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Major Aspects of the Customs and Logistics System Development in the Eurasian Economic Union

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Abstract. For the further development of a single transport area, an increase in the export of transport services, the development of the transit potential of the EAEU member states and economic integration, special attention should be paid to improving transport, customs, and logistics infrastructures.

The study examined the integration problems of the Union transport area elements such as places that are close to the state border of the EAEU member states, customs infrastructure, transport and logistics infrastructure, customs and logistics infrastructure. The authors consider the principles of customs, logistics and system analysis to be the fundamental basis for the organization of the customs and logistics system.

From the standpoint of logistics theory, the EAEU is considered as a macro-logistical system. Logistics models and methods regarded as tools for solving key development tasks of the EAEU single transport area make it possible to identify the main problems of the customs and logistics systems of the EAEU member states and to develop measures to improve interaction models of customs authorities and foreign economic activity participants.

1. Introduction

Customs infrastructure is a combination of buildings, structures, premises, open areas equipped with technical means of customs control. It also includes engineering, information, telecommunication systems and means of their support (elements of customs infrastructure) and social facilities providing activities of customs authorities [2]. So, the Eurasian Economic Commission defines the following objects of customs infrastructure as follows [3]:

- crossing points (check points);
- temporary storage warehouses;
- customs warehouses;
- free warehouses;
- buildings, structures and technical means for the operation of state control authority.

In the wording of the order of the Federal Customs Service No. 1221, the customs infrastructure includes customs and logistics complexes, stationary technical means of customs control, customs

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laboratories, temporary storage warehouses and customs warehouses established by customs authorities, as well as administrative buildings, information systems, information and communication networks, customs computer centers [4]. The same document contains the concept of transport and logistics infrastructure which is defined as a technological complex for organizing the movement of goods and providing transport and logistics services including:

- railway and inland waterways;
- car roads;
- tunnels, overpasses, bridges;
- warehouse and container terminals;
- transport and logistics complexes;
- buildings, structures, devices and equipment that ensure the functioning of the transport and logistics infrastructure [4].

The above documents show that the customs infrastructure facilities for research purposes are an element of the EAEU logistics system, and, according to certain criteria, belong to the facilities of both the customs and logistics infrastructure. So, a warehouse is an object of logistics infrastructure. In addition, a temporary storage warehouse with a dedicated customs control zone (hereinafter - TSW) refers to the objects of customs infrastructure. In this regard, we note that the customs - logistics infrastructure is in operation.

The single transport area is seen as a set of transport systems of the EAEU member states that ensure the barrier-free movement for passengers, goods, vehicles and their technical and technological compatibility based on the harmonized legislation of the member states in the field of transport [1].

Evaluation of the logistics tools use efficiency in the development of the customs and logistics infrastructure of a single transport area of the EAEU member states is considered on the basis of the Data Envelopment Analysis (DEA) method [18-19].

2. Relevance, scientific significance of the issue with a brief overview of the literature

Compilation of numerous studies made by foreign scientists such as Donald J. Bowersox, David J. Closs, Christopher M., Lyons K., Gillinham M., Leenders M.R. , Fearon H. E. , Waters D., Harrison A., Remko Van Hoek, Chase R., Axsater S.., Ballou R., and others made it possible to identify the results of applying the logistics approach in various fields. The results are as follows:

- stock reduction by 30-50%;
- time reduction of production flow by 25-45%;
- reduction of repeat warehouse traffic by 1.5-2.0 times;
- reduction of road transport costs by 7-20%, railroad – by 5-12% [6].

Russian scientists, for example, Anikin B.A. and Tyapuhin A.P. [7] proved the relevance of the logistics approach for Russian enterprises. Numerous studies are focused on the application of the logistics approach in functional areas including production, supply, distribution, in environmental projects, for example, in [8], as well as maintenance and repair of social facilities [9] and others.

However, the integrated application of logistics tools for designing, optimizing the placement, functioning and managing the customs and logistics infrastructure objects has not been sufficiently studied. Only fragmentary studies on the use of tools with respect to individual objects, functions and operations were found in the available sources. So, in paper [10] Berezkina N.N. structured methods and models of applied theory of logistics with respect to operations in the supply chains of foreign trade goods. In [11], the possibility of using elements of mass service theory to optimize the staff size at customs offices was shown. The adaptation of one of the key logistics models, the Just in Time model to customs operations and customs control, as well as the calculated dependencies for the application of time-slotting technology at bonded warehouses and customs - logistics terminals have been presented in the monograph [12]. Summarizing the above, we should underline the need for further research on the use of logistics tools in the development of the customs and logistics infrastructure of a single transport area of the EAEU member states.

