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QUALITY LEVEL OF AN INTEGRATED TRANSPORT SYSTEM IN THE CONTEXT OF INFORMATION AND COMMUNICATION TECHNOLOGIES

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Abstract: *This article is aimed at improving information and communication technologies in integrated transport systems, which lead to higher quality of services offered to customers. According to the research, focus on the customer remains the primary role of information technologies in integrated transport system. Another important task is the very philosophy of the solution, and then it is important to model and manage these technologies. The paper is supported by the VEGA Agency by the Project 1/0188/13 „Quality factors of integrated transport system in the effective provision of public transport services in the context of globalisation", that is solved at Faculty of Operations and Economics of Transport and Communication, University of Žilina.*

Key words: *model, integrated transport system, quality, information and communication technologies.*

1 INTRODUCTION

Integrated transport system is a system of transport, where several carriers on the basis of reciprocal cooperation constitute an offer of transport services for the end user, the customer, which is advantageous in a competitive environment of the liberalized transport market. The offer of transport services provides an integrated transport system mainly through the common transport and tariff policy. The final consumer of the service is offered the option of combining several modes of transport, regardless of transport operator. Integrated transport system is currently known as the most effective way of ensuring transport service area by public transport.

The benefit of an integrated transport system is primarily profit of all parties to interconnection and proper implementation of the various components of transport processes, offering a comprehensive and high-quality transport service to the final consumer.

Participants can gain an advantage for an increase the volume in the transport market, the attractiveness of the offered services, and certainty of contractual relations, economical spending, and consistency to each other and joint coordination of transport processes, especially in the connection of transport links.

In an integrated transport system there is one of indispensable prerequisite for increasing the performance and competitiveness of the participating transport companies, the information support of the integrated transport system. Quality information is currently regarded as the greatest source of wealth. Getting good information on the amount of data that are on the market is a difficult and complex process. Information necessary to decision making whether strategic or operational in the daily management of the company, are necessary to obtain from data through effort or cleverness.

The costs of failed information and communication technologies in the USA have recently been estimated at $ 91 billion and therefore depend on the quality of the software, while the integrated transport systems this dependence is even stronger. An important influence on the integrated transport systems is the fact that dependence on software increases from year to year. This is reflected in the use of software on multiple roles in the sphere of transport processes, in embedded systems in consumer goods such as mobile phones and of course the internet.

Risks associated with software failure increases with the degree of use. The resulting poor quality there are arise costs of losing opportunities for the participating transport companies, which can be very difficult to quantify.

2 THE OBJECTIVES OF AN INTEGRATED TRANSPORT SYSTEM IN RELATION TO QUALITY

One of the objectives of an integrated transport system is comparable (measurability) for the customer to enable him to calculate the usefulness of using the system. In general, the main factors of interest to the customer (obtained from the marketing research concerning the public transport) are the transportation time and costs for transportation. The lower price for transport and shorter transportation time are interesting for the customer of integrated transport system. This is the basis for rational decision-making based on the customer's own costs reduction, but also the total costs. Correct methodology of composition the integrated transport system is extremely important and moves through stages in which it should be considered alternative modes of transport on the basis of qualitative approaches.

