

# Logistics Distribution Centers in Multimodal Transport Operations

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## Abstract

*The last decade of development in distribution processes has proven the need to broaden their understanding as systems with a specific construction of the composition related to the evolution of market conditions and the growing demand of customers for complex logistics services.*

*This imposes the need to create the necessary conditions for producers of distribution services to use modern knowledge, methods and tools of the distribution, marketing and logistics process for the production of high-quality services to meet the specific demand of the logistics distribution market. The specific role in these processes is to create logistics distribution centers, which by size, characteristics, functions, structures and organization will play a crucial role in the development of complex logistics services. This requires examining the market conditions of these developments, changes in distribution processes and logistics processes, and formulating the specific operational position of logistics distribution processes.*

*Within the work, specific references will be presented for the location of logistics distribution centers in seaports.*

**Key words:** logistic system, logistic distribution center, sustainable transport, multimodal transport, intermodal freight

**J.E.L. classification:** A11

## 1. Introduction

According to a definition commonly agreed by the main regional and international cooperation organizations and structures, intermodal transport is that transport system which in turn requires the use of at least two transport modes and in which the intermodal transport unit is not divided when changing transport modes.

In accordance with the definitions approved and adopted in Geneva, June 2010, by the Working Group on Transport Statistics of the Economic Commission for Europe of the UN (WG 6 UN - ECE), has been agreed the definition according with intermodal transportation is a particular case of multimodal transport, performed in one and the same Intermodal Transport Unit (ICU) by successive modes of transport and without cargo division when switching transport modes. Efficient use of intermodal transport will lead to efficient use of existing infrastructure for freight transport by attracting the flows of goods from road to rail and maritime (river) sectors. Intermodal transport will also lead to the development of integrated activities and adaptation to the specific requirements of Romanian market, or of the Central and Eastern Europe countries markets, of imports from outside Europe, including associated activities such as transport and logistics.

## 2. Theoretical background

### 2.1. Market conditions of developments in the distribution and logistics process

In contemporary conditions, when international commodity and service markets entered into the marketing era and the basic problem for production firms is sale products and services, facing with growing competition the main objective becomes integration and coordination of activities. In the activities of firms, it becomes visible the necessity to surrender to the dictate of principles elaborated

by marketing and logistics, which have marked the objectives of future necessity to conform the satisfaction of the customer with assurance of firm profits and its development. These objectives forces to conjunction of distribution processes with functions and objectives of marketing and logistics.

The function of distribution logistics is transportation of materials and products from the places of their production to the market or to direct user or consumer. The scope of logistic distribution process is very wide, covering production, packing, storage, and transportation of commodities, with full integration of functions and processes.

The logistic system of goods distribution is characterized by:

- understanding of material and information flows as system comprising of changing numbers of rings in the chain,
- integration in the one system of management of various functions (storage, provision policy, buying policy, transportation, receiver's services, etc.),
- considering the modern market processes and their changes,
- systematic growth in distribution costs,
- fast development of the markets and progress in differentiation of the needs, products and services,
- introduction of new technologies in distribution process (storage, transportation),
- development of systems and means of transportation and transmission of information.

In distribution process products win the quality, assortment, time, property, and spatial barriers dividing the producers from final buyers of their products. The decision and functions undertaken in this process form co-ordinational and organizational functions of distribution.

- co-ordinational functions: compilation and transmission of market information, promotion of products and firms, compilation and transmission of sale-purchase offers, initiation of commercial contacts, negotiation of contract conditions which create legal background for distribution processes. The basic objective for co-ordinational functions is coordination of supply and demand by assurance of adequate effectivity of distribution channels. Evidence of these functions are decisions regarding the length, structures of the channels and the relationships between their participants.
- organizational functions: realization of the sale-purchase contracts. covering the services of various structure in the package (ordering, storage, transportation, commercial services. These functions create the physical flow of products from the producer to the purchaser, which is understood as physical distribution or distribution logistics. The general objective of organizational functions is to reach of the demanded by the purchasers level of services quality with minimalization of tot distribution costs.

Distribution processes may be conducted by the producers or consumers of goods (direct distribution) or ordered to the professional intermediaries (indirect distribution), accordance to the principle "make or buy" Nevertheless, the quality level of distribution process ought to assure the acces with the product to the greatest number of potential buyers, allow to transform them into real and loyal buyers, allow to acquire the buyers purchasing the product of the competitors, and in consequence - allow to enlarge the sales and profits of the firm and their participation in the market.

