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RESEARCH ON THE EFFICIENCY OF TRANSPORTATION SERVICES BY APPLYING INFORMATION TECHNOLOGIES

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The article presents the evaluation of Information Technologies' (IT) application to the increase of transportation efficiency. It also analyses scientific literature, related to IT in transportation process, as well as describes intellectual transport systems used both in Lithuania and abroad. The analysis of arising IT application problems is also presented. Moreover, the importance of IT in transportation services is described.

Keywords: intellectual technologies (IT), multimodal transport, information systems, integrated systems.

Introduction

The congestion of transport systems has been constantly increasing. Currently, it is planned that the flow of freight transport will increase by 55 %, road passenger transport by 36 % by the year 2020. Traditional means, e.g. development of currently existing transport networks will be useless; therefore the need to find new means and solutions to this problem arises. One of such solutions is the application of IT in transportation processes.

The advantages of these technologies for transport activities are obvious since any route can be planned by including several transport modes, all the actions can be coordinated operationally in any case of possible danger to traffic safety. Such optimisation of traffic system reduces road congestion as well as allows planning travels efficiently and increasing traffic safety.

IT also provides means for the data accumulation, analysis and storage related to the operation of transport system during rush hours. Such data allow traffic participants to consider various traffic incidents, bad weather conditions and other factors, reducing capacity [Jarašūnienė 2008].

IT purpose is to optimise the efficiency of transport system, its productivity, and service quality, increase mobility, and reduce energy consumption and environmental influence.

1. Areas of IT Application and Their Importance

IT covers a wide area of wireless and wired-based information control and electronic technologies. These technologies, when integrated into the transport system infrastructure and the very transport means, display transport flows, reduce traffic jams, provide alternative routes for travellers and help in saving time and money [Batarlienė 2010].

In addition, IT unite all the elements of a transport system – a transport means, transport infrastructure, drivers and users of traffic means – that interact dynamically. Information is the core of IT, no matter whether it is static or real-time information, or a digital map. IT functions are information accumulation, processing, integration and presentation. IT present a real-time information about current situation in roads or present it interactively, this, in turn, helps to better plan all travels for ordinary drivers, road operators, Government [Batarlienė 2011].

Researchers A. Jarašūnienė and A. Baublys describe other IT functions. IT operate together with information and management technologies that provide IT with its main functions. Some of these technologies, e.g., flow detectors, are well-known in transportation business.

Scientific literature explains why logistics should better inquire into IT technologies and care of their development. The growing numbers of cars in towns and cities are increasing the congestion of street crossings as well as reducing their permeability. A longer time, spent at crossings, adds to the environmental pollution and useless fuel wasting. These problems can be solved in several ways: by widening roads, adding more lanes, increasing fuel prices, developing public transport system and creating intellectual systems for transport management.

A rapid development of computer technologies, automatic and optical data transmission systems leads to the creation of intellectual transport systems and to the optimisation of their operating efficiency. Thus, in order to select a proper IT structure, subsystems, installation and management places, the evaluation of the efficiency of systems becomes vital [Jarašūnienė 2008].

IT could be perceived as a revolutionary product of information and communication technologies. These technologies became usual in modern digital world. Nowadays IT control transport networks, transport flows as well as select the most relevant routes. These systems provide various functions for ordinary users: from mere informative road screens to complex management systems.

IT can be easily represented in an information chain.

Information chain starts with acquiring information (from transport systems). Then this information is processed and presented to an end user. It has been noted that some external factors, such as weather forecasts etc., are also a part of this chain [Jarašūnienė 2007].

2. IT Application in Transportation Services

Currently, most drivers use GPS, GSM and radio technological solutions in transport infrastructure [Antonova 2008].

GPS is used for determining an object's location since it constantly receives and processes radio signals sent from satellites. After having processed radio signals, GPS determines a satellite's location in space as well as the distance between them two. This allows determining locations of both stationary and mobile objects.

Scientific literature [V. Zubinaitė & George Preiss 2008] name GALILEO as a Global Navigation Satellite System that is being currently developed in Europe.

Researchers N. Batarlienė and A. Jarašūnienė present several systems used for determining location:

"WebFleet" – a service of the management and control of transport means, used by companies that aim at cutting transport fleet costs and optimising labour productivity by monitoring and controlling the operating parameters and whereabouts of their transport means [Jarašūnienė *et al.* 2008].

Satellite security and control system of mobile objects "MobiSafe". "MobiSafe" system is often used for the protection of transport means as well as for ensuring security and safety during the forwarding process, e.g., of a valuable freight.

Control system "EutelTRACS" – an emergent transmission of emergency signals, monitoring of freight and transport means parameters etc. This satellite system allows the management of freight and transport means' movement [Jarašūnienė *et al.* 2006].

"GeoTrek" software is used for an efficient management of transport means and operative connection between a company's dispatchers and drivers [Jarašūnienė *et al.* 2006].

A car tracking system "Seklys" is for the monitoring, management and display of the whereabouts of mobile objects in digital maps that can be presented on a computer screen.