3. Problem statement

Consider data on the number and performance of individual objects of the EAEU customs and logistics infrastructure (Table 1). The presented data testify to the uneven development of the objects of the customs and logistics infrastructure of the EAEU member states, which is due to both objective and subjective factors. The objective factors include, in our opinion, the geographical location, the size of territories and the period of integration into a unified EAEU system.

Table 1. Number of checkpoints in EAEU states - members (according to 01/01/2018).

Type of checkpoint	Number of checkpoints				
	Republic of Armenia	**Republic of Belarus**	**Kyrgyz Republic**	**Republic of Kazakhstan**	**Russian Federation**
Automobile	4	25	9	15	117
Railroad	1	15	4	5	50
Air	2	7	2	15	86
Sea	-	-	-	2	69
Combined	-	-	-	-	11
River	-	3	-	-	2
Lake	-	-	-	-	1
Pedestrian	-	2	-	-	2
TOTAL	**449**				

As you can see in Table 2, the turnover of goods is significantly different.

Table 2. Dynamics of cargo turnover at EAEU external border checkpoints (according to 01/01/2018 [3]).

Type of checkpoint	Cargo turnover, mln tons				
	Republic of Armenia	**Republic of Belarus**	**Kyrgyz Republic**	**Republic of Kazakhstan**	**Russian Federation**
Automobile	4,58	26,02	3,59	1,176	24,824
Railroad	0,795	84,76	1,2	44,3	162
Air	0,029	0,0125	0,065	0,037	0,813
Sea and river	-	-	-	1,16	580,126

In addition, another pressing issue that needs to be addressed is the high time parameters of processing goods and vehicles at the EAEU external border check points that significantly exceed those in the EU, US and others (statistical data of the Doing business 2018 based on the World Trade International indicator according to the World Bank (Table 3)) [13].

In general, the EAEU member states according to the International trade indicator are ranked as follows:

- Republic of Armenia - 46th;
- The Republic of Belarus - 25th;
- The Republic of Kazakhstan - 102;
- Kyrgyz Republic - 70th;
- Russian Federation - 99th.

Table 3. Time parameters for customs and border operations at EAEU checkpoints [13].

Country	Time to export: border and customs control (hours)	Time to export: processing documents (hours)	Time to import: border and customs control (hours)	Time to import: processing documents (hours)
Republic of Armenia	39	2	3	2
Republic of Belarus	5	4	-	4
Republic of Kazakhstan	105	128	2	6
Kyrgyz Republic	5	21	72	36
Russian Federation	66	25.4	30	42.5

It is obvious that time indicators in all countries are different, however, for full integration within a single customs area, it is necessary to reduce all indicators to a single value. The development of a Single Window mechanism, automatic registration systems and automatic release of goods, a preliminary information system and other modern information technologies is currently ongoing. In our opinion, special attention should be paid to the implementation of scientific research, in particular, the logistics theory in order to optimize the functioning of the customs and logistics infrastructure at both the external border and inside the EAEU.

4. Theoretical part

To minimize the risk of errors in the development of plans for modernization, reconstruction, technical re-equipment, as well as to optimize the technology of International Automobile Border-crossing Point (IABP) and, as a result, reduce time and financial losses for both the participants of foreign economic activities and the state, it was proposed to use simulation modeling (SM) in [10]. The complex of technological impacts related to the processing of goods and vehicles when entering the customs territory can be represented in the form of an enlarged standard scheme of operations (customs, border, transport, etc.) performed by state control authorities.

Technological scheme is characterized by the presence of causal relationships, time parameters of the behavior of the components. Discrete-event or process-oriented simulation implemented in the AnyLogic environment makes it possible to describe all the components of the process.

The time of operations carried out sequentially one after another depends on the FEA participants' observance of prohibitions and restrictions established by customs legislation. Thus, it was identified that the technological scheme is characterized by the presence of causal connections, time parameters of the behavior of the components, the study of which is rather labour-intensive.

However, this is possible due to modern developments in the field of logistics solutions support. One of these developments is the software product AnyLogic which allows one to create models of varying complexity.