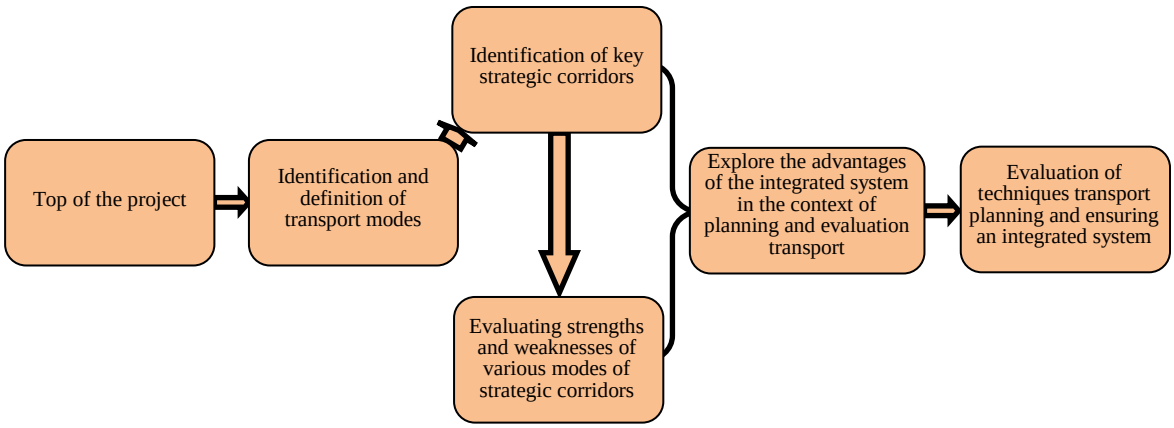

Fig.1 *Project methodology of an integrated transport system*

3 PHILOSOPHY FOR SOLUTIONS OF INFORMATION AND COMMUNICATION TECHNOLOGIES WITHIN AN INTEGRATED TRANSPORT SYSTEM

The basic philosophy in the development of information and communication technologies within an integrated transport system is a detailed specification of the information system (IS), which includes:

• technical specification, which is subject to technical parameters IS interface, terminal equipment and technical conditions of transport undertakings,

• functional (application) specification, which is the subject of detailed account of IS functionality and its functional characteristics resulting from a detailed analysis of transport undertakings.

Relevant information system specifications are systemic and partial guarantee functionality of information system in an integrated transport system.

Information system shall be designed so that in an integrated transport system occurred to streamline and speed up the work at every level of the organizational structures of transport undertakings, such as the use of modern technology - two-dimensional barcode (Aztec code, QR code, etc.), smart cards, work with the network and others. It is important to use process management in an integrated transport system because of the transparency of the processes in transport enterprises. The introduction of such a system of management and control processes is then necessary to support by information system that accurately in an electronically form maps the real transport processes that take place in the actual traffic operation. Information system must also meet the requirements for the modernization processes in transport undertakings, thereby enhancing the quality of services offered to clients of an integrated transport system. This leads to a reduction in labor intensity and increasing labor productivity in an integrated transport system. The output is increasing the quality and availability of planning, economic and operational information.

4 MODELING OF INFORMATION SYSTEM IN AN INTEGRATED TRANSPORT SYSTEM

When modeling information system in an integrated transport system should follow the procedures and rules for taking account also to the very independence of the information system, which in case of problems allows easier transition to other information system (IS another supplier). Gradual modeling rules for information system are as follows:

• system decomposition - decomposition of the components that fit the given level of abstraction,

• modeling system – creation a model of information systems corresponding to the real parts of this investigation,

• simulation - experiment with abstract models in order to test the behavior of information system in real terms,

• composition – information system compilation from individual parts based on simulation results. [1]

Before running information system up is needed to perform the test of information system, short reveals some shortcomings of information system, but almost always after prolonged use of information system are apparent serious unexpected errors, or changes, which need to be eliminated or removed completely. If it is necessary because of the unbearable limitations of information system to go to the new IS, there is the principle of the new information system: necessary to create new one with new data, it is not right to copy

data from the old information system, because with it could be copied the mistakes or deficiencies.

5 MINIMUM REQUIREMENTS FOR INFORMATION SYSTEM IN AN INTEGRATED TRANSPORT SYSTEM

With the increasing requirements on quality of the information for clients the information system applications need to flexibly respond to changes. Minimum requirements for IS integrated transport systems are as follows:

• information availability - the easiest to obtain real-time information before, during and after the transport processes in the integrated transport system (easy - intuitive access via smartphone application, electronic tagging, and electronic commerce). Determination of minimum standards - quality levels for information availability within integrated transport system,

• information accuracy - human information work (accuracy) in editable information. Minimising misinformation by introduction of automated systems for automated data processing systems by conversion or by database systems,

