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Application of the Logistics “Just in Time” Concept to Improve the Road Safety

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Abstract

The paper examines correlation in planning and organizing logistics of supplying goods and the issue of safety at urban roads; a model to determine the time of goods delivery is proposed on the basis of logistic concept “just-in-time” that takes into account the requirements of road safety on the one hand, and the customer-oriented approach of delivery, applied technologies and management solutions, on the other. The model is based on an integrated approach to the management of logistics processes; it can serve as a basis for decision making among departments in transport enterprises, logistics departments at industrial and trade enterprises, and corporate consumers. The paper also proposes to add the second level parameters to the system of logistics key performance indicators (KPI); these parameters would allow evaluating the target performance in goods transportation, as well as actual performance of logistics operations, including transportation in terms of road safety.

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Keywords: transportation planning; model of “just-in-time” delivery; logistics KPI; road safety; logistical risks

1. Introduction

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Transportation is one of the key functions of logistics aimed at supplying goods to production and trading companies, as well as to end customers (delivery of goods to final consumers has become highly popular with development of e-commerce). Consumers all around the world choose just-in-time delivery of goods with ever increasing frequency, opting for more experienced and reliable logistics operators [Ben-Daya and Akram (2013)]. Late arrivals cause idle periods leading to the growth of overhead expenses. There is a condition in the segment of delivery to end customers that implies that the customer does not pay for shipping if it is performed in violation of contractual terms. Manufacturing enterprises suffer significant losses if goods are delivered late; and operators missing delivery terms are absorbing significant penalties, the amount of which depends on delay time. Logistics operators, ports and freight station that apply queue management technology for arriving vehicles start using timely slot coordination more frequently, when a vehicle should be served at a specific time window. Late serving of a car for loading results in increasing the costs by transport enterprises.

All above underscores the significance of the issue of just-in-time through the supply chain set up to deliver various goods to serve different types of customers. However, one of the main issues in applying this approach deals with meeting the "just-in-time" delivery condition which poses restrictions on movement of trucks, and which depends on traffic intensity on city streets, road works, etc. As a rule, transport logistics managers and customer service managers often do not take into account these factors when they plan deliveries working in an unorchestrated manner. This implies a consumer service manager negotiates the delivery time without taking into account an actual possibility of goods delivery up to designated time, while logistics workers should execute the order in time to avoid fines caused by delay, downtime of vehicles, costs, public image penalty and potential loss of customers. Attempting to deliver the order by exact time causes different traffic violations: overspeeding, incorrect lane traffic, red lights running, etc. Thus, improper planning of "just-in-time" delivery becomes a reason for deteriorating economic results and compromised traffic safety.

The purpose of the study is to develop complex models allowing for delivery planning in accordance with the logistics concept of "just-in-time" delivery taking into account the factors affecting traffic safety. A set of these models would enable considering traffic safety at the stage of calculation of delivery time. The models would allow being more precise in determining the delivery onset, taking into account the probability (risk) of delivery just in time and enabling including the delivery safety factors into the key performance indicators. The models allow generating solutions that would reflect an integrated approach to delivery management in urban conditions that would serve a basis to coordinate transport operators, logistics departments of manufacturing companies, trading firms and consumers of goods to be delivered.

2. Main text

Today the concept of "just-in-time model" is considered in relation to the logistics cycle, whether it is a cycle of delivering materials and parts to production sites or delivering finished products to shops in a city. The requirement of "just-in-time" delivery significantly modifies the principles of consumer order management, including delivery of goods. First of all, it is necessary to investigate composition of the cycle at the stage of "just-in-time" delivery model development in order to find out correlations between its components and the main points of control. The in-city delivery cycle is characterized by transportation routes: these can be commuting routes on a "one to one "basis or belt routes (deliver around, pick up, or pick up - delivery) on the basis of "one to many" delivery scheme. The route includes such components as loading, movement between the loading and drop-off points (a belt route can have several components of this kind), and drop-off. The goods delivery time also depends on how the work is organized between suppliers and consumers, on the working hours, including the time of receipt of goods, duration of breaks, etc.

The issue of time calculation for logistics chains in whole [Lukinskiy et al. (2014)], [Lukinskiy et al. (2012)] and in-city goods delivery has been worked out through simulation. The result takes into account duration of separate components of the delivery cycle [Pletneva et al. (2009)]. On the other hand consideration of factors of interaction of transport organization and traffic security has not been studied in detail. Let us take the time of delivery to the k point for a delivery-around route option as an additive model: