FORMALIZATION OF QUALITY IMPROVING TASK FOR GOODS OF CUSTOMS CONTROL

JONIBEK USMONOV & ZIYODA PULATOVA

Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Tashkent, 100200, Amir Temurstreet,

108

ABSTRACT

The task is formulated to improve the quality of customs control of goods transported by rail, as a multicriteria optimization problem, number of restrictions on variable parameters are introduced, as the objective function, minimization of total costs is chosen, i.e. Waiting time for the customs post to make a decision on the release of goods, as well as minimizing the total labor of inspectors at a given time interval for the functioning of the customs post.

KEYWORDS: Information-Logical Model; Mathematical Model; Customs Inspection; Customs Control; Customs Posts; Customs Services

Received: Nov 30, 2019; **Accepted:** Dec 20, 2019; **Published:** Jun 30, 2020; **Paper Id.:** IJMPERDJUN2020264

INTRODUCTION

The tasks of improving the quality of customs services by improving the load management of the customs inspector are an initial step in the process of developing the information-logical model of the system. The next stage involves the construction of a mathematical model.

In view of the contradictory nature of the task of improving the quality of customs services and the need to find a balance between the requirements of the state and the inspectors of customs services, it is the task of multicriteria optimization.

Statistical analysis of the customs control process at the selected customs post. Prediction the flow of goods (feed GD).

Modelling of the process of customs control of goods. Determination of the rational number of inspectors.

Optimizing the workload on inspector productivity, taking into account the preferred work schedule.

Figure 1: Steps to Solve the Task of Improving the Quality of Customs Control of Goods.

METHODS

For a detailed discussion, we declare the following variables: n - the number of customs inspectors of the i^{th} group, which started working in the j^{th} time interval of the customs post, people; $Tsis^2$ - Processing time for goods declarations (GD), including the waiting time for GDs in the queue for registration and customs control, hour. [1]-[3] The variable is an integer n'_{ij} and takes values belonging to the set of positive integers (1)

$$d_{ij} \geq 0, \quad n'_{ij} \geq 0, \quad n'_{ij} \leq n_i, \quad n' \in N \quad 1 \leq n_i \leq N_i, \quad n \in N \quad (1)$$

The variable $Tsis^2$ is continuous, taking the values of positive real numbers (2)

$$Tsis' > 0, \quad Tque \geq 0, \quad Tserv > 0, \quad Tsis', Tque, Tserv \in R \quad (2)$$

It should be noted that the inspectors of the customs clearance department are divided into I groups to account for qualifications and average labor productivity, depending on work experience. The level of experience corresponds to the position. There are three positions in the customs inspection and customs control department of customs posts: State Customs Inspector (hereinafter - SCI), Senior State Customs Inspector (hereinafter - SSCI), Chief State Customs Inspector (hereinafter - CSCI). The highest post of CSCI corresponds to the most experienced civil servants performing customs operations.

Mathematical formulation of the research problem includes two objective functions

$$\sum_h^H \sum_j^J R_{hj} Tsis'_{hj} \rightarrow \min \quad (3)$$

$$\sum_j^J \sum_i^I d_{ij} n'_{ij} \rightarrow \min \quad (4)$$

And system limitations [4]

$$\sum_j^J \sum_i^I q_{ij} d_{ij} n'_{ij} = \sum_j^J \sum_z^Z V_{jz} k_{jz} + \sum_j^J \sum_z^Z V'_{jz} k_{jz} F_{jz} \quad (5)$$

$$F = f(j, t), V' = f(j, z), q = f(i, z) \quad (6)$$

$$\sum_j^J \sum_i^I d_{ij} n'_{ij} c_i \leq C \quad \sum_j^J d_{ij} \leq L \quad (7)$$

$$Tsis' = Tque + Tserv \quad Tque \leq T1, \quad Tserv \leq T2 \quad (8)$$

$$1 \leq \sum_i^I n_i \leq M'_j, \quad 1 < M'_j \leq M \quad (9)$$

$$S_{j+m}^{n'_i} > S_j^{n'_i} \quad (10)$$

$$0 \leq s \leq S \quad (11)$$

$$t < j < h, \quad h = \overline{1, H}, \quad j = \overline{1, J} \quad i = \overline{1, I}, \quad z = \overline{1, Z}, \quad y = \overline{1, N}, \quad m = \overline{1, J}, \quad 1 < j + m < J \quad (12)$$

Where I - the number of groups of inspectors, pieces;

J - The number of time intervals of the unchanged quantitative and qualitative composition of the shift, divided by the working day, pcs;

H - The number of time intervals divided by the period of work of the post, pcs.;

R - Costs of participants in foreign trade activities related to the expected release of goods, rubles per hour;

T_{sis}' is the service time of the GD, which includes the waiting time for the GD in the registration queue and customs control, hour;

T_{serv} - The time required for the release of goods, hours;

T_{que} - Time limiting the stay of the GD in the queue for registration, hour.

