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Transport Logistics

Review

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ACTIVITIES AND EDUCATION IN LOGISTICS

ABSTRACT

Logistic approach to traffic means new business policy, economy and ownership, new internal organization, external and internal communication, different corporate cultures, human resources management using scientific methods, training and education, changed management type and awarding system, knowledge of information technology, communication skills, electronic commerce, etc. Education is part of all these elements. The introduction of logistics in all the business activities has been imposed due to the following reasons: because of the life-cycle shortening of the product and its delivery, because of sudden technological development, because of production and market globalization, because of the increase in competitiveness.

This paper describes first various logistic activities with the indication of practical and scientific approaches. The logistics approach in the traffic activities requires upgrading of the professional and scientific level to a higher one which means additional training and acquiring of new skills as well as new technologies for the employees.

The basic aim of research was to specify the basic logistics activities and problems in order to indicate the need of different forms of education. Fast technological and social changes require constant improvement and modification of professional knowledge and acquiring of new scientific methods and skills.

KEY WORDS

logistics, transport, education, logistics activities, fast technological development, permanent improvement

1. INTRODUCTION

Over the past years the term “logistics” has spread with unexpected speed in the developed countries of the West, both in business communication, and in professional and scientific literature. The reason lies in the fact that enterprises, which have implemented the logistics concept in their business, have managed to overcome the economic difficulties stipulated by the economic recession, increase their competitiveness and realize a new swing in their development. Since the answers to the issues of “how to produce” and

“how to sell” have been found in the competitive battle on the market, the question of “how to rationalize” (Figure 1) has come up, in order to expand or at least keep the existing market by lower prices and the same quality or by the same price and higher quality.

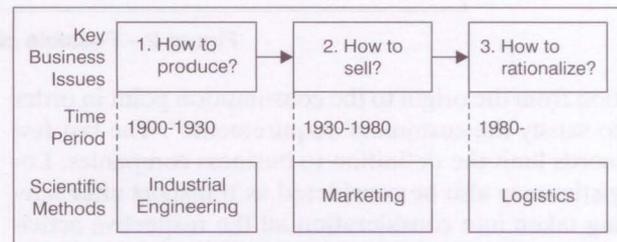


Figure 1 – Flow of business issues in the 20th century

Different definitions of logistics may be found in literature. For global logistics the following definition may be accepted:

Logistics is an interdisciplinary area of systemic sciences which encompasses organizational solutions, transport, infrastructure, resources, processes and all the elements of organizational system which insure its efficiency and economic support in the functioning for the realization of the set objectives, through overall programmed life-cycle with permanent maintenance of the required level of availability in the planned working conditions [6].

According to fields and activities to which it refers, logistics can be, e. g. globally, divided into the following separate logistics (Figure 2): military logistics, technical logistics, transport logistics, business logistics, medical logistics, social logistics, economic-commercial logistics and other specialized logistics.

Logistics from the military sphere has been accepted in the business world. Logistics in business indicates that a certain number of separate activities have been coordinated. In 1991 the Council for Logistic Management, a US-based business organization, defined logistics as [4]: “process of planning, implementation and control of efficient, effective flow and storage of goods, services and accompanying informa-

