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OPTIMIZING THE OPERATION OF STATIONS OF DEPARTURE AND DESTINATION OF GOODS

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For the last decade, the volume of freight has reduced by 35% with an average annual freight transportation decrease of 4.5%. In the midst of such indicators, there is the infrastructure overload on certain directions, especially wagon traffic to the ports and Western borders of Ukraine. This leads to delays in freight delivery.

The main difficulties arising during freight transportation organization are caused by the shortage of technically fully operational wagons as well as tractive rolling stock in due time. This leads to the “first mile” effect. The analysis of the elements of wagon operation has shown that the majority of time is spent when the rolling stock is at the unloading station. The experimental studies have proven that in almost 70% of cases there is an excess of the normative time of stay at the destination station, that is, there is the “last mile” effect.

The analysis of scientific works and research of the planned and actual performance data of rail transport has proven the existence of a significant discrepancy between these indicators.

For this purpose, in the paper, the technological process of wagon traffic on directions has been formalized with regard to the effect of the “first and last mile”, where the cost of transportation dramatically changes, that is, fines imposed on the railway in connection with non-compliance with the delivery terms. This has been done in the form of an optimization mathematical model with the possibility to determine the financial risks. The target function of the model represents the total operating costs and is based on the use of the Lebesgue-Stieltjes integral with the variable upper boundary of the time when wagons stay on the “first and last mile”, which reflects the nature of uncertainty at these stages of the transportation process. That is, time is a variable that can be controlled. Thus, a stochastic programming model has been obtained.

The formed model is universal and with the feedback provided it enable to control the transportation process with the least operating costs of the railway. In addition, the model takes into account the costs associated with freight transportation risks, which can amount to several dozens of percent of the full value of the cost.

The determined approach to the search for the optimal solution for the organization of wagons operation is the basis to form the automated wagon traffic control technology.

The practical value of the work consists in developing the technology of automated wagon traffic control on the main transportation directions, which enables to take informed reasonable decisions concerning the rational use of railway transport objects with minimal operating costs and eliminating delays in the transportation

process. The suggested procedure for optimal transportation parameters management takes into account the effect of the “first and last mile”, as well as the probability of financial risks in the wagons traffic in case of non-compliance with the terms of freights delivery. Due to the efficient organization of transportation processes at the corresponding divisions of wagon traffic, the freight cost of the railway is reduced by approximately 10% compared to the current methodology of determining the actual cost of freight.

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CHANGES IN THE LOGISTICS OF THE EXPORT OF UKRAINIAN GRAIN

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The Ukrainian economy is largely dependent on international trade. In 2018, exports of goods and services accounted for 40.7% of the country's GDP, and imports, respectively, for 41.9% of GDP (Minfin, 2021). These indicators are much higher than the world average. Ukraine, being one of the key players in the global agricultural market, provides export deliveries of significant volumes of food. For example, the average annual total export for the last pre-war 3 seasons of only four key commodities – corn, wheat, sunflower oil and sunflower meal – is estimated at 58.1 million tons, which is more than 14% of the total world export of these goods. Moreover, for corn and wheat, the average annual share of Ukrainian exports in total world trade is estimated at 15% and 10%, respectively (in 2022). Over the past few years, Ukraine has been demonstrating a consistently high increase in the volume of gross grain harvest and is strengthening its importance both in the Black Sea region and in the global market. At the same time, seaports of Ukraine are an extremely important transport road for Ukraine to world markets. More than 60% of Ukrainian exports took place through seaports. Ukrainian seaports were able to handle 250 million tons of cargo annually.

In 2022, at the beginning of the war, grain transportation almost stopped. This raised fears of a food crisis around the world and led to a sharp rise in prices. Meanwhile, the Ukrainian authorities find a solution and set out to change the logistics of cargo flows towards the European Union. Most of Ukrainian exports have been transported by rail towards European ports across borders with neighboring countries such as Poland, Romania, Moldova, Slovakia and Hungary. The volume of rail traffic through the western border crossings in 2022 increased significantly.

However, not only Ukraine had to face a number of problems when changing logistics routes towards the western borders and blockade of seaports. Such changes affected the international market, our state, maritime transport and, of course, railway. There was a shortage of agricultural products on the international market in at least 10 countries, the growth of world prices for agricultural products began, food