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DEVELOPMENT PLANNING OF CITY LOGISTICS AND DISTRIBUTION PROCESSES

ABSTRACT

The efficiency, with which the information technology has connected the world, has made possible the production of new products that affect the market structure. Social changes caused by the third technological revolution have also brought about the changes in the urban space usage. Developed with the first division of labour, oversupplies and the need to gather people at one place because of joint production, exchange of products and trade, cities have become a very important part of the entire human history. Sometimes bigger, sometimes smaller, with constant economic development as condition of survival, the cities begun their sudden expansion with the industrial revolution, the development of manufactures and industrialization.

Stimulated by the needs of industry, the cities concentrated raw materials, production means and labour at one place and in great volumes. The last hundred years of city development were the most important in the history, since, owing to technological revolution and industrialization, cities were no longer dependent on the economic successes of their environment, but rather sufficiently strong to take over the role of the development promoters, dictating the development conditions according to their needs.

Logistics, "relying" on the city road traffic as one of the sources of constant and sustainable growth of the efficiency of enterprises and networks in the urban environment, and defined by the development of technology and implementation in practice (especially in telecommunications and information technology).

It is necessary to identify the integrity of the relevant aspects of city transport logistics in the process of the technological development in order to identify the footholds and lever processes of creating and functioning of successful enterprises and the society in general.

KEY WORDS

city transport logistics, process of the technological development, planning of logistics and distribution processes

1. INTRODUCTION

Traffic is one of the most significant factors that form a city. Although it may seem that traffic is just one more service activity in the city, facts warn us that urban development is related to the development of the traffic in the cities. Roads and parked vehicles occupy 30 – 40 percent of the land area in the city centre and about 20 percent in the suburbs, and the average citizen spends daily at least an hour in traffic, as pedestrian, riding on urban (public) transport means or driving their own cars.[1]

The problem of efficient organization of city traffic occurred already in the first days of the cities. The first permanent settlements were built at a distance a human could cross during several hours or, at the most, one day, from sunrise to sunset. At the beginning on foot, then using horse(bullock)-drawn carts, rail cars with one coal "load", and finally by car or plane. As the cities grew, the city traffic grew as well, requiring today constant improvements so as not to become the bottleneck in the development of the city.

If there is a question regarding the traffic development in the cities, which has been intensively requiring an answer recently, then it is the question of the fees for the usage of the traffic infrastructure. It is not easy to break down the costs of road usage or the costs of road protection and the improvements of traffic flow conditions among all the traffic participants.

Traffic in the cities can be divided into horizontal and vertical traffic. Since there are no verified statistical data for the analysis of vertical traffic (elevators, cargo elevators, escalators, etc.) we will only assume that regarding volume and frequency the vertical traffic in the cities is very close to the horizontal one.

Horizontal traffic can be divided into above- and underground traffic. There is a problem here as well: underground traffic consists of underground rail, which is an element of traffic of only some cities, so that the number of carried passengers and tonnes of goods by underground rail are relevant only for multi-million cities, which can be subject of a special analysis. Thus, when speaking of the optimization of the transport of people and goods in the cities we are thinking of optimization of horizontal aboveground traffic.

Carriage of people is done by urban public transport vehicles and by their own cars, and all the vehicles tend to use the traffic area in the city in a uniform way (roads and parking spaces) with the value of a final number. For the traffic flow in the city it would be better if the majority of passengers (if not all) are carried by the urban public transport. However, individuals choose more often to travel by their own cars. People like spacious homes with gardens and parks, they want working places and shops located near and they want short trips to work – and all these goals are incompatible. People want to enjoy in the benefits of using their own private vehicles, but at the same time also in the driving devoid of congestion or enjoying the pleasures of walking as pedestrians across the spacious city centre – again, incompatible goals. Indeed, it is difficult to harmonize such opposing goals, because the realization of one sometimes means complete elimination of another.