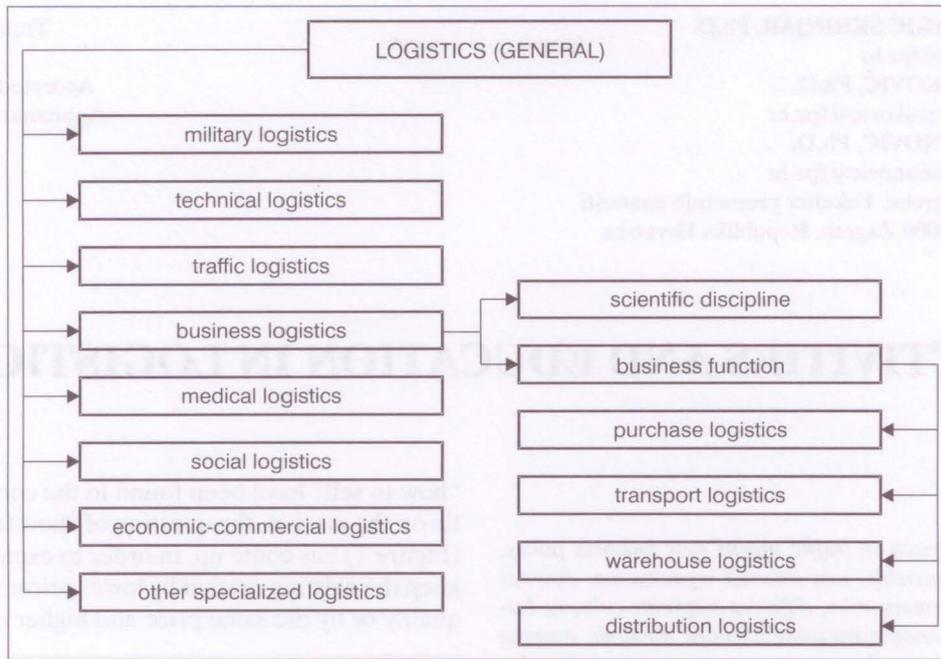


Figure 2 – Possible classification of logistics

tion from the origin to the consumption point in order to satisfy the customers' requirements". The last few words limit the definition to business companies. Logistics may also be considered as transport after having taken into consideration all the respective activities that are considered during the decision-making on material movement.

Two significant terms: *functional* and *scientific* (Figure 2) are present also in other branches of general logistics. Transport logistics has a common core for all the transport branches, but each branch has an adequate content of special scientific discipline. Transport logistics as a system could be divided into subsystems: transport of people, transport of cargo, traffic management, warehouse and distribution centres management, international logistics, logistic centre coordination and staff education (Figure 3).

Revolution in electronic communication after World War II had strong influence on logistics administration. In advanced logistic systems, a combination of advanced electronic communication with high-speed computers has almost completely replaced long-term message transfer processes, record search and record keeping, making the response of supply to demand automatic and almost immediate. Personal computers in particular had a dramatic influence on logistic planning and management. Computers enabled planners to concretely visualize the problem, often also the quantitative data.

Production and service industry, government institutions and other bigger firms have one or more logistics departments in their organization. The logistics department is also responsible for logistic management, control and planning. The company can subcon-