• timeliness of information - online traffic information with valid time (countdown), for customer to be confident and have overview with time fares, at dynamic information for example within changes in the transport organization, departures, or trips planning,

• clarity of information - clear information, easy to understand, clearly arranged, their correct structure, streamlining transport and tariff system for example interval mode, fare zones, the extent of the information displayed by technical and operational standards,

• speed of providing information - network version of IS, the possibility of immediate update of the information, one-touch able to display all the required information,

• data backup - create backup copies of data used to restore live data, if there is damage or destruction of data. Backup data can be manually or automatically through compression or encryption of data storage,

• interoperability of systems - systems connectivity, unified information system (e.g. locomotive marking), the opposite is, if the exchange of data with other information system not possible or is very laborious,

• platform independence – information system can use cross-platform languages (Windows, Linux, Mac OS, Unix),

• integrated search engine of transport links - the area of information retrieval deals with the representation, storage, organization and accessibility of information, the aim is to obtain the most relevant information about the requested object (demand for information),

• multi-layered and modular architecture - a multi-layer system is used to communicate with the outside several levels, each of which communicates only with its next level. Modular software consists of individual modules. The modules are relatively independent pieces of code that perform only a precisely defined area of activity. Modules can communicate with each other only through well-defined interfaces. Using modules brings a number of benefits that will be felt mainly in the creation of wider information system. Modular architecture allows independent development of the different parts of the code changes or a complete overhaul of one module, which will not affect other modules. The modular architecture can be implemented in the information system operations before without the more difficult the development of other modules.

• relevance of information - the information, in which the correspondence between the desired and finding information; the semantic content of the information corresponding to the user's question,

• comparability of information - is primarily used in programs of financial statements, examinations correctness, statistics, etc.

6 MANAGING BUSINESS PROCESSES WITHIN AN INTEGRATED TRANSPORT SYSTEM

Management of business processes (Business Process Management - BPM) is a combination of technologies within an integrated transport system and the voice of the customer, which maps, sets, monitors and optimizes business processes and integrated transport system to be implemented effective manner. Management of business processes enables exploring, mapping and planning processes integrated transport system with a focus on the customer, which leads to improvement using information obtained through the information system within the sub processes. Managing business processes represents a new approach to process management within an integrated transport system and contributes to the high efficiency of these processes, particularly in the areas of:

- production, operation and logistics,
- finance and accounting,
- human resources and payroll,
- planning.

7 INFORMATION SYSTEMS USED IN INTEGRATED TRANSPORT SYSTEM

In an integrated transport system, which is intended to function as a single entity, it is necessary to know partial information systems, which are used in various contractual transport undertakings. Basic division of these information systems currently used is as follows:

1. economic systems,
2. operating systems,
3. attendance systems,
4. planning systems. [2]

It follows that the connectivity of information system is a very important factor that can cause the system to malfunction. For this reason it is necessary to address to connectivity of systems enough large area within transport undertakings. The way in which the information in the system interconnect and create a connection one another is from the perspective of system functionality critical. This is mainly due to the existence of the main objective - customer orientation. The general principle is that the links are more important than the information itself, and this is shaping and disseminating feedback to the requirements of the information system.

8 CUSTOMER ORIENTATION AS FUNDAMENTAL OBJECTIVE OF INCREASING THE QUALITY OF INFORMATION SUPPORT OF INTEGRATED TRANSPORT SYSTEM

The future of any integrated transport system depends on the behavior of individual groups of customers and maximizing the rate of customer satisfaction and loyalty, which can be achieved using the following tools:

• systematic review of customer requirements - what the customer needs (what information he is interested in), as required information (size and form of disclosure), which uses feeds,

• quickly and effectively meet these requirements - a systematic approach to addressing requirements, such as setting up telephone line of first contact for customer feedback,

• interconnection quality objectives with the needs and expectations of customers - goals of transport undertakings set with regard to current and future customer needs, what customers need now and what they will want in the future,

• systematic measurement of customer satisfaction and loyalty - audit and regular monitoring, measuring customer satisfaction through the information system,

• development and customer relationship management - staff development, improvement reciprocal favorable relationships, identify what other options customers have,

• developing relationships with other stakeholders (public administration, offices etc.) - improved relations, one touch information within system.

