are differentiated depending on the distance of transportation and the nature of the transported goods;

c) have a contractual basis;

d) are hourly payments for the operations of railway vehicles.

GLOSSARY

ABC analysis is a method by which the degree of distribution of a specific characteristic between the individual elements of a plurality is determined; based on the assumption that a relatively small number of types of goods, which must be repeatedly procured, accounts for a large part of the total cost of goods procured.

Agents are intermediaries who act as representatives or assistants of another person (principal) who is the principal of him. Typically, agents are legal entities. The agent concludes transactions on behalf and at the expense of the principal.

Barcode is a series of lines printed on products sold in shops that can be read by a machine connected to a computer to give the price, keep a record of sale, etc. Barcode is a graphical representation of a digital product number in a form suitable for automatic reading with a scanner.

Broker is an independent party, whose services are used extensively in some industries. A broker's prime responsibility is to bring sellers and buyers together and thus a broker is the third-person facilitator between a buyer and a seller.

Carriage Conditions are set up on a certain route and depend on goods and materials, on the pack type.

Carrier is a legal entity or an individual entrepreneur, having the right and having assumed the obligation to carry out transportation on the basis of the relevant contract.

Commission agents are wholesale and retail intermediaries who carry out transactions on their behalf and at the expense of the manufacturer. The commissioner is not the owner of the product and works on its behalf and at the expense of others.

Cross Docking is a distribution system, which does not store but prepare the received goods in a distribution center or in a hub for the immediate reshipment to shops. The preparations per store are made by suppliers or retailers.

Dealers are the individuals or firms which buy goods from a producer or distributor for wholesale and/or retail reselling.

Distribution Center is a warehouse complex, which receives goods from manufacturing companies or from wholesale companies (for example, located in other regions of the country or abroad) and distributes them to smaller parties to customers (small and medium-sized enterprises and retailers) through their own or their commodity network.

Distribution Channels accommodate bidirectional flows such that they allow the flow of goods and services from the vendors to the consumers and

at the same time facilitates the flow of payment for the goods/services in the opposite direction from the consumers to the producers.

Distribution Logistics is the management of transportation, warehousing and other tangible and intangible operations that are carried out in the process of finished products' delivery the to the consumer in accordance with the interests and requirements of the latter, as well as the transfer, storage and processing of relevant information.

Distribution Requirements Planning (DRP) is a system of management and planning is used, which allows not only to take into account market conditions, but also to actively influence it. This system ensures a stable relationship between supply, production and marketing of products using MRP elements.

Distributors are wholesale and retail intermediaries who carry out operations on behalf of the manufacturer and at their own expense.

Economic Order Quantity (EOQ) is the quantity of a product that should be ordered so as to minimize the total cost that includes ordering costs and inventory holding costs.

Financial Flows are the directed flows of financial resources associated with material, informational and other flows both within and outside the logistics chain.

Forwarder is a legal entity or an individual, having the right and undertaking obligations to perform or organize the provision of services related to the carriage of goods on the basis of a contract of transport expedition.

Forwarding Services is a kind of activity of specialized intermediaries (freight forwarder or forwarding agent**)** to provide the sender of cargo with additional services related to the preparation of products for movement.

Freight Forwarder or **forwarding agent** is an individual or a company which organizes shipments for organizations to source goods from the manufacturer to the final point of distribution or consumer.

Horizontal Distribution channels are traditional channels and consist of an independent manufacturer and one or more independent intermediaries. Each member of the channel is an individual company that seeks the ways to maximize its profit.

Information Flows are messages in oral, document (paper and electronic) and other forms, the accompanying material or service flows.

Insourcing is the practice of using an organization's own personnel or other resources to accomplish a task that was previously outsourced; is a business decision that is often made to maintain control of critical production or competencies. Insourcing is widely used in production to reduce costs of taxes, labor and transportation. Insourcing is also defined as bringing a third

party outsourcer to work inside a company's facility.

International Freight Forwarders are international freights handled by, who have expertise in preparing and processing of documentation, customs and shipment.

International Logistics involves the management of object-logistic flows in a company's supply chain across at least the one international border.

International Logistics System is a network of organizations, people, activities, information, and resources involved in the physical flow of products from supplier to customer.

International Procurement Logistics is the management of material flows in the process of providing the company with the material resources and is associated with the processes of purchasing raw materials, components and semi-finished products outside the country.

International Transport Corridors (ITC) are a part of a national or international transport system that provides significant international freight and passenger traffic between separate geographical areas, includes rolling stock and stationary devices of all types of transport operating in this direction, as well as a combination of technological, organizational and legal conditions for the implementation of these shipments.

Kanban System is a mechanism to organise a continuous flow of production capable of flexible restructuring, which operates almost in the absence of reserves' insurance.The Kanban system implies the fact that all production units of the plant, including the final assembly lines, are provided with material resources only in the amount and in such terms, which are necessary for the fulfillment of the given subsection-consumer order.

Lead Time is a cycle time between order placement and delivery of goods (time expressed in days or hours).

Logistical coordination is a close relationship between the actions of all participants or elements of the logistics system. In modern conditions, logistical coordination takes the form of an integrated logistics flow.

Logistics Channel refers to a network that involves the participants of supply chain engaged in functions like transportation, receiving, handling, warehousing, information sharing, etc.

Logistics costs: consist of transport, warehousing andadministrative costs (sometimes additional costs are added to the order). The possibility of significantly reducing the logistics costs of the enterprise is one of main advantages and advantages of logistics.

Logistics cycle is the time to perform logistics operations; the maximum reduction of this cycle is the main goal of logistics.