Apart from the area for transport which is becoming smaller and smaller in the cities – different studies show that the average speed of vehicles in the city is 15-20km/h, and in the

[1] J. M. Thomson: Great Cities and Their Traffic, 1978, p. 16

biggest congestion even less than 10km/h – special problem is the parking space. However, unlike the dilemma of "public or private transport", the parking problem, seemingly at least, is much easier to resolve. By opening huge, multi-storey, aboveground or underground garages (some of which have already been so computerized that mechanical hands stock cars as sardines, in order to make maximum use of space), it is possible to temporarily (since the number of cars is constantly growing) solve the acute problems of the parking space.

The solution of the people transport depends largely on the land fees in the city. It is, namely, that with the distance from the city centre the market value of the land decreases and the residential blocks are built in the suburbs, thus creating a large army of commuters. Since it is difficult to locate the working places (and all the required catering objects) in the close vicinity to the residential buildings, the suburban citizens have to travel to the city centre. The problem is difficult to solve, and all the municipal authorities mainly increase the public transport, which is usually not good or efficient enough so that the individuals use their own transport again resulting in a huge chaos in traffic and congestion.

The transport of goods also participates in the total city traffic, but due to its specific characteristics it has somewhat different problems than the carriage of people. Mr. Zvonimir Jelinović[2] has thought of their solution in the following way:

1. "The bigger the city, i.e. the bigger its role in the region, the higher the probability that it will consume more products of its own industry. The result is the delivery of different products of the local producers from different areas of the city into the centre using trucks, smaller average deliveries per truck, i.e. consequently, a larger number of trucks that enter the business city centre.

Cities located within the influence scope of wider industrial centres undoubtedly have a relatively higher level of collection of goods by motor vehicles than these centres. In the cities within the domination area, the ban on entering the city centre for larger motor vehicles may help in reducing the congestion. Only one truck that delivers the goods arriving at one central point may deliver all the goods delivered otherwise to this place by 50 – 60 trucks, thus eliminating the need for their entering the city centre.

2. In any form of urban traffic regulation, i.e. public policy, the city centre should be distinguished from its other parts, based on the functional nature of each one of them.

If there are no underground routes in the city centre, the vehicles that deliver the goods i.e. perform services for the residents and companies, should be given priority over the non-commercial vehicles that carry passengers which largely depends on the function of the respective type of street in the city core. The construction of garages, bus and tram depots, postal offices and the like, should be banned from the very city centre, i.e. allowed only on the peripheral locations.

The development of integrated trade communities and regional shopping centres does not lead necessarily to the reduction in the flow of goods in the city centres, due to the need of the shops to centralize the operations of receiving and labelling of the goods. Although a large number of aggregate goods does not pass through the central warehouses but are rather delivered directly to the local shops, almost all the less expensive goods that are sold in the suburb chain stores pass through the parent shop. There is absolutely no indication whatsoever that this procedure would change.

3. The organization of collecting goods at one central point may facilitate the movement of goods and reduce the congestion. However, it is difficult to organize aggregate transport without state intervention, since the salespersons do not want to carry the collection costs. The cargo truck stations have brought in many cities to significant reduction of congestion.

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[2] Z. Jelinović: Prikupljanje i distribucija dobara (Collection and Distribution of Goods), 1984, pp. 30-32

The most suitable measures for reducing congestion in the city centres regarding the flow of goods consist in regulating the conditions by the cities under which the goods are received. This regulation should have these characteristics: a) determining border lines of the centre and ban on the entry of cargo vehicles transporting fewer than a defined number of items, i.e. of a certain weight, excluding cargo in containers; b) transport of itemized deliveries within the city centre using public transport vehicles, thus forcing aggregate transport, instead of performing this transport by the suppliers' vehicles; c) leasing certain areas along the periphery or other places only to those public carriers that perform development of aggregate transport. Thus, a limited number of carriers could provide more efficient service, since they would have assured bases for their operations (in a similar way certain areas could be provided for taxis, ambulance services, traction, etc.) and, finally d) restrictions in issuing permits for public transport performance, if this restriction improves the public interest."

