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Организационно-экономические аспекты эффективного функционирования интеллектуальных транспортных систем

Аннотация

В статье рассматриваются интеллектуальные транспортные системы как основа перехода к «цифровой» экономике XXI в. Исследование коснулось изучения подходов к понятию интеллектуальных транспортных систем (далее – ИТС) в интерпретации отечественных и зарубежных ученых. Автором определены основные показатели, свойственные «цифровому» транспорту и логистике, реализуемой транспортными комплексами ведущих стран мира. В статье описана авторская методика оценки уровня формирования ИТС-проектов, отличительной особенностью которых является учет потребностей клиентуры в качественном информационном сервисе. Отдельное внимание также уделяется параметрам организационного и экономического характера. Исследование позволило не только дать оценку текущему состоянию развития ИТС-проектов в Российской Федерации, но и сформулировать практические рекомендации по совершенствованию интеллектуальных транспортных систем в России. В процессе организационных параметров при создании ИТС-проектов автором проведен анализ зарубежного опыта Японии и США в части формирования «цифрового» транспорта и логистики. В заключительной части статьи рассмотрена проблема подготовки профессиональных специалистов в сфере интеллектуальных транспортных систем для нужд транспортного комплекса XXI в. При этом исследование описывает не только научные школы, сложившиеся в России, но и подчеркивает необходимость международного сотрудничества в данной сфере.

Ключевые слова:

интеллектуальные транспортные системы, организация, ИТС-проект, методика оценки, городской пассажирский транспорт, инновационная экономика, высшее образование, «цифровая» экономика.

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Organizational and Economic Aspects of the Intellectual Transport Systems Effectiveness

Abstract

This article describes the intellectual transport systems (ITS) as a core to move to the «digital» economics of the 21st century. The research touched the approaches to understand of the ITS covered by both Russian and western scientists. The author defined basic parameters applicable for «digital» transport and logistics used by leading countries of the world. The article provides the author's method estimate the level of forming the ITS projects having features to consider the customer requirements in quality of informational service. The special attention is also paid to parameters of organizational and economic nature. The research allowed to not only assess current developments of ITS projects in Russia but also to provide recommendations of ITS improvements. Studying the organizational parameters of ITS projects the author analyzed Japanese and the US experience in the area of building «digital» transport and logistics. The final part of article covers issues of training professionals in the ITS sphere for transportation complex of the 21st century. The study not only tells about scientific institutions in Russia, but points out the need to cooperate internationally in this filed.

Keywords:

intelligent transport system, the organization, ITS project assessment methodology, public transport, innovative economy, higher education, «digital» economy.

Technological development is an integral part of human evolution since the first tool was created; the first wheel was discovered dating 5000 BC. All technical tools used to improve human lives, to increase labor efficiency, to improve they of their life. Increasingly there are economic publications dedicated to so called informative «digital» society [5]. The scientists juggle such terms as «digital» economics, the economy of sharing, industrial revolution, industry 4.0 etc.

Currently there is a trend of transition to a new technological way in accordance with the study of strategic guidelines in economic development of several countries. ITS indicate the transition to the XXI century innovative economy with regards to the transport sector. The ITS began penetrating to the scientific terminology by the end of XX century and was considered as an innovative approach to the transportation management using information technologies. Lately the ITS have spreaded

