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Distribution Logistics
 Review
 Accepted: Oct. 2, 2007
 Approved: Dec. 19, 2007

DEFINING THE OPTIMIZATION CRITERIA FOR THE FUNCTIONING OF LOGISTICS AND DISTRIBUTION CENTRES

ABSTRACT

Planning of distribution understands the development of a feasible and viable distribution plan of finished products from the producers, via logistics and distribution centres, storage or crossdocking, to end users. Furthermore, planning represents a support to decision-making by identifying the alternatives of the future activities and by selecting the good and optimal ones. It is important to note that the scope of planning of logistics and distribution processes is not limited only to the planning of production, transport or distribution. It covers the entire logistics and distribution process with all these elements.

KEY WORDS

logistics planning, logistics and distribution centres, distribution, transport technology

1. INTRODUCTION

The scope of planning the logistics and distribution processes is not limited only to production planning, transport or distribution. It covers the entire logistics and distribution process with all the elements. It is precisely the logistics and distribution centres which can be considered as a kind of origins of logistic services. Undoubtedly, the operation of the logistics and distribution centres greatly affects the entire logistic chain (supply chain), and their optimal functioning is of extreme importance.

2. SYSTEMIC APPROACH TO LOGISTIC PLANNING

During the logistics and distribution processes hundreds of individual decisions are being made, and they need to be coordinated every minute. These deci-

sions are of different importance, so that the preparation levels of individual decisions are determined according to their importance. It is very often that decision-making is based on evaluation of different sorts of criteria (qualitative/quantitative) with various relative importance on the final decision. It is precisely this preparation that can be defined as the task of planning. Planning represents the support to decision-making by identifying the alternatives of the future activities and by selecting the good and optimal ones.

Planning can be divided into several phases:

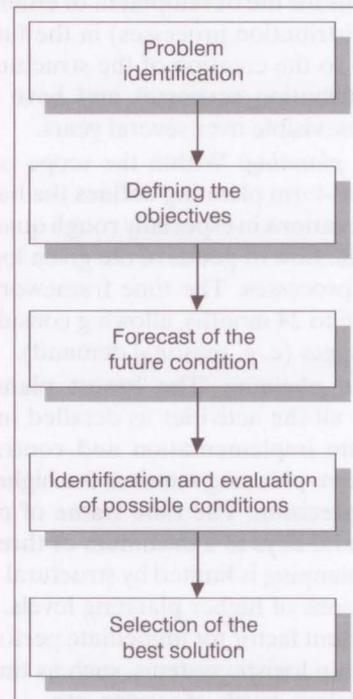


Figure 1 - Phases of logistics planning

Source: developed by the authors

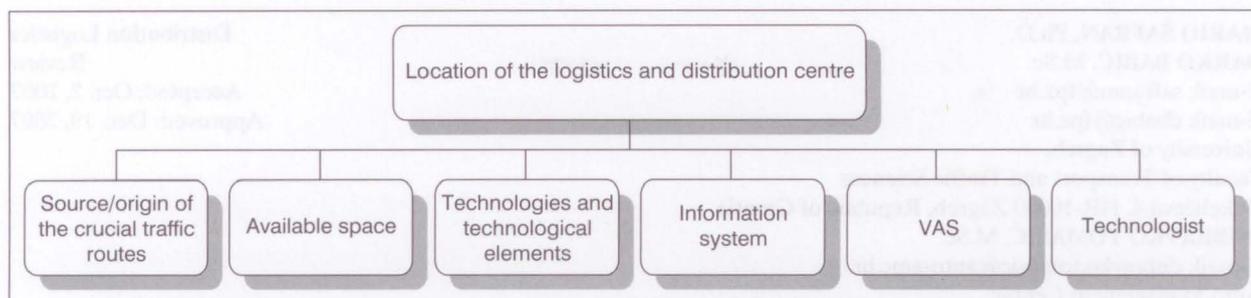


Figure 2 - Criteria definition for selection of location for the logistics and distribution centre

The logistics and distribution processes are very complex, i. e. they consist of numerous details that occur in reality but cannot affect the plan development. Therefore, it is necessary to solve the actual problems by simplified copies of these problems, the so-called models, as the basis for making plans. The representation of the real problem in the simplest possible manner, but with all the necessary details and not ignoring some serious actual factors, is called modelling ("the art of creating models"). The example of modelling criteria for the location of the logistics and distribution centre problem is given in Figure 2.

