Organization of multimodal transportation in logistics network

PROJECT PROPOSAL

THEORGANIZATION OF MULTIMODAL TRANSPORTATION IN LOGISTICS NETWORK

Abstract

Since the end of the 90th years of the twentieth century such disciplines as logistics and supply chain management began to gain popularity. However, managers have realized that not only well- regulated supply chain is a core successful factor, but also primordial organization of transportation’s scheme. This research’s aim is to discover a concept of multimodal transportation in logistics network by describing it’s features, obstacles faced while organizing it, methods and models applying for such type transportation. The proposed paper provides new results by examining different models and methods of decision making and the approbation of the most appropriate one. As a result it is expected to solve the problem of multimodal transportation organization for a certain company and to elicit the optimal route of supply chain in logistics network.

Key words : multimodal transportation, decision making solutions, supply chain organization, decision making model.

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Introduction

Logistics and supply chain management is a comparatively new scientific field which has been rapidly developing since the end of the previous century. Despite its development and maturity of the transport systems in the modern world as well as more and more developing information technologies in the sphere of cargo transportation, sometimes it is just impossible to deliver commodities from dispatch point to destination point. It is related with Russian realities, especially taking into account a geographical location of the Russian Federation and huge extension of the roads section. In this case so-called multimodal transportations come to the rescue. In respect that transport component is the highest one in total logistics costs (Christopher, 2016), the sphere of transportation is indispensable and should be paid attention to especially carefully.

Multimodal transportation is employed when the delivery by single vehicle type is unable. For instance, when point of dispatch or (and) destination are dislocated from main transport line. In this case other possible way of transport is applied in order to create completed supply chain and obey “ 7 rules of logistics”. Moreover, combined transport is used when door-to-door delivery is required, and in this case the union of marine/railway/air transport and automobile transport implementation is unavoidable.

Thus, the primary purpose of proposed research is to explore the concept of multimodal transportation in logistics network. Aforementioned aim eventually can be achieved by formulation and execution the following objectives:

1. determination of peculiarities and obstacles of multimodal transportation in Russian Federation and abroad;
2. determination of tendencies of multimodal transportation;
3. describing methods and models applying when supply chain designing and organizing;
4. examination of literature regarding multimodal deliveries and freight companies this implement;
5. approbation of one of the given approaches by the example of a certain company.

Hence, according to the primary goal and objectives, research question of this paper can be put forward as: “ How logisticians can organize multimodal transportation in logistics network and what is the economical effect of it for their enterprise? What is the role of multimodal mobility today?” These questions are explored and analyzed owing to the diversity of native and foreign literature sources, such as textbooks, periodical articles, different researches and companies’ cases. In order to answer these questions some analytical models are developed in this thesis for designing the different transport systems.

Professional significance of the given topic is undoubtable, as long as transportation is one of the driving and most significant questions considered

of organizing of supply chain, frequently creating competitive edge for the logistics company. For this reason to transportation within the general chain should be paid special attention, as at its optimal choice it is possible to reduce joint expenses and to achieve loyalty of consumers. Likewise, the giant amount of freight and passenger traffic is carried out thanks to multimodal transportation, what once more states its vitality.

So far as using models are quite infrequently applied for transportation problem, there can be faced some limitation at investigation. The limitation of the present study can be stated as the shortage of information and veritable data, complexity of some evaluations and small quantity of suitable cases.

In the context of the given topic the most important term is multimodal transportation, that means the single delivery owing to two or even more vehicle type for the same customer by one transport document (Waters, 2003). The purpose of such type of conveyance is to attain the combination of several transportation means, avoiding their drawbacks, for example, to combine low expenses of marine one with the most environmentally-friendly railway transport or high-velocity of air conveyance with high flexibility of automobile one.

The structure of proposal review can be represented this way: first of all the introduction of the topic where are the problem statement, professional significance, goal and tasks are disclosed. The main part consist of literature review, where core literature sources used in the study are briefly described and analyzed, and methodology, which covers the employed research

methods, conducted data and information about samples. Further, the anticipated results of picked tasks and conclusions gained in the proposed study were presented at the end. All references are introduced at the reference list.