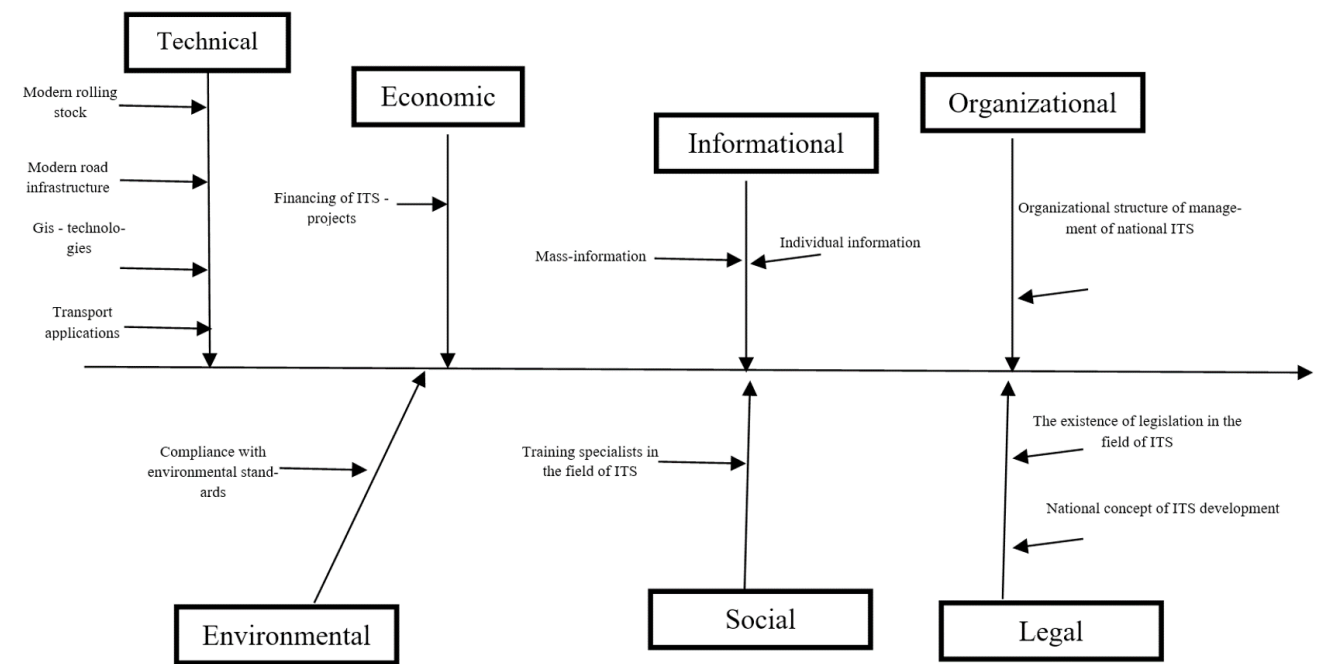


Figure 1. Main factors determining the effective functioning of ITS

in different countries which stripped the following problems to be solved: Transition to the new integration of technical means; Coordination of different of transport activities; Transport management; Ensure road safety; Increased efficiency of transport network rated capacities [8].

Mr. I.N. Pugachev and Mr. G.Ya. Markelov in their paperwork of «Intelligent Management Of Urban Transport Systems» specify the «intelligent core» consisting of information receiving, definition of traffic rated capacity, traffic flow intensity, evaluation of road situations, information processing and intended results. The authors also point out at the apparent role of ITS in originating the unified database of traffic management.

«Intelligent Transport System As A Concept Of Transport Development» by V. A. Grabaurov indicates not only the most important role of ITS in terms of transport development perspectives but affects the ITS development through the invention of the single information vicinity able to cover not only vehicles but various technical devices, dispatcher centers and TOS. In addition to domestic and foreign scientific publications, a number of ways of how to understand the idea of ITS are contained by legal documentation as well as transport development concepts. For instance, as a project of the Russian ITS generation concepts shows, ITS is understood as a system consisting of different services operating in single information vicinity [3]. In addition, such services provide planning, organization, maintenance of transportation processes and management functionally implemented by means of up-to-date information technologies primarily telematic ones.

As the analysis showed, by ITS it is necessary to understand the system able to analyze environmental data as well as a new generating knowledge based upon the established information database. Moreover ITS consist of the following main stages:

- collect information;
- transfer of the received data;
- generation of computer database;
- information processing and its distribution among traffic members.

The author's study showed that the ITS generation process is a complicated task built on various factors (fig. 1).

The other important feature of forming ITS are economic factors. A group of economic parameters consists of two parts: revenue and expenditure. The expenditure part determines volume and sources of financing, and the revenue reveals the possible saving sources (tab. 1).

The analysis showed that currently the main vector of ITS research is aimed at certain aspects of ITS generation, study of various technical aspects of ITS, standardization of their work processes and other private issues of interest to the carrier. The author's method will allow to evaluate the development of certain areas of ITS generation, to adjust the vector of scientific and project developments.