Plans are not made for the eternity, and precisely the validity of the plan is determined by time limits. Considering the time frames of planning and the importance of decisions that need to be made, planning can be divided into three different levels:

Long-term planning: The decisions that are made at this level are strategic decisions and need to create pre-conditions for the development of enterprises (logistics and distribution processes) in the future. They refer usually to the creation of the structure of logistics and distribution processes and have long-term consequences, visible over several years.

Mid-term planning: Within the scope of strategic decisions, mid-term planning defines the backbone of the usual operations in especially rough quantities and the time of the flow of goods of the given logistics and distribution processes. The time framework of planning is from 6 to 24 months, allowing consideration of seasonal changes (e. g. seasonal demand).

Short-term planning: The lowest planning level must specify all the activities as detailed instructions for immediate implementation and control. Therefore, short-term planning requires the highest level of details and precision. The time frame of planning is between several days to a maximum of three months. Short-term planning is limited by structural and quantitative decisions of higher planning levels. However, it is an important factor for immediate performance of the tasks within logistic systems, such as times of manipulation, delays, levels of service, etc.

The simple method of logistics and distribution process planning can be defined as: finding alternative

solutions, comparison with the given criteria, and the selection of the optimal one.

3. ORGANIZATION OF THE OPERATION OF LOGISTICS AND DISTRIBUTION CENTRES

The organization of the logistics and distribution centres operation can be considered through several basic elements which result in the quality of delivering the logistics service only if they are coordinated (Figure 2).

Selection of location and definition of the logistics and distribution centre capacities

The selection of location and defining of capacities of the logistics and distribution centre is a strategic issue of the capital investors. It is not only the analysis of the potential of "domestic market" which is important, but the logical question is whether the logistics and distribution centre, regarding its geo-traffic position and available capacities can become a logistics and distribution centre of a regional character. The experiences in the selection of locations and activation of capacities of the leading logistics and distribution centres show almost equal logic – to position themselves in the geo-traffic way at the source i. e. origin of the crucial traffic routes insuring the vicinity of sea, river and airports, railway terminals and key roads that best connect the location of logistics and distribution centres with the regional market. The capacities of logistics and distribution centres are usually planned in two or three phases. In the first phase the space intended for the already earlier mentioned "domestic market" is activated, and parallel already in advance and during the selection of location sufficient space is insured for the need of regional expansion. In the second or third phase the capacity development depends on the regional expansion of operation. The optimization of usability of the location and insurance of continuously filled capacities of the logistics and distribution centres is reflected in systemic monitoring of the local and regional market, and planning of the "logistics demand" in cooperation with immediate service users.

Technologies and technological elements of logistics and distribution centre

The logistics and distribution centres depend in many ways on the usage of technology, and the notion of “modern technology” does not refer only to production procedures but also to the resources. The management of logistics and distribution centres does not allow simplified consideration of the technological procedures but rather requires systemic technological opinion. The technological essence of transport in the logistics and distribution centres consists of the processes of goods manipulation and its movement by using transport means, and the storage and manipulation processes which are also components of technology.

Since the entire operation of the logistics and distribution centre is based on the principle in which the technologies and environmental protection are ranked high on the value scale, it is thus that the implementation of the technologies and technological elements can be considered as sub-systems of the organization of the logistics and distribution centres.

Table 1 - Example of applied technologies and usage of technological elements in the logistics and distribution centre specialized for the logistics of new cars

Technologies in logistics and distribution centres	Technological elements in logistics and distribution centres
Technology in the delivery of cars	Railway tracks, reception unloading ramp
Technology of manipulation and storage	Manipulative and storage areas
Technology of finishing and increase in the value of cars	Centre for putting cars into operation, metal and finishing shop, upholstering workshop, mechanical and electrical workshop
Transport technology	Transport units of various capacities, dimensions and applied technologies of loading

Information system

The information system and communication are today one of the biggest challenges in the operation of the logistics and distribution centres. The problem of organizing efficient information system is becoming even more complex with the increase in the number of the logistics and distribution centre service users and its dislocation, and the business environment which includes several connected users of the same information system, that are important for the integrity of the delivery of logistic services (customs, forwarding agencies, external suppliers, etc.).

The information system in the logistics and distribution centres needs to be automated and integrated

which means that it should encompass the entire business system i. e. create integral functionality of all the subsystems with the aim of optimal management of the entire logistics and distribution system. In practice such activity is called business integration and system networking.