Literature Review

The determination of multimodal transport

First of all, it is necessary to give a definition to term “ Multimodal transportation”. The concept of multimodal transport discussed in the following study was developed at Delft University of Technology (Van Binsbergen & Visser. 2001; Schaafsma, 2001), which will be extended to define and illustrate typical characteristics of multimodal transport in general. The definition of multimodal transport is that two or more different modes are used for a single transportation between which the commodities have to make a transit. This mode might be determined by vehicle type or by transport function (Van Nes, 2002).

In other sources, especially in foreign ones the term “ Combined” transport is used as well. For example, Frémont and Franc (2010) in their article, concerning this topic, state, that the combined transport is a transport where the major part of the journey is by rail, inland waterways or sea and any initial and/or final ways carried out by road.

As well as term “ multimodal” transport is employed, the “ intermodal” is also well-known. Intermodal transport is the transport of unitized loads by coordinated use of more than one transport mode so that the comparative

advantages of the modes are maximized and the transport chain is guided as one unity (Panayides, P, 2002).

Domestic transport and shipping companies one of the first in Russia, at the beginning of the 90th, have realized necessity of realization of the combined transportations of the foreign trade freights and creation of multimodal terminal systems of cargo movement. (Sergeev, Prokofieva, Lopatkin, 2005). Authors note importance and question relevance of development in Russia of the international transport corridors and what is more, of terminal complexes and the multimodal transport logistic centers in a zone of inclination to. According to authors, it is the most vital factor of creation of the transport and logistics systems integrated into a national international logistics system.

The advantages of multimodal transport

All the researchers and logisticians note the big amount of multimodal transportation’s advantages. First of all, the usage of several transport modes permits to gain the combination of different means of haulage, at the same time avoiding their drawbacks. For instance, it is possible to combine law costs of marine conveyance with high carrying capacity of railway transport or high-velocity of airway delivery with the flexibility of automobile transport (Waters, 2003).

Moreover, combined transport partially extends inland the economies of scale that are reached on the sea by giant vessels. That is why, even if the organizational complexity of combined transport is greater than the one of

single transport, the volumes handled by combined transport reduce costs on the inland transport leg (Panayides, P, 2002).

Moreover, a late investigation has shown that in the case of door-to-door transportation, combined waterway-road transport is responsible for 20% shortage of less carbon dioxide (CO2) emissions than road transport (Franc & Fremont, 2010). It demonstrates, that the usage of multimodal transport allows to apply more appropriate mode of haulage in accordance with eco-friendly idea. As example, it is presumably to avoid automobile’s vehicle (due to its negative impact on the environment) and implement into supply chain railway or waterway transport, which are more ecologically friendly.

Methods and models applied in multimodal transportation organization

There are many methods and models which are applied during multimodal delivery designing. More recently the verity of authors all around the world offers different approaches to solve the issue of making decision. Among these approaches there are such models as: analytic hierarchy process, the model of decision supportfor alternative choice, A DEA-like method, decision tree. All of the mentioned methods and approaches were described in proposed research.

First of all, method of analytical hierarchy of processes, which is the most widespread approach among methods of the multi-criteria analysis, will be described. This method is also known as Saati’s method all over the world and is wide used in math. It helps to pick decision and choose one, the most priority, scenario among all ones stated on the basis of creation of a matrix. He allows to count “ value” of each factor in the chosen scenarios and to

define the best alternative according to assessment of experts (Gogas, Papoutsis & Nathanail, 2014). In periodical articles it is one of the most popular approach, many authors pay attention to it and apply in their own discoveries. Concerning this article, there are three development scenarios, that helps to achieve better results to port of Thessaloniki, and the challenge of evaluators is to define the most appropriate one by means of decision matrix, priority vector, etc. The most ponderable disadvantage is quite high subjectivity of this method, forasmuch as the weights of various factors in scenarios are arrogated by experts with their own opinions and issue vision.

