THE USAGE OF LITHUANIAN ROAD TRANSPORT INSPECTORATE INFORMATION TECHNOLOGIES AND ESTIMATION OF TRANSPORT TECHNOLOGICAL PROCESS

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1. Introduction

Using new Information Systems between transport means is very important. The activities and using of IS of the state road Transport Inspectorate which is playing very important role in the development of transport system is described. There are showed activities of IS of Inspectorate, estimation of IS, computerized IS in Inspectorate. The estimation of interdepartmental collaboration and common IS using with foreign countries are showed.

Analysis of technological processes and their optimisation in transport enables successful functioning of transport means, thus guaranteeing for consignee reliability, independency and quality [1–4].

The inspection quality partially makes a positive influence on security, freight preserve, and efficient delivery to the client. Therefore it is important to analyse technological processes in transport, their optimisation opportunities, as well as the application and assessment of models.

2. Activities of Information Systems (IS) of Lithuanian Road Transport Inspectorate (LRTI)

One of the goals of the Inspectorate is to ensure equal competition environment to all participants of the road transport business. The Inspectorate protects interests of transport users by enforcing laws and other legislation regulating road transport activities.

In implementation of the functions assigned thereto the Inspectorate is developing the legal base of its activities, it takes part in legislative activities, proposes draft amendments to and revisions of taws, drafts rules, instructions and other regulations within its competence.

The Inspectorate has a very important role with regard to ensuring order in the Lithuanian road transport economy and integration of Lithuania to the European Union.

While aiming at the exploitation of modern information technologies and telecommunications possibilities in order to implement the objectives of the Inspectorate as well as aiming to put into practice the concept of the electronic authority, the Inspectorate have worked out IS general project of modernization, the implementation of which is to KIS “Keltra” model change the Inspectorate’s current computerization state in terms of the use of information technologies, work organization and other aspects. IS model and its architecture are demonstrated below. Such IS model will enable us to organize a centralized data base at the Inspectorate’s central headquarters in Vilnius, to provide operative information to regional divisions in the shape of the data base replicas by means of on-line communication with the Inspectorate’s regional divisions as well as to unite local computerized networks of Vilnius central headquarters and regional divisions as well remote stationary and mobile

computerized workplaces into a common computerized network using MPLS VPN technology. Data exchange with other institutions as well as legal persons is to be based on HTTP/HTPPS official reports and data is to be transferred in portfolios. There should be organized www service and so on.

3. Estimation of Interdepartmental Collaboration and Common Using with Foreign Countries

Analysis of interdepartmental collaboration between Inspectorate and institutions showed activity by changing data, data basis and electrical tools. Data is taken from 10 technical supervision enterprises. Data is sent to state institutions (The state taxman inspection, statistical department, and other juridical persons), Police department, Customs department usually take answer in writing form.

Inspectorate is using technology by state organized security net for connection to state budget data basis in Finance ministry and documents basis in Communication ministry. Inspectorate is going to modernize IS activities and hope that consumers of modernized IS will be the following:

- Inspectorate state officers and workers, who are using, analyzing this data in their activities;
- workers and officers of other institutions who need data of inspectorate;
- customers of Inspectorate, who can get information and take data about their activities;
- other institutions, enterprises;
- Lithuanian citizens;
- members of EU road Transport Inspectorate, who carry on the control and rest regime drivers of transport means;
- in future – institutions of EU.

At present there is no unified interstate data exchange programme in road transport field of activities. This programme would be regulated not by EC members, but by EC legal enforcements and agreements. As a result of that the Inspectorate does not receive constant information related to the organization and carrying out of road transport activities. This kind of information is only exchanged in the course of interstate meetings when giving or receiving information in the written form.

In accordance with EU Committee regulation 3821/83/EEC enacted in 1985, December 20, concerning the use of tachographs in road transport means starting with 2005, transport means should be equipped with electrical devices which will calculate drivers' work and time. There will be observed common regulations associated with drivers' work and time accounting as well as with drivers' time and work regime control. Each EU member-state will have to create its own drivers' work and time accounting system. Yet, there will be a possibility for each EU member-state to get acquainted with drivers' work and time accounting data bases that have been accumulated by other member-states. For this purpose there will be used IDA programmes (see below), which organize safe EU states institutions network as well as such a service as TACHONET. TACHONET network service is an organized telematics network for exchanging information about the issued tachograph cards to drivers, working on EU scale and enabling us to monitor professional drivers' driving and rest time.