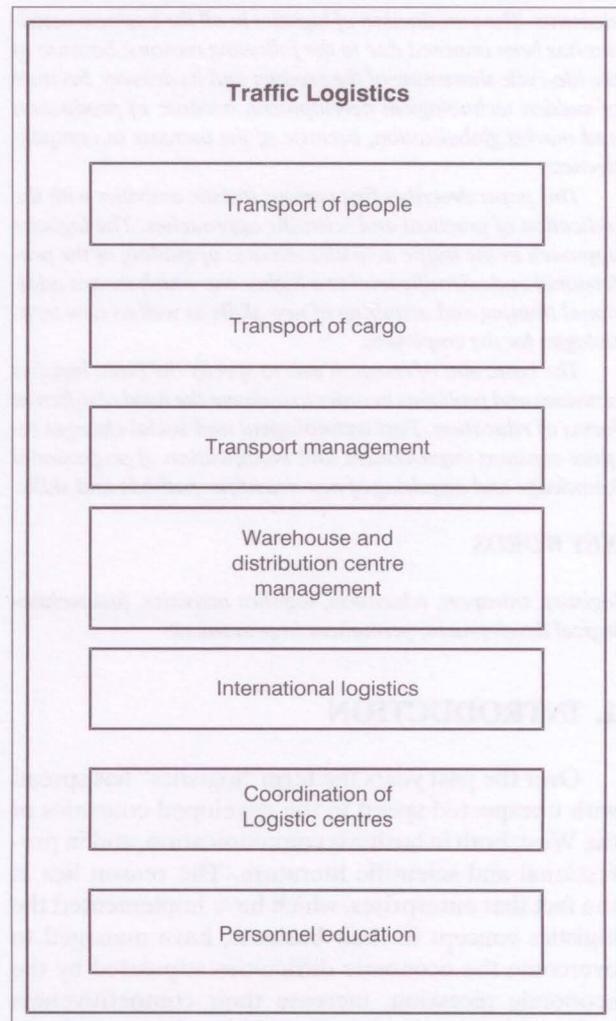


Figure 3 – Transport logistics subsystems

tract a third party to perform some of the specific logistic services, and this practice is called *the third-party logistics* (outsourcing).

2. ABOUT LOGISTICS IN GENERAL

The logistics activities include services to customers or users, demand forecasting, documentation flow, distribution problems, control of machines and other technical means, order processing, packaging, maintenance and servicing problems, production or services organization, purchase, return products management, collected waste disposal, transport management, warehouse and distribution centre management, etc. These activities have to be planned and performed in coordination. Special activities include decision-making in logistics chain. The logistics manager may pay more for one element of the service in order to save an even higher amount on another element. For instance, air transport is more expensive form of transportation, but it saves money on packaging because airlines are more careful with cargo than some of their competitors. Also, because the goods will be delivered more quickly, payment for them is received more quickly. The decision cannot be made without quantitative indicators and various methods of optimization.

The tendency today is more towards electronic data and documents exchange, and therefore the logistic expert has to be well educated in information technology. Very often good computer experts participate in the logistic teams. The information flow in logistic chains is a special issue and a very significant activity of logistic departments.

A logistic expert has to be qualified to manage finances and to know quantitative methods of optimization. The decision-making on the quantities of raw materials and finished products on stocks is related to the estimate of inventory costs, which include interest on the money invested in raw materials and finished products, warehousing costs, risks of deterioration, slower money flow, etc. Therefore, the curricula of high and higher education study the costs, optimization methods, decision-making.

In production systems with the Just-in-Time principle the stock replenishment insists on small, precise supply deliveries exactly when these are necessary – neither sooner nor later. Also, the parts have to be without defects, since there are not spare parts on stock which would provide the replacement part.

Packaging is a special activity of business logistics. Two purposes are served by packaging: production promotion and protection. Promotionally the attempt is made to make the product stand out on a store shelf with the message to the customer walking by “take me home”. The protective function is to protect the product and, in some cases, to prevent the product from

damaging the surrounding items. Retail packages of food and drugs have to be protected against unauthorized handling so that the customer can determine whether the package has been tampered with. The choice of packaging can also be influenced by the concerns for environmental protection. The recyclable packaging is enjoying increasing demand. Many local and state laws encourage the recycling of beverage containers, which is currently the situation in the Republic of Croatia.

Most retailed products are packed in a hierarchy of packaging. This concept can be compared to the building blocks. Special problem is in the dimensioning of packaging boxes, the problem which is in literature known as *rucksack problem*. Optimal loading of packaging boxes on pallets is everyday activity at distribution logistics centres. The goods that have not been packaged is often treated as bulk cargo. The bulk cargo leads to problems of *optimal volume utilization*. Examples are transport of iron ore, coal, and grains which are carried in trainload, truckload and shipload lots. Such cargo is loaded, unloaded and transferred by large machines which include more and more electronics and information technology. This segment is continuously experiencing advancements of the cargo handling systems, both mechanically and in the improvement of automation and safety. Liquids such as oil are pumped through pipelines or carried in vessels called tankers. Flour and cement are carried between dry tanks pneumatically (i. e. by large vacuum devices). In order to increase the efficiency of these systems, strong cooperation of hydrodynamic experts, mechanical engineers, electronic engineers, computer experts and transport logistics experts is necessary.