One of the basic parameters of ITS generation processes is a possibility to place passengers in a single ITS vicinity characterized by:

- level of internet development (coverage rate, number of users);
- share of various age categories in internet surroundings;

Table 1

Economic parameters of the evaluation of the formation process of ITS

Group of parameters	Name of specific indicators
Expenditure side	The share of budgetary funds (in absolute terms and in relative terms) allocated to the ITS by the federal budget; the share of budgetary funds (in absolute terms and in relative terms) allocated to the ITS by the regional budget; the share of budgetary funds (in absolute terms and in relative terms) allocated to the ITS by the municipal budget; availability of other sources of financing for the project; specific of all non-public sources of ITS financing in the total amount of funds.
Income part	Macroparameters
	Increase in the share of transport in the country's GDP; the share of the country in the structure of the ITS market of services and equipment.
	Microparameters
	Economy of fuel and lubricants; the economic effect of reducing the level of accident rate.
	Indirect economic effects
	Increased mobility of the population; growth of the proportion of the population using public transport; improvement of the state of the environment (reduction of harmful emissions into the atmosphere); growth in the value of real estate from the development of ITS projects.

- share of users having up-to-date communication devices;
- number of information displays and kiosks;
- quality information resources supplying traffic info.

The above features give users an opportunity to connect to information sources or data generated by ITS vicinity which is a combination of methods transmitting traffic info directly or through ITS region to end user (driver, passenger, dispatcher department). Although information flows could be both mass and individual [1].

Along with the physical–environmental, economic and legal factors in the process of ITS generation the important role is played by aspects of organizational nature. As the analysis showed the development and implementation of ITS are limited by single national control centers of two types. The first is a single center of concentration of knowledge, experience and technologies in the area of ITS, the second is designed to concentrate all control systems in a single structure for managing ITS. Such an organization is created on the basis of public – private partnership (fig. 2).

Each approach is reflected in a way of completed projects in several countries around the world. At the same time, along with providing the required level of technology development, an organizational structure of project management is the necessary condition to realize the ITS. This structure is responsible for creating a single national management structure of the ITS, integration and coordination of activities of scientific institutions, government agencies, business representatives in order to realize ITS projects. In addition, the single center capabilities will allow to hand the ITS experience

over to the regions, to plan the ITS development on a national scale, to generate recommendations, methods of efficient ITS functioning an organizational structure of project management taking into account the specifics of a particular region.

Since the ITS are able to significantly influence not only the better quality of passenger transportation it is necessary to take into consideration the ecological requirements while developing the ITS projects. According to analysis, the use of ITS and the increasing environmental component of transport system closely interact because of optimizing transport flows and increasing speed, reducing misuse of runs of rolling stock which result to a possibility of saving fuel and lubricants (POL), reducing harmful emissions of motor transport into the atmosphere. Besides, the professionally trained personnel is one of the main factors that determine the transition to the ITS. Currently a basic requirement to a professional in the area of transport management is a systematic coverage of all stages of the life cycle of transport systems. In addition, the hasty growth of transportation means and transport technologies is a growing trend. In this regard, we need to talk not just about education, but also a systematic personnel training in the area of transport automation [6].

In practice, in Russia, particularly in Moscow, interactions of science represented by higher educational institutions (HEI) and the practice are reflected by the following activities of the Traffic Organization Center (TOC):

TOC is responsible for highly skilled personnel training in order to operate the Traffic Management Automated System (TMAS). Such professionals will apply their