In accordance with the requirements of EU Committee's directives No 70/156/EEC and No 92/61/EEC as well as their later supplements, all EU states accumulate data about the adequacy assessment of transport means in their particular country. This is the accumulation

of the information about technical characteristics of transport means as provided by its producer, which describe transport means in detail, in order to control transport means adequacy to the producer's technical requirements and ensure that a user acquires only safe, checked and certified transport means. In Lithuania all the data concerning transport means adequacy assessment is accumulated by the Inspectorate, the data is provided by the public establishment "Regitra" as well as by technical service institutions. An adequacy assessment system of high quality has been created in Latvia, (on the basis of ORACLE data base control system and safe data conveyance network) Holland and other countries.

There are not legal acts that would regulate the organization of the centralized data base of transport means adequacy assessment. Yet taking into account the accumulation of that data in each country, it would be expedient to organize interstate exchange of adequacy assessment data or exchange data in any other way.

4. Application of Technological Means and Modelling of Processes in Transport Means

Analysis of management by complex technical systems. Management problems are very important and urgent.

Management of the quality of transport technologies application in transport covers an integral multi-plan process and consists of the following operations: analysis of management system, planning of transportation quality (security of transportation, safety of transported goods, processing of transportation documents), reception of the information on haulers participating in the process of transportation, analysis of this information, reception of feed back information and its analysis.

Management of quality of technological means application in transport, which meets the general theory of management of transport, embodies an integral multi-plan process consisting of the following operations:

- Creation of management programmes;
- Planning of transportation quality (transportation safety, security of goods, documentation procedures, etc.);
- Reception of data and analysis about all haulers participating in freight transportation;
- Indications arising from received information analysis.

Thus the management of technological means application quality or technology of transport covers implementation of means, handling and consolidation. The main principles of management technologies are the following: systematic definition of tasks, adaptation, dynamics, quality normative, and standardisation.

The optimum achievements of technological quality standards are defined on the basis of cost of organisational-technical and economic measures interrelated with commercial principles and impacting certain factors and conditions.

Creation of a model of transport starts from the analysis of the modelled object, by the application of mathematical formulae, accumulation of information with the aim of qualitative coordination on the basis of experimental mode and with the view of accomplishing the task, to make its analysis, correction of model by supplementary solutions and finally, to carry out the last testing of the experimental model. Only after accomplishment of such operations, the model may be disposed to information system for the use and accomplishment of the tasks [11–14].

The object analysis has to pertain to a full view of the modelled system and its management capacities.

From the mathematical formulation of the system will depend on how efficient will be the system. The mathematical formulation of the systems makes the modelling of the whole process, i.e. description of economic processes and economic-mathematical actions of the model. The aim of modelling is a possibility to manage and control a concrete process.

Several mathematical models are used for the optimisation of the process in transport:

- Optimal programming: linear, non-linear, discrete, block, etc.;
- Network methods of management and planning;
- Theory of mass servicing/handling, etc.

In general the mathematical model may be expressed as follows:

$$z = f\left(x_1, x_2, ..., x_n\right) \to \max\ \left(\min\right); \tag{1}$$

$$\varphi_i = \left(x_1, x_2, ..., x_n\right) \le b_i\ \left(i = 1, 2, ..., m_1\right); \tag{2}$$

$$\varphi_i = \left(x_1, x_2, ..., x_n\right) = b_i\ \left(i = m+1, m_1+2, ..., m_2\right); \tag{3}$$

$$\varphi_i = \left(x_1, x_2, ..., x_n\right) \ge b_i\ \left(i = m_2+1, m_2+2, ..., m\right); \tag{4}$$

$$x_j \ge 0\ \left(j = 1, 2, ..., n_1\right); \tag{5}$$

$$x_j\ \left(j = n_1+1, n_2+2, ...\right); \tag{6}$$

$$x_j \le 0\ \left(j = n_2+1, n_2+2, ..., n\right); \tag{7}$$

here (1) – the function of aim; (2)–(7) – restriction system; $b_i \ge$ free members of restrictions $\left(l = 1, 2, ..., m\right)$.

The aim of the system is to show the system's condition to be achieved in the process of management. The use of methodological basis in the creation of technological management would enable a possibility to meet all the demands and requirements of the market.

The efficiency of the technological process may be evaluated by the only criterion – the growth of national income in regard with the production costs or increased transportation resources under the optimal proportion between consumption and accumulation funds.

By their content all economical criteria of the national economy may be attributed to one of the three groups:

- Maximum economical effect under fixed expenses/costs;
- Minimum expenditure under fixed effect;
- Maximum economical effect by using available resources.

Given the concrete task the economical criteria have to meet these requirements:

- To reflect objective demands of the national economy for handling/servicing system;
- To reflect the demand of this service for the national economy system;
- To reflect costs/expenditures and obtained results;
- To foresee the scientific progress of this type of services.