$T1$ - Maximum time of stay of GD in the queue;

$T2$ - The maximum period for the release of goods;

d_{ij} - The duration of the work of the inspectors of the i^{th} group, who started working at the j^{th} time interval of the customs post, hour;

n'_{ij} - Number of inspectors of the i^{th} group, who started working in the j^{th} time interval of the customs post, people;

n_i - Number of inspectors of the i^{th} group, people;

n_i^y - The y -th inspectors of the i^{th} group;

N_i - The total number of inspectors of the i^{th} group, people;

q_{ij} - Marginal productivity of labor of inspectors of the i^{th} group, who started working in the j^{th} time interval of the customs post, pcs / h.;

z - The category of complexity of GD;

Z - Total number of categories of complexity of GD, pcs.;

V_{jz} - The current amount of work (the number of registered GDs of z -categories of complexity) in the j^{th} interval of the work time of the post, pcs.;

V'_{jz} - The planned amount of work in the j^{th} time interval of the work of the post, pcs.;

k_{jz} - Coefficient of complexity of GD of z^{th} category of complexity of GD;

F_{jz} - The intensity of arrival of the GD in the j^{th} interval of the work time of the post, where $F = f(j, t)$, where t is a smaller time interval than j ;

M - Total number of workplaces, pieces;

M'_j - The number of employed jobs in the j^{th} interval of the work time of the post, pcs.;

L - Maximum duration of work of each inspector during the period of the work of the post, hour;

C_i - The tariff rate of the i^{th} group of inspectors per hour, sum;

C - The maximum wage fund for the period of the customs post, sum;

$S_j^{n_i^y}$ - Preference of the y^{th} inspectors of the j^{th} group to work in the j^{th} time interval of the customs post;

S - The maximum level of preference for inspectors to work in the j^{th} time interval of the customs post. [5]-[7]

The first objective function (3) determines the total costs of participants in external economic activities as a result of the expectation of a customs post decision to release goods that must be minimized. This function (3) reflects the important direction of assessing the quality of customs services, expressed in the economy and efficiency of customs control. As the second objective function (4), the total labor of inspectors is taken at a given time interval for the functioning of the customs post. Function (4) reflects the second important direction of assessing the quality of customs services, expressed in cost-effective customs control. Function (4) should be minimized, based on the requirement to save costs for the provision of customs service's due to more rational use of resources. Minimization of both functions should lead to an improvement in the quality of customs services. [8]

The balance equation (5), which is part of the system of constraints of the problem, is aimed at observing the processing condition of the total number of GDs of different labor intensity, taking into account the variable intensity of the product flow. In this case, the expression

$$\sum_j^J \sum_z^Z V_{jz} K_{jz}$$

Reflects the number of registered GDs of different complexity categories z in the j^{th} time interval of the customs post,

$$\sum_j^J \sum_z^Z V'_{jz} K_{jz} F_{jz}$$

The number of GDs of different complexity categories, whose delivery is expected in the j^{th} time interval of the customs post with the intensity specified by the defined probability density function F_{jz} .

The sum of these values reflects the total amount of work that must be performed by the inspectors of the department of registration. This volume should correspond to the amount

$$\sum_j \sum_i q_{ij} d_{ij} n'_{ij}$$

That determines the total marginal productivity of inspectors' work q_{ij} , the number of which is equal n'_{ij} , and the time of work d_{ij} . It is necessary to pay attention that the functions (6), which are part of the balance equation, are nonlinear and are schematically represented in Figures 2 - 4. [9]

In this task have been considered the following limitations: the maximum wage fund; the norms of labor legislation limiting the maximum duration of working time; the total number of inspectors; the number of equipped workplaces; the preferences of inspectors for work in a particular time interval; the customs legislation limiting the maximum period of registration of GD and the release of goods.

The time of waiting for the participants in foreign trade activities consists of the time the in the queue for the registration and the time in the registration.

