



INNOVATIVE MODEL FOR PROCUREMENT OF DIGITAL TRANSPORT TICKET IN RAILWAY TRAFFIC

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***Abstract:** Traffic organization and planning is becoming a major challenge for researchers and employees in transportation companies. In order to achieve acceptable results in order to increase revenue, transport companies must apply advanced Internet technologies. This paper presents the starting points for modeling an innovative model of digital business in railway transport with the integration of road transport services. The model of innovative business in railway transport can completely replace the previous traditional activities for the purchase and purchase of a transport ticket. The space (facility, office space) of the railway and road carrier for issuing and charging for transport tickets can be replaced by virtual space provided by advanced internet technologies. The main goal of this paper is to present the basics of an innovative digital business model that meets the needs of users for transportation as well as increase business revenues in the transport company. The innovative model includes the following interactive components: human resources (user with their need, service administrators), technology (required for the implementation of service activities), organizational processes (flow of activities and application of innovative technologies), environment (virtual space technologies, Internet for digital communication between the user and the service provider) and services (digital record of the transport ticket on the smartphone). In this way, the available technology provides the initial basis for the realization of the needs, desires and requirements of users of digital map services, while the transport company also reduces costs by reducing the number of employees, equipment and other material costs.*

INTRODUCTION

The subject of this paper is the definition of an innovative contactless transaction model of digital business (DB) in railway transport based on advanced Internet technologies (IT). Defining an innovative contactless transaction model should improve and implement the current operation of railway transport. To lead to greater satisfaction in accordance with the real wishes, needs and expectations, through increasing the quality of transport services, all participants in the DB process [1],[2],[3],[4]. The development of IT also leads to the development of innovative DB models through the application of applications on smartphones

with the help of which transport companies (TC) provide pre-determined services to customers. Advanced IT enables various models for the application of mobile applications. Mobile applications allow service users to meet their needs from anywhere and at any time of the day under certain conditions that are in line with the vision and mission of TC. The development of innovative models of mobile applications requires the use of specialized integrated development environments.

Monitoring and analyzing the performance of mobile applications is a complex problem when applications rely on remote services over the Internet. The causes of possible failures and performance anomalies of client-server applications are difficult to determine due to their distributed nature. The author's work [5] presents a mobile infrastructure analysis system that helps to efficiently detect and debug applications in a distributed environment, holistic application analysis and network activity on client devices, application servers, databases data, etc.

RELATED RESEARCH

The approach to modeling the innovative DB model in TC combines the analysis of IT with the perspective of economic value from business areas [6]. Innovative business models contain pre-planned strategies that should enable better TC business and greater satisfaction of service users. One of the basic conditions is the application of the methodology for the realization of the technological model with the aim of increasing the quality of service. The authors [7] propose a sustainable concept of transport where road and rail transport are combined with recommendations for future planning of better services. Services are defined on the basis of transport capacities in passenger transport. These services are pre-designed to meet specific passenger requirements and meet design criteria [8]. To increase profits in TC business, a service provider (SP) can efficiently sell products through online channels [9].

The development of railway passenger traffic implies the use of criteria related to the transport process by determining the indicators used for assessment based on social and economic factors [10]. The innovative model of the DB should highlight the relationship between quality, use and satisfaction with the price of the ticket, which are also indicators of the quality of SP. One of the important approaches is to consider the attitude of users where the opinions of users about the service are considered and to define the methodology for comparing indicators over time, by structuring an approach that can be replicated in different urban contexts [11].

COMPONENTS OF AN INNOVATIVE MODEL

The very current application of the new paradigm of the business entity, whose interactive components are human resources, technology, organizational processes, environment (virtual process) and service / product, is being investigated in the field of transport services with digital management of critical business activities (figure 1). Basically, transport is a multimodal structure and services are predominantly organized in the integration of multiple modules. Transport service is determined by technological and behavioral components. The technological component is determined by the capacities of transport organizations as service providers, mechanisms for access and delivery of services, security requirements and business-process technological resources. The behavioral component is determined by the roles of responsible operators for service delivery with management of security factors and user-people factors, input data they provide, needs-desires, requirements and expectations as well as contextual information important for synchronizing activities in service process structure [12], [13].