Both previous mentioned authors and Kabashkin with Lučina (2015) in their researching common work applied method of analytical hierarchy of processes in the context of transportation transit system. The object of their paper is to suggest the multiple-criteria approach for evaluation and choice the alternatives of cargo transportation in the large scale transportation transit system for the decision makers – cargo owners. Each of 57 alternatives (divided further into 7 clusters) is represented by the set of key performance indicators and set of parameters. There has been developed a two-level hierarchy system of criteria with ranging expert evaluations based on Analytic Hierarchy Process Method. The best alternatives were suggested according to this method.

The other wide used approach in management decision making is decision tree method. Brodeckiy (2004). in his article discussed problems of management of logistical risks in supply chain. The possibilities of implementation of method are considereddecision-making in the conditions of uncertainty, and also widespread approaches to risk management

withinclassical theory of risks. Use of suchmethod will allow to organize more effectively the corresponding business in logistics, to make it more competitive. In this research author use decision-tree approach, which assist to pick one the most appropriate solution in uncertainty conditions. This approach demonstrably indicates the likelihoods of all possible scenarios. This model, none the less, has an element of subjectivity during accounting. Moreover, every expert has their own issue’s and benefit’s vision, so in this case for several evaluators solutions can diverse.

Supply chain sustainability

Besides being indispensable and bringing stable economic benefits, logistics is undoubtedly also associated with considerable negative impacts on society and the environment from the related transport operations and infrastructure needs (Lu & De Bock, 2015). A big number of various researches and statistics attests to this factor, designating it by a huge issuance. Therefore, achieving deep cuts in the economic and environmental costs of European logistics will require more than the efforts of individual companies working in isolation. It will need to be reinforced by the collective action of groups of companies working together to share assets and services. If they do this, they will be able to harvest much of the so-called ‘ low hanging fruit’, which yields both economic and environmental benefits.

It cannot be denied that the transport system inflicts to environment serious damage. Transport is the only major sector of the economy that is responsible for growing percentage of total CO2 emissions. Most barges still use diesel engines which produce important emissions triggering a need to

find solutions to improve barge transport performances (Franc and Fremont, 2010). The road networks suffer from recurrent congestion, the accessibility of economically important centers is deteriorating, and the negative impact on the environment is considered to be too high.

That is why, recently one the most actual and popular factor of supply chain success is its sustainability. It is concerned of eco-friendly attitude to environment and social responsibility to society. In proposed paper was used the article, based on eco-oriented idea. The authors of it are Ji, Wu and Zhu (2016). This study addresses the issue of eco-design for transportation in Sustainable Supply Chain Management (SSCM). Data envelopment analysis (DEA) is adopted and extended to construct a model for this application. This proposed model, together with the tractable algorithm developed in this research, can provide stakeholders with a Pareto Optimal transportation strategy. This derived transportation strategy can help stakeholders realize certain transportation goals with less resource consumption and pollution emission.

Now in Russia the ecological logistics only begins to gain steam when in the western countries it is used for the benefit to society for a long time and quite successfully. However, it is worth mentioning, that not only foreign investigations are directed to eco-friendly development in logistics, but also Russians one as well. Abramova, Kuskova, Karpova (2014) in their common article reckon, that the modern logistics expands the horizons, set itself an environmental problem that is not less significant in the world. It is caused by the fact that 60% of air pollutions are necessary on vehicles which, in

turn, are the main material base of production relations between sites of a logistic chain.

Methodology

The methodology of every study research is determined in accordance with its problem and basic objectives. So far as this study paper is quite theoretical, the primary methods are going to be analysis and generalization of accessible literature sources concerning stated topic, statistical analysis, case study and quantitative comparison.

The first method is understandable enough: it poses examination of plenty of information material, its summary and describing within the framework of the given study. This method will be used in the first and in the second chapters of the study. At the beginning information about logistics as science will be included, along with framework of multimodal transportation and its features and issues. Then, in the second part, the data respecting approaches applying in this sphere will be disclosed. It is the only method that is vital for every investigation, however it can face several difficulties such as lack of information and statistical data, non-accessible data regarding focus company.