The formulas introduced above are based on the physical meaning of the quantities. The expression $t < j < h$ shows that the task uses three different lengths of time, depending on the need to observe certain real conditions for the functioning of the customs post. [10]-[11]

RESULTS

The laws of distribution of functions in Figures 2 to 4 were obtained empirically, based on statistical data on the process of performing customs operations and exercising customs control by the customs posts of the Keles district of Tashkent region, Uzbekistan.

Figure 2: Graphs of Functions of Marginal Labor Productivity of Customs Inspectors of Different Groups of Posts, Depending on the Category of Complexity of Declarations for Goods, $q = f(i, z)$

Figure 3: Graphs of Probability Density Function of the Distribution of Time Intervals between Consecutive Receipts of Goods Declarations. $F = f(j, t)$

Figure 4: Schedule of Distribution of the Total Number of Declarations for Goods During the Working Day, $V = f(j, z)$

CONCLUSIONS

The above mathematical statement of the problem of improving the quality of customs services provided by customs posts, by improving the management of inspectors' workload and the characteristics of its basic components, reveals the significant complexity of the task. Non-linear objective functions, different types of variables (integer and continuous), and the nature of constraints (linear and nonlinear) of the multicriterial problem posed make it impossible to assign it to one of the classes of optimization problems.

IMPLEMENTATION

This research was supported by The State Customs Committee of the Republic of Uzbekistan through Tashkent University of Information Technologies named after Muhammad Al Khwarizmi (grant №И-2017-4-4)

REFERENCES

1. Lande D.B. "Basis of information flow integration", *Handbook, Engineering*, 2006, 240 p.
2. Kenavy, E. M. "The economic impact of counterfeit goods in Egypt." *International Journal of Business Management & Research* 3.3 (2013): 111-128.

3. Усов А.В. Введение в методы оптимизации и теорию технических систем // А.В. Усов, Г.А.Оборский, Ю.А.Морозов, К.А.Дубров. – Одесса : Астропринт, 2005. – 496 с. [In Russian: Usov A.V., Oborskiy G.A., Morozov Yu.A., Dubrov K.A., "Introduction to the optimization methods and theory of technical systems", Odessa: Astroprint, 2005, 496 p.]
4. Olifer V.G., Olifer N.A., "Computer networks 3rd edition", Piter, 2006, 958 p.
5. А.Саидов, М.Мирбобоев, Ш.Алметов, Н.Фаниева, И.Бобоқулов. "Божхона органларининг ахборот тизимлари асослари". I том. Тошкент. 2016. 421 p. [In Uzbek: Saidov A., Mirboboyev M., Almetov Sh., Ganiyeva N., Boboqulov I., "Information systems bases of customs organizations", 1st chapter, Tashkent, 2016, 421 p.]
6. А.Саидов, З.Абдурахмонов. "Божхона юк декларациялари маълумотлари билан ишлаш" автоматлаштирилган ахборот тизими. Ўқув қўлланма, Тошкент, Олий ҳарбий божхона институти, 2012 йил, 151 б.[In Uzbek Saidov A., Abdurakhmonov Z., "An automated information system with working customs cargo declarations", Handbook, Tashkent, High military customs institution, 2012, 151 p.]
7. Deepa, S., and R. Umarani. "Steganalysis on images based on the classification of image feature sets using SVM classifier." *International Journal of Computer Science and Engineering (IJCSE)* 5.5 (2016): 15-24.
8. Rezer S.M., Prokofeva T.A., Goncharenko S.S., "International transport corridor: formulation problems and development", M.: Viniti Ran, 2010, 200 p.
9. Кротов И.Е. Управление проектом «Электронная таможня» в Европейском Союзе// Материалы I международной научно-практической конференции 21-22 декабря 2009 г., в г. Баку «Информационные системы и технологии в таможенной сфере». Баку, 2010. [In Russian: Krotov I. Y. "Management of the project "Electronic customs house" in the EU". Materials of the I international scientific-practical conference December 21-22. "Information systems and technologies in the customs sphere". Baku. 2009.]
10. United Nations Organization, "Statistics of international goods trade: concepts and definitions 2010", New York, 2011.
11. Jiyanbekov, K., Usmonov, J., & Azimov, S. (2019). The probability model of railway transport system activity. Paper presented at the Transport Means - Proceedings of the International Conference, 2019-October 1256-1259. Retrieved from www.scopus.com