Spare parts management and organization of service are special segments of logistics. The sold equipment has to be maintained. For instance, car manufacturers often create stocks of parts of all the models of automobiles up to 10 years old. The buyers of capital equipment insist on knowing that their purchase will be kept functioning for many years. Prompt delivery of spare parts is also necessary.

Companies often have to find the location for a new facility. Usually this decision is made after the system analysis and design, wherein the determination is made of how many facilities the company should be operating. A company that needs to distribute spare parts over night within a large region could probably reach almost all markets by air from a single warehouse location if the firm were willing to use air-express services. If the same company wished to use trucks for surface deliveries from warehouse to those same markets, would probably need to distribute a number of warehouse sites throughout the country. Or, e. g., a growing company may decide that it needs a new warehouse to serve a certain region. Several lay-

ers of analyses are performed, each being a more detailed one. After having selected a region then a city is selected within the region. The criteria here include markets, availability and price of labour, taxes, climate, and transportation. Within that chosen city, various sites are examined, taking into consideration the factors such as land use controls, street traffic capabilities, room for expansion, soil stability, water- and sewer-line capacity, police and fire protection, proximity of rail tracks. Some companies serve shrinking markets. They have to decide which production or distribution facilities to close, and the closure must be scheduled in a way that reduces the negative impact on the company's overall operations. All these requirements lead to the issues of *allocation on the network* or on the so-called *zero-one programming* where there are still many open problems. *Therefore, logistics is at the same time both a practical activity and a scientific discipline.*

The production at the company is organized by others but with the assistance of the logistics staff. The production is scheduled in an attempt to balance the demand for products and the plant capacity and availability of inputs. Inbound material and parts have to be organized so as to fit into the production process. The production process itself is organized to fulfil the existing and planned orders. The manufactured products must be scheduled for shipment to wholesalers, retailers and customers. If the company is running a special advertising campaign to promote its product, then additional products must be available for sale. The logistics staff take care also of the costs of carried materials. They hope to develop back-and-forth hauls of materials in order to better utilize transportation equipment. The "just-in-time" philosophy required disciplined, on-time deliveries. On the other hand, company has to be as flexible as necessary in order to be able to react to unforeseen events. The shippers and receivers of cargo sometimes establish "windows" (slots) of two to three hours' length within which trucks must arrive to pick or deliver cargo. Related to organization of specific shipments is routing problem – i. e. selection of exact route that a vehicle should take. Many truck deliveries today are determined by special quantitative methods and computer programs. Determining of optimal routes on the network is a complex management problem which cannot be solved only by intuition. There is an increasing number of papers that treat the vehicle routing problem, known in literature as VRP (*Vehicle Routing Problem*) [2].

3. GENERAL TRANSPORT LOGISTICS AS SCIENCE

At today's level of development of science, technology, production forces, production and social rela-

tions, one could say that *general traffic logistics as a science* is a set of interdisciplinary and multidisciplinary knowledge which study and apply the laws of numerous and complex planned, coordinated, regulated, and controlled activities (i. e. functions, processes, measures, rules, operations, activities, etc.) which use the traffic infrastructure, traffic suprastructure and other potentials and resources to connect all the knowledge directly and/or indirectly contained in the function of overcoming space and time distances, fast, safe and rational flows and flow rates of carried items (i. e. flows of cargo, passengers, live animals, information, etc.) from one place (i. e. point of delivery) to another place (i. e. point of receipt), including the respective information flows, at the same time satisfying the needs of active participants in the traffic service production process [11].