Organization of the delivery of value added services (VAS)

The organization of the delivery of additional services of logistics and distribution centres increases the quality and the entire value of the “logistics and distribution centre products”, and stimulates the customer’s demand for logistic services. Therefore, it is necessary to invest into the organization of the delivery of services of additional values which means using of advanced technologies that in practice represent the tools for performing and delivery of additional services. The market successful logistics and distribution centres are separated from those less successful ones by the awareness and competence of the traffic technologist as the “operative manager” of the logistics and distribution centre who finds optimal solutions and creates models that show the logistic service user that the investments into technology bring new value, saving, speed and tangible advantage for the service user.

Transport technologist as carrier of the logistics and distribution centres development

In well-organized logistics and distribution centre the focus of the organization needs to be shifted from the economic sector to the technological sector with the dominating role taken over by the transport technologist. With such organization, the transport technologist with their specific knowledge, skills and competence becomes the carrier of everyday operative activities of the logistic centre, but also the carrier of its development. Collecting the experiences through everyday business operation, by communicating with the market, and at the same time taking into consideration the economic and general social environment, the transport technologist is becoming the person who is the only one capable and professionally competent in planning the regional development of the logistics and distribution centre, and finally in managing this development. With such organization other services and structures in the logistics and distribution centre become “internal outsourcing” to the transport technologist, i. e. internal suppliers of services, information and data which are then used in the function of further development and improvement of technical and technological elements of the logistics and distribution centre, optimization of the business simultaneously taking into consideration the protection and preservation of the environment.

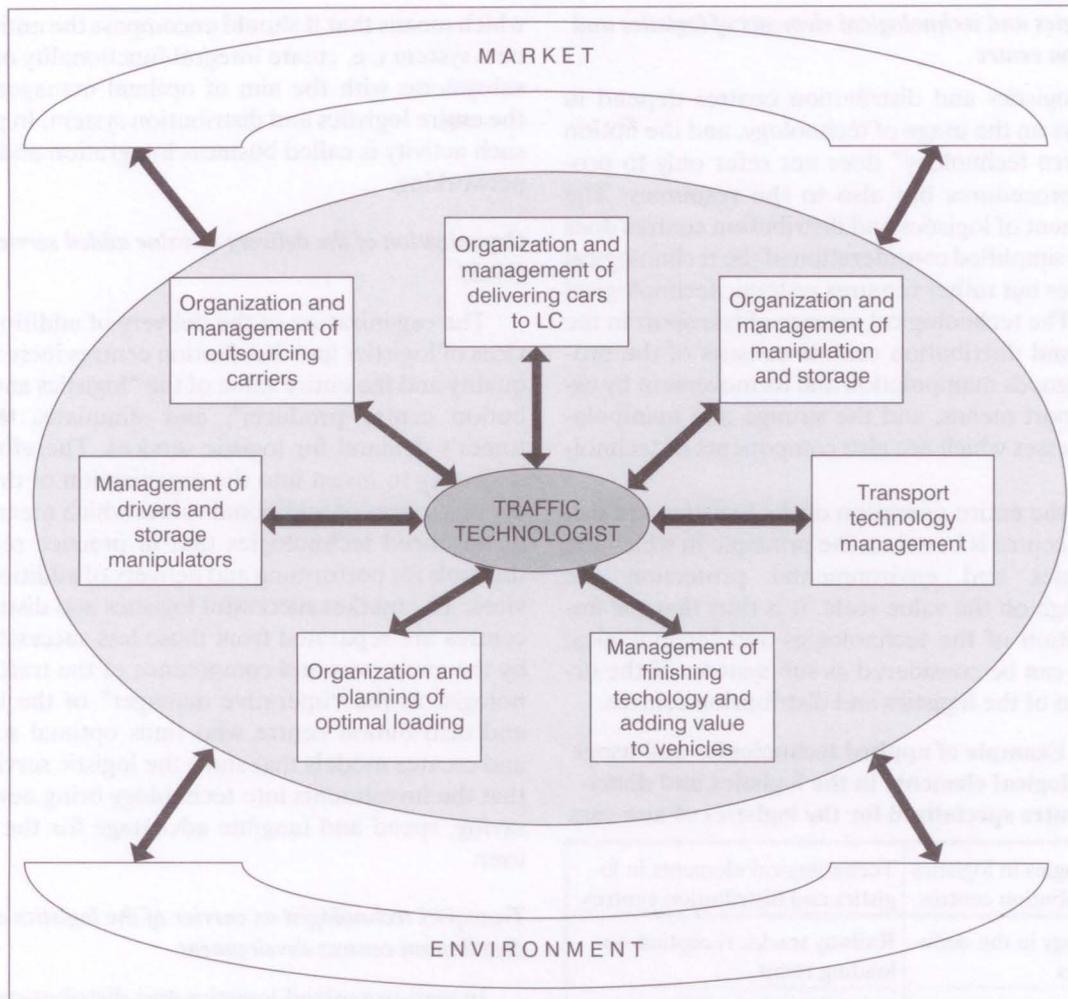


Figure 3 - Transport technologist in the centre of operation of the logistics and distribution centre of new cars