In distribution logistics there is important of application of marketing tools of market analyse and demand evaluation, which allow to define the quantity and structure of demand for services and creation of production program

Logistics as management system is aimed to create balance of logistic services or logistic product on the market on structure, quantities, qualities, and prices related to the expectations of the customers. Logistic services allow to create logistic chain of supply which essence is the chain of ordering, storage, and transportation. The chain creates technological ties of points (ordering, storage, transport) with ways of transport of cargoes and organizational co-ordination of all rings of the logistic chain

With logistic services are connected the necessity of quantification of needs, quality level, time regimes, diversification of offers (service packages), and creation of effective information system to supply the logistic decisions and information management.

## 2.2. Organizational forms in logistic. Distribution processes

To improve the co-ordination of logistic processes there are created "logistic service centres", which general objectives are: optimization of logistic process on time and cost of realization and to produce "total a complex logistic service". Optimal location or logistic service centres are multipurpose transport terminals; specific role is for seaports (and inland ports, too), which - beside their traditional functions - create the points of concentration of various activities (carriers of all branches of transport, cargo transport centres, commercial and industrial centres).

These changes are decisive for actual and future roles of logistic service centres located in sea ports, to which sea ports have to comply to maintain competitiveness on the port service markets. These changes comprise of: (Niculescu, 2016)

- planning and effective realization of transport with minimalization of time and cost.
- application of specific and modern solutions offered by various carriers,
- assurance of adequate technology of loading/discharge and carriage of all kinds of goods,
- guaranty of adequate storage of cargoes,
- forming of cargo units,
- production of un-productive logistic services,
- offer of consulting services on transport logistics,
- offer of complex transport services on various regions and distances,
- assurance of infrastructure adequate to requirements of complex container services,
- planning and programming of commercial services and location of industry,
- assurance of adequate information system and communication.

To prove the co-ordination of distribution process there are created "distribution centres", which are oriented on specialized storage Services, consolidation and deconsolidation of Cargoes, confection services, commercial and handling services and effective flow of goods and information

General objective of distribution centres is creation of such kind of physical flow of goods which assure right delivery to the receivers and eliminate high costs of transport, storage and keeping adequate level of stores. This effect is evident in organization and equipment of distribution centres in the most modern technique, technology and adequate project. The crucial role in the center activity is for information system created on EDI and covering all participants (suppliers, receivers, service producers). Owing to this distribution centres become important information centres.

Optimal location of this centres are multipurpose transport terminals, with special preferences to seaports.

Necessity of co-ordination of distribution and logistics processes was the background of creation of logistic distribution centres, which serve various regions and markets. Logistic distribution centres were justified in restructuring of distribution and logistics channels, concentration of goods in strategic centres which allow their physical distribution and logistics services, necessity of minimalizations of ordering costs, maintaining stores, costs of storage and transportation, development of necessary information system, improvements in documentation stem and reduction of risk and error. On the other hand, there are noticeable preferences from the cargo holders in complex services, with their structure far from traditional meaning of physical distribution. The main idea of this processes is: "give us the goods, and we know how to deliver the right cargo in right quantity and quality, in the right manner to the right time and place, on the right price". This principle is the developed form of logistic principle "just in time" by the introduction of elements of physical distribution characteristics.

This means. that logistic distribution center in its objectives is market oriented with general intent of dynamic activity on the market, acquisition of new potential and real customers and of creation of new and effective distribution channels.

Simultaneously, the center offers have to present service packages of different quality and structure to comply to the demand of different customers.

## 2.3. Operator of logistic distribution. Processes as element of the center

In logistic distribution systems the basic role is for operator of logistic distribution processes, which cover firms serving commercial activities or complex logistic services. Operators have to conform to specific criteria on capital assets, technical equipment, personnel, organization

capabilities and information systems, which allow them to produce complex logistic distribution services

In logistic distribution systems there are two groups of operators: (Cambra, 2009)

- operators of "hardware sphere", who dispose technical potentials creating "point and network" infrastructure and mobile production potentials (personnel, organization, information),
- operators of "software sphere", who dispose personnel, organization, information and "know how" potentials and necessary technical potentials to produce services

This classification is related to the mode of financing of creation and activities of logistic distribution centres, in which it is possible to define two groups of investors and firms. commercial investors whose activities are profit-oriented, and public investors who - apart from profit orientation - are oriented to reach some public objectives.

The first group of operators, "hardware" ones, create mainly multimodal transport operators (MTO), carriers who may be maritime inland carrier or international forwarder, whose capital, technical equipment, personnel, organization and information system allow to enter into production of complex logistic services.

The first group of operators, the "hardware", mainly creates multimodal transport operators (MTO), carriers which may be inland sea carriers or international carriers, whose capital, technical equipment, personnel, organization, and IT system allow entry into the production of services complex logistics.