3.1 Transport logistics activities

Traffic logistic expert is concerned with cargo consolidation, carrier charges, carrier selection, documentation, tracing and expediting, loss and damage claims, diversion or change of destination, delays and detention, transport of hazardous materials, and use of private carriage. The carriers charge less per weight for handling larger shipments, because less paperwork and individual handling is involved. Therefore, traffic managers would like to see customer's daily orders consolidated in one single weekly order or have orders for several customers in a distant city consolidated into a single shipment to that city, where it would be broken down for delivery to each customer separately. Often road carriers have tariffs from point of delivery origin to point of receipt for shipments that are smaller than one truckload. The tariffs vary according to the length of haul, size of shipment, and classification of a product (a number which marks the ease with which the carrier can handle the product; e. g. gravel has a low classification number, bees – in hives – have a high classification number etc.). The traffic user pays these tariffs or may be able to negotiate a percentage discount if they are willing to make a long-term commitment of traffic to a specific carrier. For regular shippers of truckload, railcar load, ship, aircraft loads, it is possible to negotiate contracts with carriers. Some carriage tariffs may be regulated by the government but usually carriers affect the legislation processes in various ways.

The carrier selection is a procedure in two phases. First, the company has to decide which transport mode to use – water, rail, pipeline, road or air transport – for every available transport mode. Air transport is the fastest for intercity shipments, but also the most expensive. Road transport is less expensive and more widely used. Rail is usually even less expensive,

although often not so consistent nor of such quality as road traffic service.

Water and pipeline transportation are cheaper, although not available at all sites. If effect is considered achieved by certain traffic branches within a certain period of time, one picture is obtained, and if transport costs are considered then a completely different picture is obtained. E. g. intercity cargo within the USA, in the early 1990s [4], about 37 percent were moved by rail; 25 percent by trucks; 21 percent by oil pipelines; 16 percent by water; and less than 1 percent by air. However, expressed in terms of dollars spent for intercity cargo transportation, trucks carried 81 percent; rail 11 percent; and others 2 or 3 percent each. Once the modal choice is made, the traffic manager must choose which carrier company or companies should get the job.

After the selection is made and the contract signed, the carrier's performance is monitored in order to make certain that the quality does not deteriorate. The documentation is the preparation and handling of all the documents that accompany the shipment, most must be completed before shipping. In the late 20th century, computers and electronic data interchange (EDI) have made the documentation less of a burden. Tracing and expediting are related; both involve paying attention to a shipment which is in the carrier's hands. Tracing is the effort to find a delayed or misplaced shipment. Expediting is an attempt to have a specific shipment move faster than usual through the carrier's system because the customer needs it immediately. Loss and damage claims reflect the carrier's responsibility to deliver the goods in good order. If packages are missing or are damaged, the shipper must determine which of these problems were the carrier's fault and attempt to collect the amount of the damages from the carrier. Among other things, the quality of transportation is the higher the lower the total amount of damaged or lost cargo. Diversion and re-consignment cover the practice of sending cargo, which is followed by the decision to change the destination. The customer may request that the shipment en route be delivered to a warehouse in city B, rather than city A. In that case, the shipper's traffic manager has the shipment diverted from city A to city B; the re-consigned goods are rerouted after delivery to their original destination. Delayed loading and unloading and detention of carrier's equipment are usually specially regulated. This is to prevent the shippers and consignees from using the carrier's equipment as warehouses.

Passenger transport logistics can be analyzed in two ways. Individuals want to travel to a certain place. They organize their own transportation or contact a carrier or tourist agency. If a larger group of people are to be transported, specialized companies may take

over the organization of transportation and accommodation.

The transport of hazardous cargo requires special attention. Sometimes, only certain routes, warehouses, and vehicles can be used. The communities along the way may have special requirements that affect the movement and storage of the materials. For some hazardous material movements, specialized transport means must be used. Containers and vehicles in that case have special markings, and additional documentation is needed as well as possible shipment accompaniment. For all such and similar tasks specially qualified and trained people are required.