The benefits of information support of integrated transport system can be defined as follows:

• reduce labor intensity and thus saving time, automation of routine activities, reducing the share of manual labor,

• reduce errors when creating a data transfer due to human factors (e.g. the use of QR codes),

• more efficient internal management processes within the transport undertakings; management processes within an integrated transport system, efficient access to information, connecting all information into a single unit, making them available to all users, reduce operating costs, improve economic results of operations,

• flexible communication and reciprocal information,

• increased competitiveness, unify user interface information system (web, fax, call center, e-mail, ...)

• monitoring, measuring and evaluating the performance of individual employees,

• archiving of internal and external documents.

9 EXAMINING INFORMATION SUPPORT OF INTEGRATED TRANSPORT SYSTEM

The main source of information within this article was the electronic questionnaire realized in the second half of 2012. It contained fourteen questions which should reveal the largest and the smallest benefits of information support within integrated transport systems. Basic set of questionnaires created the set of 40 enterprises in the sector of public transport in Žilina region.

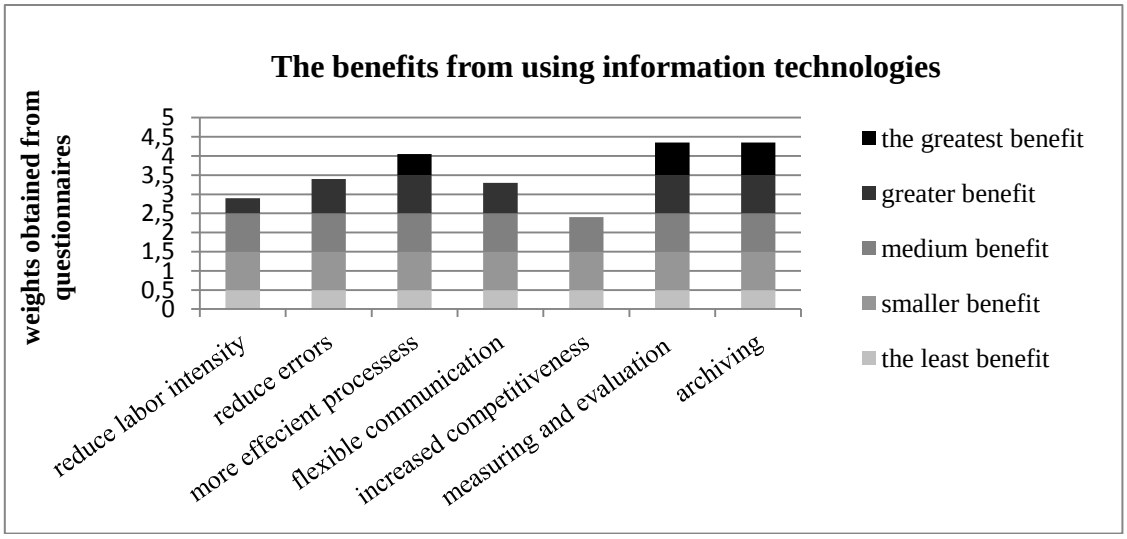

Fig.2 *The benefits from using information technologies*

10 CONCLUSIONS

The realized research showed that information a communication technologies help transport undertaking especially in the areas of monitoring, measuring and evaluating their own performance, and further computerization of archival documents. This fact leads to understanding own processes and thus high efficiency and operational management processes. Thus, the quality of information and communication technologies has a positive impact on the quality of services offered, that affecting customers. Similarly, these benefits help to reciprocal comparability between transport undertakings and facilitating the detection of connection between the quality of transport processes management and performance parameters of the offered services. Customer orientation remains the primary task of information technologies within integrated transport system, another important task is the philosophy of a solution, and then it is important to modeling and control these technologies.

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