2. LOGISTIC SYSTEMS IN THE CITIES

Most general, the logistic systems can be defined as the systems of space-time transformation of goods, and the processes that flow in them as *logistic processes*.

The characteristic of logistic systems is the understanding of the connection of the movement process (transport) with the holding processes (warehouses). The movement processes and the holding processes can be presented by a grid. The vehicles move along the network of city roads, stay at nodes and pass over to a route which leads further. The nodes can be differently connected, and road vehicles may move also differently. Apart from goods, roads also provide the transport of energy, information and people. According to this idea of network, the basic logistics system structures can be distinguished. Here we distinguish the single-level, multi-level and combined logistic systems.

In one-level system space and time are spanned by direct flow of goods between the point of delivery and the point of receipt. At point of delivery the goods are prepared, and at the point of receipt they are used.

In multi-level system the flow between the point of delivery and the point of receipt is interrupted at least in one point, whose task is to regroup the goods into smaller units or, indeed, their aggregation into bigger units for the delivery. This is conditioned by the uses of the receiver at the point of receipt.

Units of quantity can be homogeneous or heterogeneous. Heterogeneous units refer to the already composed range, which can refer to the warehouse for the supply of a certain regional market and they are dispersed further according to the customers needs. However, it happens more often that the heterogeneous units are created as a range for the customers needs and dispatched as such, and homogeneous (more or less) units are delivered.

A striking example for gathering homogeneous goods is a big shopping centre. Here we notice dispersion of big logistics receiving units into smaller ones, that can then be regrouped into a batch according to the customer needs. The basic function of logistic systems is space-time transformation of goods. Its fulfilment is related to the functions of change in the quantity and type of goods and the function of facilitating the transformation of goods.

Thus, these functions are carried out in the processes[3]:

- transport, regrouping and warehousing, with focus on the goods flow processes;

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[3] Segetlija, Z. and M. Lamza-Maronić: Distribucijski sustav trgovinskoga poduzeća (Distribution system of a trading company), 1994, p. 80

- packaging and marking, with significance on the processes assisting the goods flows;
- delivery and processing of orders, with significance on the information flow processes.

The flow of goods from point of delivery to the point of receipt assumes also the information exchange between the two points. Information are exchanged before, during and after the completed flow of goods. They start it, follow it and explain it, control and accompany as well as confirm or identify deviations. Therefore, the information flow processes are also logistic processes. Thus, logistics processes are tasks that are realized through the flows of goods and information transformations. They refer to planning, managing and control of these transformation flows.

3. ROAD AREA – VEHICLES RATIO MODEL

Theoretical assumption of the model is the conversion from one form of organization into another owing to technological changes and transfer of capital. We observe the period of time t**0** (which denotes the starting state) and period of time t**1** (following the technological and economic changes). At time t**0** we can define a simple scenario, whereas in time t**1** we can find the network scenario of supply and demand networking.

In an assumed office building at time t**0** there is a company with a hundred offices, and for them purchases and distribution are done by an internal logistics department of this company. According to this theoretical assumption, all the orders are grouped at one place and the order is then sent to one supplier denoted with D**0**.

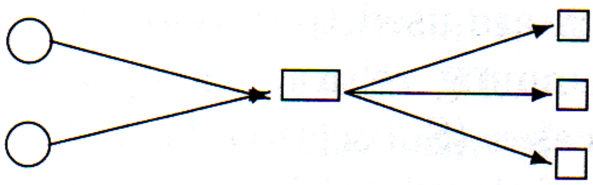

Figure 1 - Model of simple distribution network
Source: author

Let us suppose that the delivery according to this order fits into a single truck which occupies a road area of X**k**. During the delivery for all the fifty offices the supplier's truck D**0** arrives in front of the building and, occupying space Dp**0** delivers the goods. The rest of the road (approach road, parking lot, etc.) at the moment of delivery in front of the building is unoccupied.