Logistics flow is an integrated product and information financial flow that

connects the participants of the logistics system. It is based on material flow, including flows of goods, raw materials, semi-finished products etc.

Logistics function is a set of logistics operations that performs a specific logistical task. There are three main logistics functions: supply; production; marketing.

Logistics interface is software that allows joint work of participants of the logistics system. Such interaction is affected reduction of EDI (Electronic Data Interchange - English, - electronic exchange data).

Logistics Intermediaries are a party who arranges shipping, warehousing, distribution and other goods movement on behalf of goods providers and shipping companies.

Logistics is the planning, executing and controlling process in terms of reducing the cost of raw materials stocks flow, unfinished production, finished products, service and related information from the point of its origin to the point of consumption (including import, export, internal and external movements) to fully meet customers' requirements.

Logistics Management consists of the process of planning, implementing and controlling the efficient flow of raw-materials, work-in-progress and finished goods and related information-from point of origin to point of consumption; with a view to provide satisfaction to the customer

Logistics network is a layout of logistics participants operations, which shows the relationship between them.

Logistics operation is a set of actions to transform the logistics flow; for example, transportation, storage and warehousing, loading and unloading.

Logistics system is an adaptive feedback system that performs logistics functions, consists of subsystems and has connections with business environment. Logistics systems are divided into: industry; regional; functional.

Macrologistics System is a large economic system of flow management, which includes enterprises and organizations of industry, supply and marketing, transport and other intermediary structures of different departments and forms of ownership, not limited to the territorial location.

Market Intermediaries are the bodies involved in transacting the product from the producer till the time it gets purchased by the ultimate consumer.

Material Flows are material resources (MR), incomplete production (IP) and finished products (FP), to which the logistic activities related to their physical movement in space are applied: loading, unloading, docking, cross docking, transportation, sorting, consolidation, divestment, etc.

Material Stocks are products of industrial and technical purpose, which are at different stages of production and circulation, consumer goods and other products that are expected to enter the process of production or personal

consumption.

Micrologistics System is an economic system that covers the internal logistics area of one enterprise or a group of enterprises united on corporate foundations.

Multifunctional Terminal Complex is a freight forwarding enterprise that acts as a transport and distribution logistics center with a wide range of services provided for transportation, cargo processing, storage, service and commercial, business services for the customers and representing a complex of engineering devices and structures with modern technological equipment.

Multimodal Terminal is a cargo storage, cargo handling, transshipment and storage complex, built at the nodes of the transport network and served by several types of trunk transport while combining cargo handling technologies.

Multistage Distribution Channel is a wholesaler buys and stores goods in large quantities and supplies the same to retailers in smaller quantities (for example: apparel is first goes from producer to the wholesaler and retailer and then finally to the consumer).

Optimized Production Technology (OPT) is a production system that takes into account capacity constraints in the production process and does not attempt to continuously operate at full capacity. The aim is not to produce as many units as possible, but to raise throughput while keeping inventory and production costs low, thereby achieving an efficient, continuous workflow.

Outsourcing is the process of hiring an outside organization that is not affiliated with the company to complete specific tasks. It is a business practice in which a company hires another company or an individual to perform tasks, handle operations or provide services that are either usually executed or had previously been done by the company's own employees.

Production Logistics is one of the functional areas of logistics that explores the processes that take place in the field of material production; aims to ensure that each machine and workstation receives the right product in the right quantity and quality at the right time.

Service Flows are the service flows (intangible, special type of product or activity) generated by the logistics system as a whole or its subsystem (link, element) in order to meet external or internal consumers of business organization.

Singlestage Channel - channel contains only one intermediary, which is typically the retailer in consumer markets (for example: perishable goods such as foods, etc).

Stock-Keeping Unit (SKU) is a category of unit with unique combination of form, fit and function (i.e., unique components held in stock).

Stocks in one form or another are present throughout the length of the logistics chain, both in the sphere of production and in the sphere of product turnover.

Supply Chain Management (SCM) is the integration of key business processes that begin with the final end user and cover all suppliers of goods, services and information that add value to consumers and other stakeholders

Terminal is a complex of engineering and technical devices and structures intended for the reception, accumulation, processing, dispatch and delivery of goods.

Terminal Technologies - complex forwarding services for consignors and consignees, carried out through a network of terminal complexes and distribution centers.

The Just-in-Time Delivery System is a delivery system that is based on synchronizing the delivery of material resources in the required quantity and at a time when the logistics system needs them, in order to minimize the costs associated with inventory creation.

Transportation is a key complex activity associated with the movement of material resources, work-in-progress or finished products by a particular vehicle in the logistics chain, which in turn consists of complex and elementary activities, including forwarding, cargo handling, packaging, transmission property rights to cargo, insurance, etc.

Vendor Managed Inventory (VMI) is a theory based inspired by integration in supply chain management regarding the system dynamics; the vendor (supplier) (someone who is selling something to retailer network, especially one kind of goods, materials, etc.) manages the stock levels and availability in his customer's warehouse, based on forecast demand.

Vertical Distribution channels are channels that consist of a manufacturer and one or more intermediaries that act as one single system. One channel is a member, as a rule, either owns the other, or gives them certain privileges. Such a member may be a manufacturer, wholesale or retail intermediary.

Warehouse Logistics is the management, planning, and organization of operations within a warehouse; includes managing space, planning shipments, and organizing information so that the warehouse operates to the best of its abilities.

Warehouse Management Systems (WMS) are the systems used in effectively managing business processes and direct warehouse activities, including receiving, put away, and picking, shipping and inventory cycle counts.

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