Finally, a company may have its own fleet of vehicles – trucks, planes, or ships. Their operation and control is the responsibility of the logistics manager. This is a special branch of logistics: *maintenance and reliability of technical systems*, where statistical methods and algorithms play a special role.

3.2 Warehouses and distribution centres

Special activity in traffic logistics is the organization of warehouses and distribution centres. This logistic activity includes management of location at which the company's inventory is stored. Warehouses and distribution centres are similar but have different emphases. Canned foods, e. g. are canned during one month of the year at the end of the growing season and then shipped out in a fairly even flow for the next 11 months. Or, as a contrary example, Christmas decorations are made throughout the year, but the sales are concentrated in a four- to six-week period. The distribution centres focus on faster turnover (or transit) of goods. Chains of food stores use distribution centres for receiving railcars and trucks filled with pallet loads of individual grocery products. Inside the warehouse, all the products are placed in individual stacks. Then the orders are "picked" and assembled for each retail delivery. They are assembled, loaded on pallets, placed on vehicles and delivered at the point of receipt.

3.3 International logistics

International logistics includes movements across borders, and these movements are considered more complex for several reasons. First, there are delays at the border. Goods have to be inspected, and often import duties, or charges are assessed. Additional inspections at the border may be conducted to determine whether the goods meet that nation's health, safety, environmental protection and labelling standards. Most countries in the world – excluding the USA – insist on using the metric measurements. Many documents are necessary for international shipments,

and often the logistic efforts involved in assembling the documents are more challenging than those in moving the product. Usually all documents must be present at the point where the goods are passing through the importing nation's customs and inspection posts. Many international movements go aboard ships, and the process of moving through ports and being at sea is more time-consuming. Differences in time zones limit the period within which communication can be realized. The European Union is trying maximally to simplify the transport of goods and people between its member countries.

3.4 Special logistics activities

The group of specialized logistics includes also the service industry which has its own requirements. Often the service industry processes paper records and has to organize paper transfer phases which are analogue to the processes used by the production companies for the transport of goods. Computer networks are increasingly used to perform administrative jobs in logistic networks. Hospitals have to have medicines and a wide range of materials and supplies ready for use. Before a surgeon schedules a procedure, the needed instruments must be selected, placed in their order of use, sterilized and held ready.

The individual elements of a firm's logistics system must be connected. The company's management can have a separate logistics department that is equal in status with other major departments such as finances, production, marketing, etc. However, it is more likely that the majority of companies will distribute these functions to various departments, and they will be "loosely" coordinated by logistics personnel. Today some companies rely on the third party logistics, outsourcing or classical "make-or-buy". The topic regarding outsourcing has always been very high on the scale both in research and in practice, and the interest for this topic has increased over the last years.

Another way in which logistics activities are linked is by communications. Recently, improved communications have substituted the inventory. Some chain stores have scanners at checkout counters where the customer buys the goods. These scanners are linked directly to the chain's home office so that the office receives instantaneous information as to what is being sold. With such knowledge they may restock the store and intermediate channels immediately, rather than having large inventory at the store in anticipation of what might sell.

Third, control systems help link the elements of logistics systems. The reason for this is that the goods moving through the system has a value and therefore may be target for pilferage by employees or organized thefts conducted by outsiders. Therefore, the logistics

system needs a control system which tracks the goods as they move from place to place to ensure that nothing disappears. The system is designed so that when goods do leave the system, they must be exchanged for proper documentation or payment. Computers also help link the logistics activities of a company. Since 1992 more than 1500 different computer software packages have been available to logistics managers.

4. EDUCATION IN LOGISTICS

The basic challenge of logistics: to deliver the right product to the right place in the right quantity at the right time, in the best condition and at an acceptable cost requires a wide range of compatible knowledge. In production logistics chain the logistics experts perform a number of connected activities: purchase management, communication with suppliers, material management, human resources management, inventory management, warehousing of finished products, distribution and transport, customer service, information management and finances management, insurance of ecological standards, etc.