A transport management system "NaviSat". It is crucial to know the current information about the activities of transport means in transportation business. "NaviSat" system allows operators to know the exact whereabouts of transport means [Batarlienė 2011].

3. Problem Analysis on the Instalment of IT in Various Transport Modes

The analysis that has been carried out on the instalment of IT in various transport modes, revealed that there is no unanimous register of country's roads that would accumulate the most important road data. Currently, all this data is stored in various institutions, it is not updated. Therefore, there are no detailed digital maps and no logic transport scheme. Drivers are using unreliable and non-detailed maps for navigation. There are no adapted digital road maps for the provision of IT services. IT development is executed non-co-ordinately in two levels: national level and municipality level. The carried out analysis showed that Lithuanian railway infrastructure mostly uses management system standards, created in CIS

countries. The governors of Lithuanian railway infrastructure have virtually no opportunities to participate in the development of management system technologies and standards.

It is obvious that the infrastructure of Klaipėda Sea Port cannot use to the maximum the handling capacities of ships. Some of the ships cannot be loaded due to an insufficient port's depth. An inland water transport is underdeveloped; therefore, there are very few users of IT services. In addition, there is no need for the development of IT solutions.

4. Problem Solutions to the Instalment of IT in Various Transport Modes

Most of IT products (navigation, planning, real-time information etc.) could be realized through mobile devices.

IT activities could both enhance the integration and efficiency of different transport modes. Currently, the majority of IT in railway transport is for interior use. The opening of systems to exterior users would increase its efficiency. Modernization of railway infrastructure and application of IT means create opportunities for more forwarding activities. IT instalment may optimise cooperation with different transport modes, and, in general, promote railway transport. IT use in water transport would create conditions for a quicker attendance of ships (quicker loading and unloading, quicker document management). This would lead to a less time spent at ports, while the very ports could attend more ships. IT means could ensure a better ship management in the territory of ports ("A Long-Term (up to 2005) Development Strategy of Lithuanian Transport System" (23/06/2005, No.692)).

The integration of various transport modes creates new opportunities for the increase in freight mobility, more effective use of transport means, improvement in freight forwarding and Customs' service quality. Various business companies successfully cooperate in transportation process. Foreign experience shows that the insurance companies, banks' subsidiaries, centres of information technologies, transport research, couching and training companies successfully find a niche in forwarding activities.

Most often used IT bring those companies into international networks, and this makes them more competitive in an international market of transport services. IT efficiency is undoubted in Denmark, Italy, Germany and other EU countries that have a long experience in this field since IT allow to cut freight forwarding costs up to 20–30 % (Feasibility Study of the Implementation of Intellectual (Smart) Systems in Lithuania. 2011).

Forwarding and stevedoring companies must enter a huge amount of data and perform a lot of operations. The creation of a uniform system would reduce the processing time of documents, used in freight forwarding process. The creation of an integrated freight transportation system would add to the modernization of e-services, better use of information technologies and more effective use of currently operating systems' resources and opportunities. It would also add to cutting time and costs of business subjects and institutions that control, forward and reload freight. A quicker processing of documents, used in transportation process, growing reliability of services and management improvement would increase Lithuania's competitiveness and attractiveness as a transit corridor.

5. IT Economic Efficiency

IT instalment requires big investments; however, it brings a long-term reward. Thus, it is vital to evaluate the most efficient IT means.

Annual economy effect:

$$E = E_m - E_n k, \tag{5.1}$$

there:

E_m – annual profit increase after IT instalment;

E_n – standard investment efficiency coefficient (0,12);

k – IT development and instalment costs.

IT efficiency coefficient (E_S) and investment payback time (T_S) are calculated according the following formulae:

$$E_S = E_m / k; \tag{5.2}$$

$$T_S = k / E_S. \tag{5.3}$$

IT is considered efficient if:

$E_S \geq E_{nIT}$, $T_S \geq T_{nIT}$,

here:

E_{nIT}, T_{nIT} – standard IT efficiency coefficient is equal to 3,3, while capital investment payback time is equal to3,3 years.

IT is considered efficient if it gives benefit within 3 years. This is also based on the fact that within this period of time software gets outdated and the previously developed IT looses its relevance, forms of documents; laws etc. also change [Batarlienė 2011].

6. Conclusions

1. The IT application analysis, carried out in companies working in the sphere of freight transportation, forwarding, logistics, revealed that technologies are applied taking into consideration services provided by that company, unfortunately, this is done only at a company's micro level. The provision of multimodal IT services at macro level is complicated, there is no uniform agreement.

2. It has been revealed that in order to effectively apply IT in transportation services, it is necessary:

- To develop and install a transport network traffic and users' information management and control system for the optimisation of infrastructure.
- To develop a system of multimodal transport information and management.
- To modernize railway data transmission and traffic management system, ensure its agreement with similar systems in neighbouring countries.

3. The potential of existing multimodal IT means is not fully used, e.g., freight and goods information system (KIPIS), developed for Klaipėda port, is used only by a small part of port's companies. There are no solutions that would allow planning shipments between different transport modes.

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