Thus, a discrete event model for customs and logistics operations has been demonstrated on the example of operation at one of the check points [10]. The parameters were set according to the expert data collected through a survey of FEA participants.

The model (Fig. 1) is a structural diagram that consists of elements - active objects that build the flow graphs simulating customs and logistics operations [10].

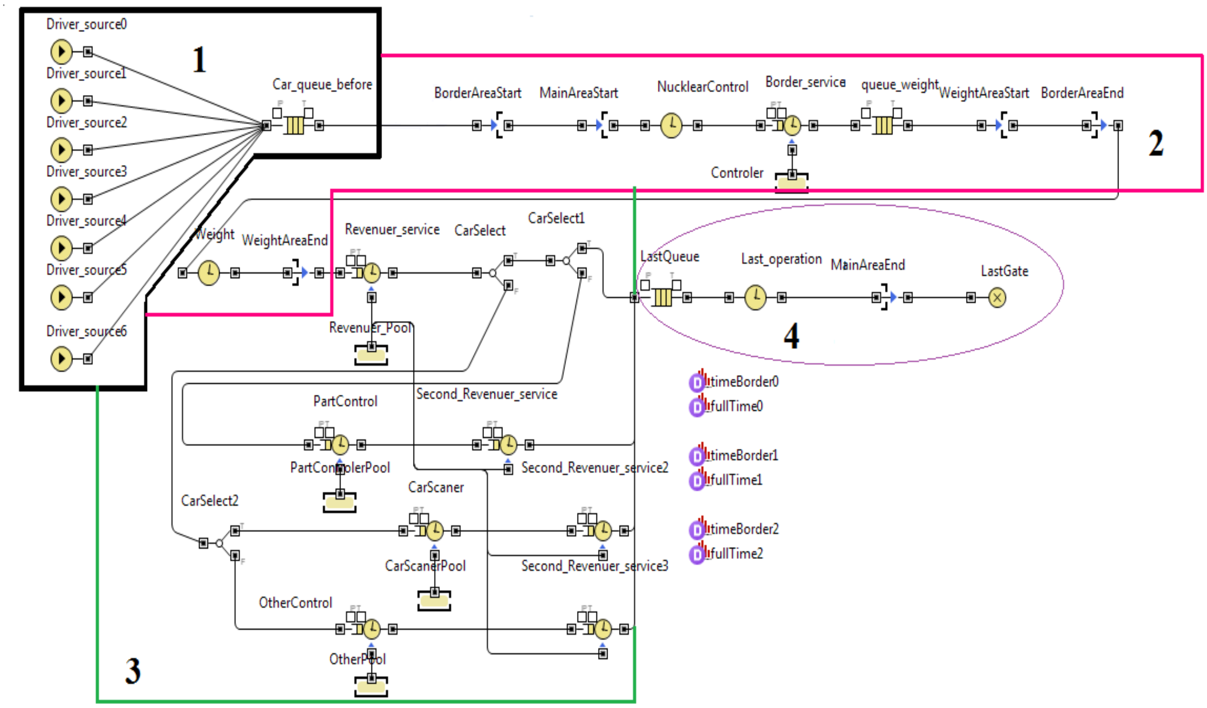

Figure 1. Simulation modeling of customs and logistics operations at an international automobile checkpoint for entry into the Russian Federation implemented in the AnyLogic environment [10].

AnyLogic allows one to obtain preliminary information for further decision-making on possible ways to increase both the capacity of checkpoints without financial costs and compliance with the requirements of ensuring the national and economic security of the state.

The risk of errors in making final decisions depends on the depth of the model development including the reliability of embedded time parameters that optimize the functioning of the model [10, 21].

5. Practical significance

The aim of the study is to determine the most effective approach to increase the capacity of checkpoints without financial costs, on the one hand, and compliance with the requirements of ensuring the national and economic security of the state, on the other hand. Individual parameters corresponding to specific operations were set for the model objects.

For example, for vehicles arriving at an International Automobile Border-crossing Point (IABP) for the implementation of customs and logistics operations, the parameters of the imitation model of IABP are as follows:

- intensity of cars arriving at the checkpoint;
- number of stops on the territory of the checkpoint due to the ongoing customs and logistics.

The resource support of IABP includes the following:

- - number of customs officials responsible for customs and transport control;
- - number of corridors organized in the customs control zone at the checkpoint.