Source: developed by the authors

Based on the evaluation criteria defined in Figure 2 an example of multicriteria decision-making process in Croatia is made. The defined criteria are applied on a group of alternatives (Sisak, Karlovac, Vinkovci, Varaždin and Rijeka) where each alternative represents a possible location of the new logistic and distri-

bution centre. The goal is to select the best location for the new centre. Results of decision and planning process are summarized in Table 2. The greatest importance among the criteria (42.7%) belongs to the geo-traffic positioning of the centre at the source i. e. origin of the crucial traffic routes insuring the vicinity

Table 2 - Evaluation results for the model of selecting the location for the logistics and distribution centre

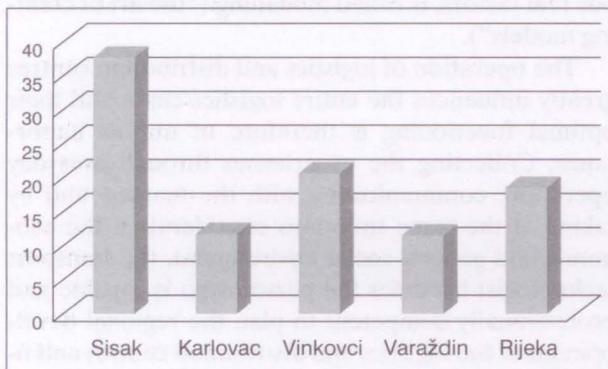
Ideal mode		PAIRWISE	PAIRWISE	PAIRWISE	PAIRWISE	PAIRWISE	PAIRWISE
Alternative	Total	source/origin (L: .427)	available space (L: .291)	technologies and technological elements (L: .067)	information system (L: .083)	VAS (L: .083)	technologists (L: .050)
Sisak	.901	1.000	1.000	.416	.390	1.000	.804
Karlovac	.283	.156	.381	.156	.390	.333	.704
Vinkovci	.495	.416	.381	.416	1.000	.793	.605
Varaždin	.277	.156	.381	.156	.392	.264	.704
Rijeka	.442	.416	.091	1.000	.923	.537	1.000

of sea, river and airports, railway terminals and key roads that best connect the location of logistics and distribution centres with the regional market.

When criteria evaluation is made and comparison of alternatives regarding each criterion is completed, the selection of the best alternative (centre location) is possible. The placing of each alternative with its relative importance regarding the goal is shown in Table 3.

It turns out that Sisak has the best results by relative importance of 36.7%, followed by Vinkovci with 20.6%. They are then followed by Rijeka (18.4%), Karlovac (11.8%) and Varaždin (11.6%).

Table 3 - Results for the selection of new location decision-making process



4. DEFINING OF OPTIMIZATION CRITERIA FOR THE OPERATION OF THE LOGISTICS AND DISTRIBUTION CENTRES

The defining of the criteria for the optimization of the work of logistics and distribution centres may be considered as the planning of all technologies which participate in the work of logistics and distribution centres. It should be mentioned that the scope of planning of logistics and distribution processes is not limited only to the planning of production, transport or distribution. It covers the entire logistics and distribution process with all the elements. The very logistics and distribution centres may be considered as kind of origins of logistic services. No doubt the work of logistics and distribution centres greatly influences the entire logistic chain (supply chain), and therefore its optimal functioning is of great significance.

In order to optimize the work of the logistics and distribution centres, one should define the criteria according to which the optimization shall be carried out.

The criteria of optimizing the work of logistics and distribution centres include:

- strategic long-term planning,
- creation of supply chain networks,
- demand forecasting and planning,

- sales planning,
- stock planning,
- supply chain planning,
- production planning,
- distribution planning,
- transport planning,
- delivery schedule.

Strategic and long-term planning

This element provides answers to the following questions:

- Which products do we want to manipulate?
- What market are the products intended for?
- In which manner can we avoid the conflict of the given objectives?
- In what way can we best use the assets and infrastructure in order to achieve maximal profit?