The base of complex logistic service offer is integration of technical equipment, methods, procedures, information, and organizational systems. Operator MTO have to dispose logistic network with center of management, logistic regional centres and local points, local branches home and abroad, necessary technical infrastructure (stores and store areas, loading/discharge, transport, technical workshops, etc.), information system, control systems of logistic distribution processes, good market position and relations with customers, and professional personnel. Offering broad and high quality complex logistic services, the operator has to persuade to the customers to professional service. Important factor to this is accessibility of MTO services, which prove to locate his activities within logistic distribution center

The second group of operators, "software sphere", create operators of intermodal transport, international forwarders, inland and home forwarders and other service producers participating in complex logistic services.

Considering the character and scope of their activities. it is justified to locate their operation within logistic distribution centres.

#### **2.4. Logistic distribution center - its essence and functions**

Many firms understand and accept that "idea of complex distribution" and "idea of complex logistic services" and the role and the importance of this ideas for rationalization in management in flow of the goods, services and information through their commercial and marketing (distribution) channels. Steady trend to creation of logistic distribution centres results from growing tasks subsequent to the increase of the of the streams of products and cargoes flowing in international trade. The production, trade and transport firms apply more and more modern and sophisticated solutions to assure optimal shapes of logistic and distribution processes. As the product and cargo streams get wider, application of effective logistic and distribution systems led to creation of specific points, called logistic distribution centres, which allow to solve new tasks. (Rodrigue, 2020)

Logistic distribution centres usually have the form of defined areas, equipped with developed elements of necessary infrastructure and superstructure, and reserve areas. Within these areas there exist and act many firms able to serve complex logistic and distribution services and to produce various complementary services to the basic services. With creation of these centres is connected application of logistic management of the center and in the firms - customers of the center, which contain formulating of strategy, planning, steering and control of physical distribution, storage, commercial services and other factors related to few and storage of raw materials, final products and other goods, with necessary information, as activities oriented to cope with particular demands of the customers (packages of services).

The functions of logistic distribution center may be formulated as follows:

- collection of the goods from the places of their production or delivery to the places of final destination (consumption/production),
- storage of goods, confectioning, packing, other commercial services,
- consolidation/deconsolidation of goods into unit loads,
- assurance of adequate technology of loading/discharge and transportation of all kinds of goods with use of containers and specific container equipment,
- production of logistic services,
- assurance of infrastructure necessary for operational purposes of customers,
- assurance of necessary information system and communication,
- consultancy and advisory services in legal, economic and organizational problems,
- legal and financial services for operations,
- management with storehouses and storage area,
- application of modern solutions offered by particular operators.

The logistic distribution center has to be prepared to formulate the scope and structure of complex logistic services in correlation to the conditions and preferences of the disponents of goods. The center has to create conditions to transform the offered packages of complex services, which is possible into two forms:

- flexible broadening of the service offer, by joining further functions and services connected with physical distribution and logistics services,
- rapid enlargement of the offer, which become the new framework of complex offer, with particularities negotiated with specific customer.

Differentiation in objectives and functions of logistic distribution centres lead to formulation of strategy in creation, location and organization.

### **2.5. Strategy in the creation and logistics location of distribution centers**

The scope of objectives and functions of logistic distribution centres are decisive for multisubject structures necessary for compliance with all objectives resulting from logistic and distribution processes, distances of operation and spatial structures of operations.

This assures the use of optimal level of synergic effects resulting from co-operation of particular firms, and to develop branch specialization, specialization in direction of operations and competition between firms within the center.

This has positive impact on creation of qualities, costs and prices of packages of complex logistic distribution services.

The strategy in creation of logistic distribution centres have to be supported by particular market analysis, considering specific conditions and features of hinterland and foreland, needs and possibilities, economic potentials, existing and potential distribution and logistics channels, conditions of distribution and conditions of and logistic processes, physical distribution. In formulation of the strategy important and useful will be marketing analysis based on marketing mix formula (7P).

For strategy formulation the basic importance is for SWOT analysis, which allow precise evidence and analysis of internal and external conditions, strengths and weaknesses, opportunities and threats of the project.

Evaluations resulting from these analyses with allow to formulate the strategy with use of strengths and opportunities, strengthening the weaknesses and neutralization of threats.

The strategy in creation of the center have to consider the scope, area and specification of activities, which make possible formulation of rank (international or regional), of character (general or branch, processes related to unified cargo only, processes related to conventional and unified cargo, decisions with relation to the main ring of the logistic chain). The strategy have to be based on existing terminals (container, general cargo or universal), including terminals to the structure of the center for complexity of operations.

The strategy of creation of the center have to consider already existing elements of its future infrastructure, and existing connections of the center with hinterland and foreland. The preferred solution in creation of the center have to be full integration of the terminal and surrounded areas, on which may be developed all the elements of infrastructure and suprastructure.