By the way, the information about focus company that is suggested to be used in the proposed paper can be found in the Internet and this company’s own web-site. As well as their mission, values and priorities (that are useful at model approbation and the last chapter of research), other extra data can be applied. It is anticipated to find a real case concerning the topic wherever possible. Case study is one of the most helpful method of study, because it

helps to observe a real situation with its challenge and to examine pros and cons of any phenomenon.

Not only the description, but also the comparison of chosen data is inclusive in this study. In particular the models and methods of decision making are going to be contrasted. The main approach, that will be employed in the practice (analytical hierarchy of processes) is going to be analyzed especially clarified.

During approbation of analytical hierarchy of processes required evaluations will be carried out. According to final results some suggestions and recommendations will be expounded and can be adopted by other companies.

Anticipated Results

The proposed study is anticipated to correspond with all set objectives and central purpose of research. It is expected to depict not only the peculiarities and problematic points of multimodal transportation in different regions of the world, but also its trends and approaches applied during organizing the supply chain. Among all existing approaches only one will be approbated by empirical way in the example of a definite enterprise.

This paper is suggested to implement analytical hierarchy of processes method in order to identify the most appropriate (the most economically and stably expedient) route for one multimodal delivery. Unfortunately, for the time being the points of dispatch and destination are still unknown, but presumably it is going to be the routing between Russia and Europe. The

parameters of this “ perfect” rout are: costs, duration, sustainability (an impact on social and environmental aspects), complexity. As a result of the study this appropriate optimal way will be indicated, counted and recommended to organizations that support the same priorities and values that have been embraced by aforementioned method in the given research paper.

Conclusion

By and large, the conceptual framework of multimodal transportation was developed in this research paper by its itemized description. The primary problem concerning multimodal transportation and its influence on companies were demonstrated, in light of the above it was found that this type of haulage had a big quantity of benefits. Among them there are: the possibility to provide door-to-door delivery, the simplification of material flow transportation and organization, insurance and packing costs drawdown, more streamlined and instant cargo handling, the option of more unstressful routes of conveyance, and so on.

The main research questions dealt with main thesis were indicated and now can be briefly summarized. First of all, the peculiarities of multimodal transportation were demonstrated, inter alia of which the principal one is the single delivery by two and more transport vehicle. Then, the main obstacle at combined haulage fulfillment is quite low level of technical facility in transport hubs and nodes, especially it relates to railway cargo station in Russia. In addition, here subsists the problem of different delivery subject’s

scarce cooperation and low concernment of transport operators in some aspects of delivery.

As for tendencies of multimodal transportation, here are remarked the following: predominance of container cargo (what is quite accountably, because exactly this unified cargo unit assist in uninterrupted moving of material flow), development and implementation of IT-technologies not only in cargo handling process, but also in custom clearance and interaction with customers. One more observable trend in modern logistics (particularly in multimodal delivery) is eco-friendly oriented strategies and company’s values, that lead to creating of sustainable and society responsible supply chain.

Further, in this investigation basic models and methods applying in supply chain projection were indicated and described. Among them are: analytic hierarchy process, the model of decision support for alternative choice, A DEA-like method, decision tree. The very first one was approbated in practice in the last chapter of proposed paper. As result, the appropriate (the optimal) scheme of supply chain was gained and counted.

For realization of analytic hierarchy process model, it is required to set some parameters that have an impact on eventual choice. These parameters that define the supply chain organization depend on the focus company’s values and priorities, that can distinguish for various ones. Some companies are interested just in costs reduction, therefore low price of delivery prevails for their business, while for other organizations the top priority is high level service, so their alternative is the other. There are some enterprises, for

those friendly attitude to environment is preferable, that is why their choice falls on sustainable, ‘ green’ supply chain.

Thus, thanks to the ability of multimodal haulage to combine different ways of transport, it becomes possible for logistics companies to design and organize their own supply chain in accordance with their mission and values. In conclusion it is pertinently to point, that all evaluations were predominantly made in view of transport’s aspect, not taking into account other functional spheres of logistics. This can be reflected in future investigations.

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