Let us suppose that for the needs of the model, owing to the transfer of capital and development of technology, there have been some changes in the company, so that the company is divided, due to privatization, into a hundred small companies. What technological and capital changes can be assumed? The development of telecommunications and information sciences has made possible the networking of the small companies, so that a company with one employee can operate successfully today working networked with its suppliers and customers, and also small companies for sales, legal, accounting, marketing, financial and other services. These companies can be in the same building, or they can be at a distance of hundreds of kilometres. Thus, we assume that in time t**1** in the same building we now have a hundred companies each of which has one office and each orders the goods independently of one another.

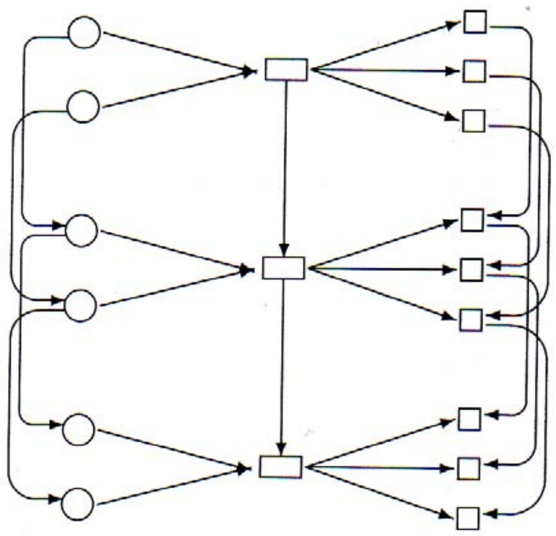

Figure 2 - Model of complex distribution network
Source: author

Let us suppose, because of the model that in time t**1** all the hundred companies at one moment order the goods from their suppliers who are all different and we mark them by numbers from D**1** to D**100**. Let us also suppose that the ordered goods will be delivered by the suppliers at the same moment by smaller vehicles covering a total area of Dp**1**+Dp**2**+Dp**3**+Dp**4** ....+Dp**99**+Dp**100**, and that they will occupy a space which is the sum of ΣDp**n** (where n denotes numbers from 1 to 100).

If we assume that the road area occupied by a single truck D**0** of average size of ca. 20m², and that the road area occupied by a single small delivery vehicle Dp**n** ca. 8m² we obtain a simple formula that shows that the space occupied by logistics activities defined in such a way, is as many times greater as the occupancy space of road, that is occupied by the sum of area of small delivery vehicles in relation to the truck (in this case it is 40 times – that is (Dp**n** x 100): Dp0 = ponder differences in the occupied space, which in this case means 8x100=800:20=40). This means that in this case the space occupancy of roads, used by small delivery vehicles to arrive to the supposed building (and which is the result of the technological and economic changes) was 40 times larger compared to the previous state, in which the logistics procedure was performed by a single truck.

If we use this formula also to calculate the road congestion in case of arrival by passenger car to the shopping centres in relation to the urban public traffic means, we can also obtain the result of increased congestion due to the use of smaller passenger vehicles instead of, for instance, buses and trams. Here we will take into the ratio the number of people who travel by their passenger cars (for the needs of the model it is 4 persons here), and the number of people occupying the places on the bus (for the needs of the model it is 60 persons here). Let us assume that the area of the occupied road is the same as in the previous example. The ratio of passengers here will be 60:4=15, which means that the bus passengers would fill 15 passenger cars. If we compare the given areas now, we obtain a ratio in which 15 vehicles would occupy 120m^2 (15x8=120), which is 6 times more (120:20=6) than the road area occupied by a bus as a vehicle of public urban transport.

These results show that the possibility of road congestion after the technological changes (telecommunications, informatization, changes in the quality and availability of vehicles, etc.) is now increased by more than 40 times, when speaking of the delivery of goods, and 6 times if we speak about the private shopping (and delivery of people and goods from the shopping centre home). Here we assume that the total area of roads in city X is denoted as X**pp**, as related to the area of vehicle X**pv** which occupy it. This means that if the area of all the vehicles at one moment on a single road were equal to the sum of vehicle areas, in that case we would have complete gridlock and the vehicles would stop moving. This means that at moment t**x**, when X**pp** equals X**pv**, there is complete gridlock on the urban roads.