Logistics experts also increasingly have the key role in considering the development of a new product. Most often the logistics experts play their role in multidisciplinary teams in order to ensure efficient supply chain management.

Whereas logistics covers a number of functions, each with its own challenges and skills, they are all interdependent and the practitioners must work together and search for optimal solutions not for single phases but rather for the logistics system as a whole. Management, coordination and continuous improvement of the whole supply chain or logistics network require very high-level managerial skills and the competence to define and optimize long-term strategic objectives of the company.

Supply chains feed on data and depend on information sharing, especially in a global environment where speed of communication is of basic significance, and supply chains grow ever more complex. Today, all areas of logistics use of information technology to process, tailor and deliver real-time information when and where it is needed. The logistics expert has to be quite highly qualified in information technology, qualified to use ever faster and more transparent communication technologies.

The ability to appraise and use the IT packages and electronic communication methods has become a key competency of logistics managers, not least because, with the growing use of the Internet, the supply chain is at the centre of some of the most exciting developments in telecommunications and electronic commerce – known as e-commerce.

The traffic logistics expert is faced by a number of different issues:

- How to achieve minimal fuel consumption by the fleet?
- Is the distribution centre efficient regarding energy?
- Can packaging material be reused or recycled?
- How to combine business development with the sustainable approach to environment?
- How to realize the transport?
- Which financial management strategy to select?
- Relations between people
- Selection and implementation of information technology
- How to select the location for warehouses and distribution centres?
- Education and training, etc.

Logistics expert must be educated to perform activities in various segments of logistics. Of course, as a practical activity, logistics affects many areas of professions and sciences. It is often necessary to have the basic knowledge for cooperation with other professions and therefore the training programs have to cover different areas of knowledge. The curriculum of the *FACHHOCHSCHULE des BFI WIEN* – Department of *Traffic logistics* includes the following structure of subjects:

- Foreign language	7 %
- Mathematics, physics, chemistry	16 %
- Traffic	16 %
- Information technology	8 %
- Logistics	14 %
- Economy	17 %
- Law	3 %
- Management and organization	16 %
- Electrical engineering	3 %

The structure of the traffic syllabus of the mentioned school shows that the education in logistics requires a wide framework of educating the traffic professionals both at the professional and at the scientific level.

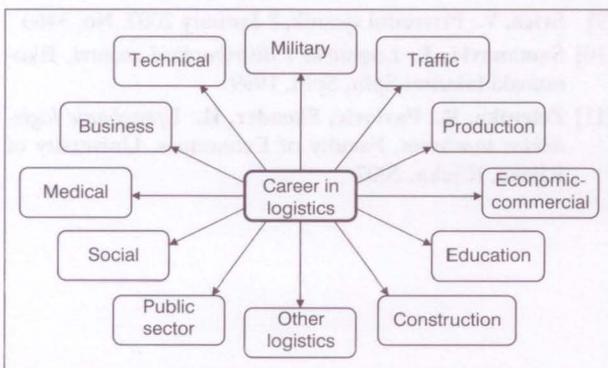


Figure 4

A well educated logistics expert can achieve successful professional and scientific career in many areas of human activities (Figure 4).

The demand for personnel in the field of logistics is increasing from year to year in the Republic of Croatia. Higher vocational schools and faculties in the Republic of Croatia which provide study of logistics in their curricula try to provide the students with the necessary knowledge for business communication in international logistics chains, to acquire the basic knowledge in mathematics, physics, statistics, economy, information technology in business, traffic technologies of single traffic branches, basics of entrepreneurship and management, forwarding, risks. The curricula have also the objective to make students acquire skills of organization, management and maintenance of logistics systems, warehouse and distribution centres management, investments and financing, business communication, decision-making with the use of quantitative methods and advanced information technologies.