Optimal selection of the criterion sometimes causes certain difficulties and problems that cannot be solved unambiguously. The criterion of application of technological means has to be analysed comprehensively, so that afterwards to avoid errors in the solution of problems. The criteria usually depend on management parameters (x_j). Shifting dimension changes depending on the number of variation possibilities. Most peculiar are those that are using in tasks various technologies. Not only relevant technologies often are included into the model, but the indices defining the economical parameters of the system as well [13–14].

5. Using of Models in Transport Terminals

Lithuanian transport system development strategy foresees the investigation of the interface between all transport modes, namely: road, railway, maritime, inland waterways, pipeline and in part, air transport [10]. For this reason the whole number of models was adapted and principally changed.

Static model with discrete-continuous variables. If we dissociate ourselves from the structure of transportation volumes and changes of direction in time, then the model of the problem may be presented as follows:

$$\min_{X,\,\eta} F(X,\,\eta) = \min_{X,\,\eta} \sum_u \sum_k f_{uk}(X, X_\Pi)\eta_{uk}\,, \tag{8}$$

When there are restrictions:

$$S_p X = b\,; \tag{9}$$

$$X \geq 0\,; \tag{10}$$

$$\eta_{uk} = \begin{cases} 0 \\ 1 \end{cases} \forall u\,,\, k\,; \tag{11}$$

$$\sum_k \eta_{uk} \leq 1 \quad \forall u\,; \tag{12}$$

$$X_u \left(1 - \sum_k \eta_{uk}\right) = 0 \quad \forall u\,; \tag{13}$$

$$\sum_u \sum_k r_{juk}\eta_{uk} \leq R_j \quad \forall j\,, \tag{14}$$

where f_{uk} – function of brought out costs exposed in the network element u, being k level of its development (taking into account the development costs); X – initial vector of network loading by flows of all freight types; X_Π – defined vector of network loading with passenger transport; b – vector of shipment-delivery amounts in the network peaks; X_u – loading vector of the network element loading u; η_{uk} – indices showing the network element's u status k (if $\eta_{uk} = 1$, then it exists, if $\eta_{uk} = 0$ – it does not exist); $\eta = \{\eta_{uk}\}$ – the sought vector of the status of technical furnishing of network elements; r_{juk} – use of the resource j in the network element u, seeking to lead it from the initial status into the k status; R_j – general permissible

consumption quantity of the resource *j*; S_p – generalised incidents' matrix corresponding to the flows of transportation of non-uniform freights: $S_p = \|S_{ijl}\|$, whereas $l = 1, 2, ..., p$;

$$S_{ijl} = \begin{cases} +1, & \text{if the radius of the network goes out from the} \\ & \text{node } i \text{ and it is possible to perform} \\ & \text{by it the transportation of } l \text{ type freight} \\ & \text{(total number of freight types - } p\text{);} \\ -1, & \text{if the radius } j \text{ goes enters into the node } i \text{ and it} \\ & \text{is possible to bring by it the freight } l\text{;} \\ 0\text{-other cases.} \end{cases}$$

Thus, according to the purpose function (8) general brought out costs are minimised when there are restrictions:

a) restrictions of a technological type (8) and (9) – the condition that all transportations should be performed;

b) for reconstruction: restrictions (11)–(12) – every element may be only in one status, and if the element is not created, then the work performed by it equals zero – restriction (9)–(14);

c) resource restriction (14) – every resource type may be used within the limits of the defined amounts.

In solving the problem (8)–(14) there is obtained the list of means of the optimal development of the network, however, there are not identified their implementation terms, as well as their stages, i. e. a successive change over the time of the level of the elements of technical status.

6. Conclusions

1. Having considered LRTI IS use, IS current situation and prospects, having evaluated interdepartmental and interstate data exchange, it is obvious that:

- LRTI IS activities analysis shows the use of the internet communication as means of communication with data basis located at other institutions. It has been found out that the Inspectorate collaborates with others;
- institutions by means of data exchange or electrical tables as well as make use of the safe state data conveyance network (SDCN) organized on the basis of VPN technology with other state's institutions;
- it has been found out that at present SDCN is decentralized, therefore it is difficult to administrator it;
- bearing in mind modern technologies and legal acts IS modernization is being prepared in order to implement modern technologies and telecommunication possibilities for interdepartmental and interstate collaboration.

2. It was explained that technological service of transport means consists of technological operations of transport means, of the transport terminals graphically reflecting the sequence of working operations in regard to aerial location, necessary equipment, outfit and workers.

3. The analysis showed that complex approximation of the technologies used by the organisation and those rationally functioning within it enable optimisation of technological document handling process.

4. The described models may be used also for the solution of complex problems, for instance, for the assessment of efficiency influence on separate transport means functioning.

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