To achieve this goal (determination of the most effective way to increase the throughput of checkpoints), the Data Envelopment Analysis (DEA) method [18–20] was used. To construct the base CCR model of the DEA method, the output parameters Yn and the input factors Xn were identified (Table 4, Fig. 2).

Table 4. Input factors and output parameters of IABP model.

IABP object	Number of stops	Intensity of arriving cars at the checkpoint, car/min	Number of customs officials	Number of corridors
	X_1	X_2	Y_1	Y_2
1	2	0,78	9	2
2	2	3	8	2
3	2	1,8	7	2
4	2	0,3	9	4
5	2	0,3	8	4
6	2	0,3	7	4

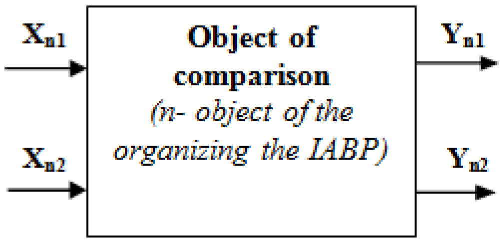

Figure 2. Evaluation Model of organising the IABP.

Input factors (Xn) of the model for evaluating the IABP include the following:

- number of stops on the territory of the checkpoint due to customs and logistics operations (X1);
- intensity of cars arriving at the checkpoint (X2) that negatively affect the throughput of IABP.

Output parameters (Yn) of the model for evaluating the IABP that positively affect the throughput of the IABP include the following:

- number of customs officials responsible for customs and transport control (Y1);
- number of corridors organized in the customs control zone at the checkpoint (Y2).

Table 5. Assessment results of IABP model by DEA method.

IABP object	DMU	Score	X1 {I}{V}	X2 {I}{V}	Y1 {O}{V}	Y2 {O}{V}	Bench-marks	{S} X1{I}	{S} X2{I}	{S} Y1{O}	{S} Y2{O}
1	1	100%	1	0	1	0	2	0	0,48	0	2
2	2	88,89%	1	0	0,89	0	1 (0,35) 4 (0,54)	0	2,23	0	0,86
3	3	77,78%	1	0	0,78	0	1 (0,18) 4 (0,60)	0	1,08	0	0,76
4	4	112,5%	0,82	0,18	1,12	0	5				
5	**5**	**100%**	**0,95**	**0,05**	**0**	**1**	**1**	**0**	**0**	**0,69**	**0**
6	6	100%	0,95	0,05	0	1	4 (0,68) 5 (0,32)	0	0	1,68	0

Measuring effectiveness in the CCR-model for compared IABP objects is achieved by optimal weighted ratio between the output parameters involved and input factors. According to the rules of DEA method application, an effective IABP object that provides the highest throughput of the checkpoint has parameters that correspond to object No. 5:

- number of stops at the checkpoint - 2;
- intensity of arriving cars at the checkpoint - 0.3 cars / min;
- number of customs officials - 8;
- number of corridors organized in the customs control zone at the checkpoint - 4. (Table 5).

6. Conclusions

In the past decade, the concept of integrated logistics has been actively developed and used for the end-to-end management of the main and additional flows in an integrated business structure. Moreover, these issues are considered within the framework of intra-company integration and cooperation, whereas we should speak about the integration of logistics functions and operations in the supply chains as a whole, that is, optimization not of specific links but the whole chain (Table 6).

Table 6. Models and methods for optimization of location, construction andoperation of checkpoints [14].

Tools	The appropriate field of application
Just in time	Meeting deadlines at checkpoints. Compliance with AETR. Compliance with the delivery time (including customs transit).
Decision making models	Search for ways to eliminate inconsistencies
Decision tree	Structuring and defining key decision options
Mass service theory	Determining the optimal number of state officials at the checkpoint
Models of choice	The choice of the optimal route of transportation with respect to the customs border crossing (check point).
Forecasting methods	Traffic forecast for optimal planning.
The Six Sigma Theory	Changes in the degree of deviations in the service quality of cargo traffic at checkpoints
Methods of simulation and economic - mathematical modeling	Simulation of time operational parameters at checkpoints. Modeling the parameters of organizing the checkpoints.

In addition, issues of establishing an adequate analytical toolkit — a set of models and methods that provides an objective assessment of opportunities and prospects for development based not on hypotheses but on calculations — still remain topical.

In general, the implementation of the logistic approach in the supply chains of foreign trade cargo will help reduce logistics costs by increasing the IABP capacity.

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