We can now, at several levels, place into ratio e.g. the difference between the number of computers in time t**0** and t**1**, or the number of companies in time t**0** and t**1** or some other indicator of technological or economic changes with the result obtained by placing into the ratio the total areas of urban roads and the number of (e.g. delivery) vehicles, so that the comparison of ratios may be an indicator of the situation. Here the range from full availability of space (with no vehicles or X**pv**=0), over the availability of space taking into consideration the area of roads in an assumed city, at an assumed moment (X**pp** > X**pv**) to complete gridlock (X**pp**=X**pv**) has shown how much of the available space of roads has remained until full congestion.

4. DEVELOPMENT PLANNING POSSIBILITIES

Apart from the logistics systems, globalization is present in all the areas of living and therefore it also occurs outside the economic sphere. It can be seen in sociological, humanistic, natural-science, technical and technological areas, science, ecology, cultural and art manifestations, and elsewhere. For the globalization measure the economic effects are taken. Here the main principle is that the capital does not know limits and its expansion to the most profitable areas cannot be stopped thus bringing benefits first of all to the most developed, the richest and the biggest. This shows that the globalization is a world process in all areas and it cannot be stopped. In order to eliminate the increase of disparities, caused by the process of globalization there will certainly be corrections and/or radical changes in the future.

The globalization process has its quantitative and spatial dimension. The increase in the goods flows renders globalization a quantitative dimension, whereas space dimension, which supplements the quantitative one, has expanded not only beyond the state borders but also beyond continents, which means that the world economy has become one.

The globalization of the world economy is affected by the following factors: globalization of economy and mobility of capital, increase of competition, development and improvement of communication systems, development and improvement of transport systems, transport means, transport technologies and infrastructure, increase of purchase power and levelling of customer habits and customs.

As in all the economic branches, it also holds for the logistics that it has to use the “economy of scale” which reduces the costs per product unit and thus increases the competitiveness. Therefore, there is an increase in the concentration of the production in multinational companies that prevail on the world market. It is precisely with the intention of approaching the customer that the multi-national companies opened shops in the retail field all over the world.

In the conditions of fierce competition in some geographic areas the benefits are used such as: cheap labour, possibility of supply from close vicinity, customs and tax benefits, etc. The globalization trend which can act only with adequate logistic support is noticed in automotive industry, where all the bigger manufacturers in the world offer production-standardized and similar models. By taking over the overall development of individual automobile subsystems, entire production chains get adapted. Taking into consideration all the safety elements, the manufacturers have to meet the delivery deadlines on time. The requirement towards the manufacturers in this case is such that they adapt through their production units to the dynamics of the multi-national companies since some parts cannot wait for the delivery from remote destinations. There is something very similar occurring in the hypermarket chains where individual companies locate warehouses in the close vicinity of the shopping centres thus allowing "Just-in-Time" supply. The entire logistics process is thus placed to a lower, specialized level, which becomes a kind of a separate part of the system[4].

5. CONCLUSION

Owing to the significance of transport, transport logistics and implementation of information technology, the globalization has expanded to the area of traffic. The logistics and traffic giants continuously invest capital into the expansion of their own network which allows easier flow of goods. The globalization trends can be seen in all the transport modes, and in surface transport primarily among the forwarding agents, i.e. logistics operators. The goal of globalization has been clearly determined – faster overcoming of goods flows and thus enabling faster distribution of goods to the end customer.

This clearly shows the role of globalization in the planning of logistics and distribution processes. For a logistics company, namely, to have positive results in business and to be competitive on the market, the global planning of logistics and distribution processes is necessary, since partial planning provides only short-term and insufficient solutions.

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