In formulation of the strategy of creation of the logistic distribution center it is necessary to consider tire factors of its attractiveness:

- accessibility from the hinterland and foreland,
- quality of services,
- complexity of services,
- efficiency of services,
- flexibility in reaction to the changes of the markets,
- universality of service offers,
- reliability in logistic operations,
- modernity of projects,
- scope and structure of operations on hinterland and foreland,
- structure of packages of complex logistic and distribution services,
- modernity in management of the center,
- effectivity of information system,
- price competitiveness (maximum of services on minimal price)

## **2.6. Organisational structure of the logistic distribution center**

Diversification in character, functions and objectives of the logistic distribution center is decisive for multisubject activities and complexity in organisational structures and managerial systems. The natural tendency of many firms engaged in distribution and logistic processes and operations, and of many firms producing various additional services, is location of their activities within the center.

Additionally, there is tendency to enter into the center from various firms and institutions related to distribution and logistic operations and firms and institutions producing complementary services.

Complexity and differentiation in activities of various firms and institutions may prove, that within the centre will appear the tendency to form main logistic structures related to specific activities:

- center of distribution of goods, which cover operations related to distribution processes, commercial services (production, confectioning, packing), storage services, forming of cargo units warehousing, custom stores, depository houses, and services related to entering into logistic processes,
- center of transport of cargoes, which cover transport firms of various branches, operators of distribution and logistics processes, container and general cargo terminals, other firms cooperating in distribution and logistics processes operating the infrastructure and suprastructure of the center,
- logistic service center, covering firms acting as operators of transport systems (combined, intermodal and multimodal), offering packages of complex services,
- information center, covering complex system of EDI with information channels and communication,
- disposition center, which co-ordinate and control the activity of the logistic distribution centres,
- management center, common for the whole project of the logistic distribution centres,
- institutions and firms producing additional services
- commercial banks servicing operations of the firms within the center,
- insurance companies and agencies,
- custom offices and agencies,
- state administration controlling offices (coast guard, maritime administration, sanitary and epidemiology office, standardization office etc.),
- quality and quantity control institutions,
- post and telecommunication,
- hotels, motels, gastronomy,
- cultural institutions.

Structures of logistic distribution center have to comply to the methods of logistic system of management.

### 3. Research methodology

The study developed the methodology for assessing the efficiency of intermodal transport using multi-criteria analysis with criteria such as transport cost, transport time, reliability and sustainability. The "decision on mode selection, passenger satisfaction estimation, transport project evaluation and alternative fuel selection using PROMETHEE priority ranking" was analyzed (Stoilova, 2018).

The methodology includes four steps using sequential activities (Stoilova, 2018):

1. „Selection of alternatives”.
2. „Definition of quantitative and qualitative criteria, such as environmental criteria (CO2 emissions), economic criteria (transport cost and infrastructure charges), transport surcharge, transport duration, traineeshipment operation needs, safety, reliability, stability”.
3. „Determination of weighting criteria using Shanon Entropy, DEMATEL, AHP and equal weighting”
4. „Establish ranking priority order using Compromis programming”.

### 4. Findings

The solutions to these steps are dependent, and in order to make it easier to achieve them, in practice a sequential treatment is applied, and a number of simplifications are used (Campbell, 1994).

The value of the transport cost has been considered to be independent of the volume of the transport flow (even though the objective of logistics centres is to allow concentration of transport flows to achieve scale effect).

The determination of important criteria in relation to the objectives of each category of participants are evaluated according to the options for the location of a logistics center and it is necessary to establish the decision variables, function, objective and efficiency indicators, evaluated according to each criterion. In addition, the constraints that ensure the applicability of the model must be defined.

The model can be organized into four components:

- the component on territory characterization and transport network formalization.
- the component for financial evaluation.
- the component for the evaluation of the costs of operating the center;
- the component for assessing the effects on the environment and local traffic.

### 5. Conclusions

Multimodal connectivity includes individual modes of transport (air, sea and land) as well as intermodal links. As such, it involves a network of links (such as roads, railways and transport routes) and nodes (facilities such as seaports and airports).

Intermodal transport, due to the synergy effect of its individual components (other modes of transport), has advantages and is currently being promoted by the EU, as reflected in the recently introduced mobility package. Legislative action, increasing competition and a general change in market conditions in the transport industry make intermodal transport a necessity and a future.

Intermodal transport enables the creation of modern and efficient transport chains by combining different modes of transport into a single system.

The main targets to be achieved in line with the 2011 EU White Paper on optimizing the performance of multimodal logistics chains, including through increased use of more energy-efficient modes, include target 2.1: by 2030, 30% of road freight transport over 300 km should be shifted to other modes, such as rail or road freight. 2.2: 30% of road freight over 300 km should be shifted to other modes, such as rail or waterborne transport, by 2030 and 50% by 2050; and 2.3: a fully functional, multimodal EU-wide TEN-T core network should be in place by 2030 and quality and capacity should be increased by 2050.

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