Some economists claim [9]: what company has in the balance is worth between 30 and 60 percent of its real value, and the remaining 40 to 70 percent is intellectual capital. The key values are intangible. These are innovations, image, talent, knowledge, development and research, entrepreneurial spirit, client satisfaction, employees' satisfaction, level of market handling. Parallel with studying logistics processes and activities, care should be taken about the education in logistics both at professional and at scientific level.

The analysis of foreign successful companies shows that they have increased their education together with strengthening the organization of the whole concept of human potentials.

Three levels of educational programs at enterprises may be emphasised [5]:

First level – Qualification for current tasks: preparation to achieve at work the success standards set by the company (instructions, profile amendment, seminars, lectures, workshops).

Second level – Additional potentials: expansion of knowledge for additional potentials within the work being done (professional and technical qualification, re-qualification, rotation, special tasks, internal qualifications).

Third level – Career development: challenge to the motivated and competent employees to prepare themselves for moving up in the career (in-service and from-service vocational training, scholarships, specializations, seminars, graduate studies).

5. CONCLUSION

In the present business world the knowledge is the goods as any other, and a very required at that. Knowl-

edge and competence of the manager in the logistics are the greatest assets in good company operation and are more and more appreciated.

In order to be successful in business in today's world of fast technological changes, continuous improvement is necessary as well as new knowledge to supplement the professional knowledge but also to acquire new scientific developments. A company achieves its competitiveness on the market, among other things, also through the quantity of skills and knowledge of its employees.

Regarding the speed of technological changes, the companies will not be able to employ associates from the regular schools and faculties for quite some time yet, who will satisfy their production, technical, technological, organizational, entrepreneurial and managerial needs within the shortest time possible. It is to be expected that the Bologna declaration will certainly contribute to a certain development, but the companies develop faster than the education. Many logistic companies have recognized this and organize their own internal education to supplement the profiles, to change knowledge and technology, for essential requirements of keeping the company in competition. The importance of continuous education of the employees has been also recognized by many companies in the Republic of Croatia e. g. the Intereuropa concern organizes every year its internal school providing qualifications for current business activities.

Raising of scientific and professional level will certainly contribute to the appearance of many journals that deal with various segments of logistics. They provide more and more space for the quantitative methods of logistics processes optimization.

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SAŽETAK

AKTIVNOSTI I EDUKACIJA U LOGISTICI

Logistički pristup u prometu znači novu poslovnu politiku, ekonomiju i vlasništvo, novu internu organizaciju, vanjsku i internu komunikaciju, drugu korporacijsku kulturu, upravljaj-

nje ljudskim resursima znanstvenim metodama, osposobljavanje i obrazovanje, promijenjen tip rukovođenja i sustav nagrađivanja, informatička znanja, komunikacijske vještine, elektroničko poslovanje i drugo. Edukacija se povlači kroz sve ove elemente. Uvođenje logistike u svim djelatnostima poslovanja nametnulo se iz slijedećih razloga: zbog skraćivanja životnog ciklusa proizvoda i njegove isporuke, zbog naglog tehnološkog razvoja, zbog globalizacije proizvodnje i tržišta, zbog povećanja konkurencije. U ovom radu prvo su opisane različite logističke aktivnosti s naznakom praktičnih i znanstvenih pristupa. Logistički pristup u prometnim djelatnostima zahtjeva podizanje stručne i znanstvene razine na višu razinu što za zaposlene znači dopunsko učenje, stjecanje novih vještina i usvajanje novih tehnologija. Osnovni cilj istraživanja bio je specificirati osnovne logističke aktivnosti i probleme kako bi se ukazalo na potrebu različitih oblika edukacije. Brze tehnološke i društvene promjene zahtijevaju neprestano usavršavanje i dopunjavanje stručnih znanja te usvajanje novih znanstvenih metoda i vještina.

KLJUČNE RIJEČI

logistika, promet, edukacija, logističke aktivnosti, nagli tehnološki razvoj, stalno usavršavanje

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