Creation of supply chain network

This element optimizes the use of the necessary means in the current logistic network which includes suppliers, production locations, locations of distribution means and end users. Analyses and simulations allow testing of various combinations i. e. the influence of opening of new or moving the current infrastructure facilities on the total revenue and level of service. By performing various methods of logistic networks planning, the locations of new infrastructure facilities may be determined, which would meet in an optimal way the customers' needs. These methods are usually used for decision-making on whether larger quantities of stocks will be kept at one place or whether the transport costs of more frequent deliveries will be increased.

Demand forecast and planning

Demand forecast and planning with empirical knowledge (forecasts based on the demand within the previous period) use statistical data and mathematical functions. It may be said that demand forecast is a one-sided process, since forecasts are used as the basis for planning only the possible customers' demand, rather than the quantity of goods that can be produced over the future period.

Sales planning

Sales planning can be defined as a process in which demand forecast is converted into a feasible operative plan that can be used by producers and salespersons. This process may include the planning of production and/or optimization of supply chains in order to determine the possibility of meeting the demand.

Stock planning

Stock planning allows optimal level and location of finished products which meet the demand and the level of service of the end users. In principle, stock

planning is used to calculate the optimal level of safety stocks at every location.

Planning of supply chains

Planning of supply chains compares the demand forecast with the actual demand in order to develop a "master plan" (schedule), based on the multi-level sources and critical materials. The developed master plan spans the points of production and the distribution destinations, by synchronising and optimising production, distribution and transport.

Production planning

The term production planning means the development of master plan for single factories (producers). The master plan is based on the availability of materials, factory capacity, demand and other operation factors. The production planning cycle represents a complex process which is in the majority of considerations represented as the start of logistics and distribution processes. If these processes are considered from the other side, i. e. for the production of certain products, semi-products and raw materials are needed, that are delivered to the factory; they then represent for the factory the final products and the end of one section of the logistics chain. These facts clearly show that the production is a component of the logistics and distribution processes which are neither start nor end of these processes, and these are precisely the reasons why good production planning is necessary for the success of logistics systems.

Distribution planning

Distribution planning means the development of a feasible and viable plan of distributing end products from the producers, via logistics and distribution centres, warehouses or crossdocking, to end users. Distribution planning is based on the actual transport costs and requirements that represent single goods locations.

Transport planning

Transport planning uses current transport prices for the minimization of dispatch costs. In order to minimize the transport costs and maximize the usage of the fleet, transport planning means the optimization both of the external and the internal goods flow. One of the main transport planning functions is allowing and performing collective (bundled) transport of goods, and the inclusion of intermodal transport systems into the logistics and distribution processes.

Delivery schedule

The function of delivery schedule is to create a feasible (realistic) plan which meets the time requirements for the delivery of product by the producer. The producer determines the optimal methods and time of delivery, taking into consideration receiving orders,

production schedule and availability (planning) of transport.

5. CONCLUSION

The logistics and distribution processes are very complex, i. e. they consist of numerous details which occur in reality, but cannot influence the decision-making. This is precisely why it is necessary to solve the actual problems through simplified copies of these problems, the so-called models, as the basis for decision-making. The representation of the actual problem in the simplest possible manner, but with all the necessary details and without ignoring some serious real factors, is called modelling ("the art of creating models").

The operation of logistics and distribution centres greatly influences the entire logistics chain and their optimal functioning is therefore of utmost importance. Collecting the experiences through everyday operation, communicating with the market, and by taking at the same time into consideration the economic and general social environment, the transport technologist becomes the person who is capable and professionally competent to plan the regional development of the logistics and distribution centres and finally to manage this development.

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SAŽETAK

DEFINIRANJE KRITERIJA ZA OPTIMIZACIJU RADA LOGISTIČKO-DISTRIBUCIJSKIH CENTARA

Planiranje distribucije podrazumijeva izradu izvedivog i ostvarivog plana distribucije gotovih proizvoda od proizvođača, preko logističko-distribucijskih centara, skladišta ili cross-docking-a, do krajnjih potrošača. Nadalje, planiranje predstavlja podršku donošenja odluka identificirajući alternative budućih aktivnosti i odabirući dobre i optimalne. Važno je napomenuti da područje rada planiranja logističko-distribucijskih procesa nije ograničeno samo na planiranje proizvodnje, transporta ili distribucije. Ono pokriva čitavi logističko-distribucijski proces sa svim elementima.

KLJUČNE RIJEČI

logističko planiranje, logističko-distribucijski centri, distribucija, tehnologija prometa

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