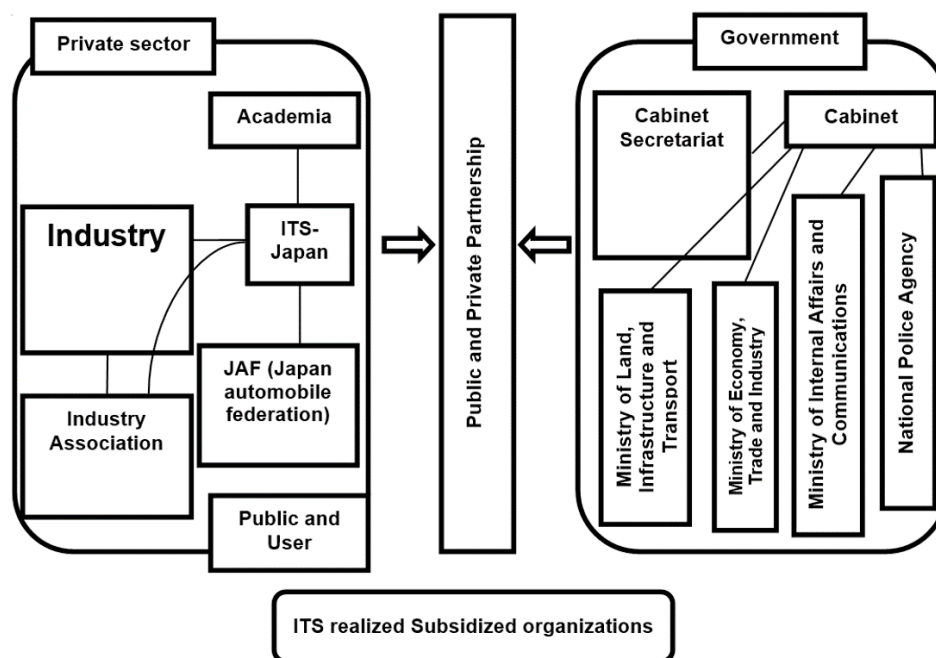


Figure 2. ITS organization of Japan [9]

knowledge and skills in all road facilities of the city. They'll provide monitoring, technical support, information support.

Interaction with leading Universities and research institutes (NII).

Participating in industry conferences and various forums («Expocitytrans», the exhibition «Transport and logistics», international urban forum and others).

The analysis of western practice in ITS – education [2] showed that currently a course on «Transport telematics» or «Intelligent transport system» presented in a vast majority of educational programs is applicable for the transport industry personnel training used both as a basic higher (bachelor, master) and secondary education. Plus, the higher educational institutions providing personnel training are combined in educational union (research network) of «ETNITE» aimed at developing common standards,

approaches, methodologies of training in the area of ITS. The study showed that training specialists in the field of transport telematics was launched together with active phase of ITS distribution in the US (1996) [4]. The process of training specialists in the sphere of ITS in Japan started in 1999 with the assistance of VERTIS («ITS Japan»), the Ministry of Economy and Industry of Japan [10]. The course is based upon interdisciplinary education including various aspects of ITS (economic, legal, social etc.) [7]. The professionals have been taking interdisciplinary courses involving technological, economic and social sides of ITS operations in Japanese universities since 1999. The author's analysis resulted to a proposed method of estimating social parameters of evaluation of ITS consisting of two elements – training ITS professionals at high schools as well as the analysis of current market of ITS specialists (tab. 2).

Table 2

Social parameters of the evaluation of the formation process of ITS

Group of parametres	Name of specific indicators
Training of specialists in the field of ITS in universities	<ol style="list-style-type: none"> 1. Number of calls having specialized training directions in the ITS area. 2. Availability of training directions for «intelligent transport systems» in the educational programs of universities. 3. Presence of interuniversity network, training specialists in the field of ITS. 4. Share of graduates of «transport universities» with specialization in the field of ITS.
Analysis of the market of specialists in the field of ITS	<ol style="list-style-type: none"> 1. The share of employees of industrial enterprises in the field of ITS which has specialized education. 2. The share of employees of branch enterprises in the field of ITS, having a different education (refresher courses) in the field of ITS or having certificates (diplomas), allowing to work with one or another type of technological equipment.

This study allows to conclude that ITS generation is a multifarious process covering different spheres of society. To date the study of transport science in the field of ITS process is aimed at estimating effectiveness of project implementation. However the issue of availability of control parameters («control points») remains untouched that allows to some degree of credibility judge about the degree of ITS development in various countries. The elements of a methodology for assessing the effective ITS functioning described by the author in this article will allow to assess the level of development of individual areas of ITS generation and to adjust the vector of scientific and project developments.

The above mentioned methods allow to realize there is now the active process of ITS generation is on in the Russian Federation not only in such big cities as Moscow, St. Petersburg and Sochi. The ITS separate elements like

cameras, speed limit sensors etc. can be found yet on several federal highways penetrating the whole country. The ITS development in Russia is of limited nature expressed separately in the following technological processes:

- GPRS grow;
- production of regional traffic management centers;
- automated road tolls;
- automated video—controlled traffic violations.

Therefore, the need of ITS development will influence the country competitiveness in the long run. This is due to economic reasons especially reductions of transport «piece» of goods and services' «pie». The effective «digital» transport and logistics will allow to speed up the economy, to increase the client—oriented service and to improve life quality of the population. As it said above, necessary social and technical factors will be required requesting legislation amendments and organizational changes.

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