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Logistical Costs Minimization for Delivery of Shot Lots by Using Logistical Information Systems

Irina Makarova[a], Ksenia Shubenkova[a]*, Anton Pashkevich[b]

[a]*Kazan Federal University, Syuyumbike prosp, 10a, Naberezhnye Chelny 423812, Russia*
[b]*Tallinn University of Technology, Ehitajate tee 5, Tallinn 419086, Estonia*

Abstract

The article considers the possibility to reduce logistical costs using optimization of the supply chain management with the help of a decision support system. It was shown that the implementation of such systems at the transport companies allows to choose the best available options of transport route and mean of transport. It concerns in the first instance enterprises, which have an extensive dealer network and focus on deliveries of shot lots on delivery routes. The developed algorithm to make a reasonable management decision concerning the choice of route and delivery schedule gives an opportunity to manage optimally a vehicle fleet and to reduce idle runs.

The optimization of delivery routes is based on the minimization of fleet usage, their total run and standing time as well as takes into account traffic intensities on road sections. It allows also to reduce transport load on the road network, which leads to improve ecological situation in the city. The model for the city of NaberezhnyeChelny was built and tested within the scope of research. Its implementation gives a possibility to correct proposed routes in such a way as to avoid "problem" parts of road network.

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Keywords: supply chain management, delivery route, delivery schedule, decision support system

* Corresponding author.
E-mail address: ksenia.shubenkova@gmail.com

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1. Introduction

Producers and suppliers of essential goods require specific development strategies to work in the sharp competitive environment. These strategies must allow, on the one hand, to reduce expenses and, on the other hand, to find reserves how to increase profitability of production and delivery processes. The cost saving means not only tariff reductions, but also a rational management of logistics operations taking into account problems of socio-economic development as well as ecological safety and road safety in the cities.

To make a correct assessment of logistics expenses it is necessary to go deeper inside the transportation process: to analyze means of transport, processes of raw material supply and production distribution, optimization of technological processes, coordination with other modes of transport, etc. This is due to the fact that potential for optimization assumes the unity of purpose for all process actors, which have sometimes conflicts of interest among them.

As far as transport costs create always the largest part of logistical costs, to improve economical effectivity of processes at the company is possible by reducing empty legs by product delivery, effective usage of vehicle fleet, building of new more rational transport routes as well as implementation of logistical information systems (LIS) (Dondo and Cerdá, 2015).

Classics of integrated logistics, Bowersox and Closs (2013), pointed out rightly that firms with advanced logistics systems take the view that it is cheaper to search optimal solutions using information than to carry out non-optimal shifting of stocks.

The data management in LIS provides all kinds of operations, which are necessary to execute a transportation order, to control all activities and to assess their efficiency. Furthermore, one of the main LIS functions is routing and generation of a transportation plan. This function is realized most frequently using analytical modelling as well as simulation technique.

2. Existing solutions to optimize delivery routes of shot lots

2.1. Special aspects and functional requirements to organize a carriage of shot lots

A solution of the routing problems is especially important today taking into account that around 80% of all cargo turnover are carriages of shot lots transported by delivery or gathering and delivery routes (Patila and Divekarb, 2014). To plan a transportation of small lots, it is necessary to have in mind their following characteristics:

- Time to carry out loading-unloading operations is essentially bigger than driving time
- Driving time depends on traffic intensity and capacity of road network sections, which are used by route
- Coherence and performance of cargo delivery are essential
- Restrictions related to compliance of ecological and noise standards could appear for the period of transportation.

In addition, the route must be built in such a way that utilizations of vehicle kilometrage and capacity are maximal. It is also necessary to endeavor to realize transportation with the minimal amount of vehicles used.

Problems to plan transport of shot lots are referred to the class of discrete optimization tasks. Such problems allow finding the best possible option with the help of the simple search method, which demands often extensive resources due to the large amount of feasible solutions. Existing approaches of directed search for the reasonable and efficient management decision making requires carrying out computer-based experiments.

2.2. Research works and studies in the field of routing

Building of transport service model is based on rational transportation routes and delivery schedules (time schedules or timetable), i.e. routing. The history of routing problems starts more than half a century ago. The first work dedicated to this topic was published by Dantzig and Ramser (1959). In this research paper the group of tasks was formulated, which later was called Vehicle Routing Problem (VRP).