Basically, modeling an innovative DB model based on advanced IT includes: human resources, applied technology, organizational processes, environment (place or space) for e-

process implementation and service or product [1]. The components "human resources" and "services" have a dual purpose that can be seen as part of the structure of an innovative model in the process of realizing service transactions, and then can be independent until using a digital map or planning the next trip. Human resources can be analyzed by service users as well as TC employees in the structure of the innovative model.

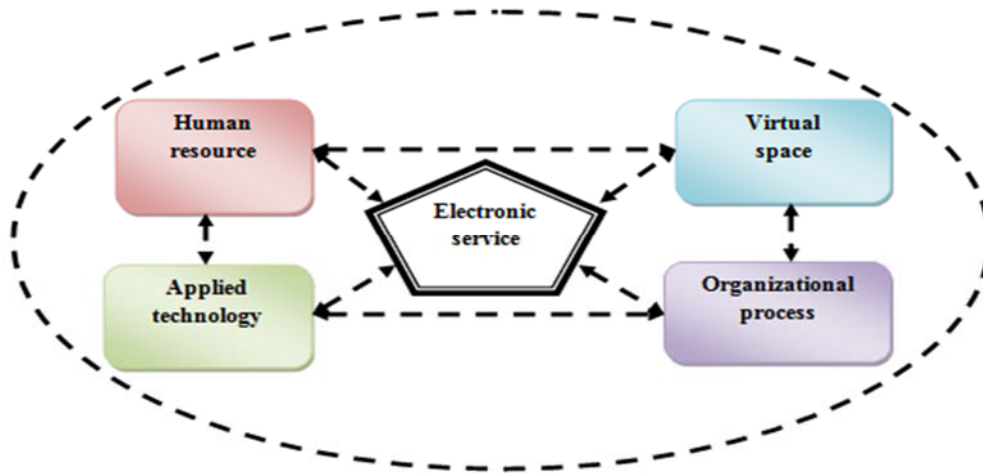


Figure 1: Interactive components of the model

For the development and use of the model, the service user plays a key role as the initiator of the digital process for the procurement of a transport ticket. Employees of TC, IT administrators have a special role in arranging the accessibility of innovative model services, availability at any time of the day during the week as well as for the security requirements of all interested participants during the interaction activities. The service, the transport ticket in the digital record that the user receives on the smartphone, represents the final result of the digital process (DPr). Applied technology and organizational processes determine the ability and implementation of DPr services in order to procure a map in a virtual environment based on the Internet platform.

Based on the above, it is necessary to develop a model of an innovative transaction model of DB based on advanced IT in railway and road transport. The model should include the infrastructure consisting of hardware, software and network that have the role of connecting the computer, the user and to connect devices and communication channels for data transmission.

ACTIVITY FLOW IN AN INNOVATIVE MODEL

The user of the service uses the railway application via a mobile device as a basis for the realization of an innovative contactless model in order to purchase a transport ticket (Figure 2). By opening the application installed on the smartphone, the service user has the option of choosing the travel route. After selecting the route, it reviews and selects the travel date. For a certain date, it selects the number of trains where the possibility of choosing the type of place (sitting, bed) is opened. The selected request is sent via a wireless connection to the service provider's service, railways.

When the service receives the request of the service user, the requested service is conditionally reserved and a new page related to the road carrier is opened. The user of the service has the option to select an offer in road transport or to skip and focus on registration in order to pay for the selected service online. In case of major disruptions in train traffic or extraordinary events, there is a possibility that the railway will not accept the request of the service user, the carrier application is out of order. If the payment process is successfully

completed, the railway reserves the requested service resource and sends the user a digital record representing the transport ticket containing:

- Date and time of payment for the service;
- Ordinal number of internet payment in the contactless ticket service
- Number of seats;
- Travel route;
- Date of travel;
- Number of service users;
- Total price of the service;
- Bar code for validation and control in the vehicle.

It should be noted that the bar code that represents the e-card in digital format is of great importance. The user of the service from a smartphone must validate on the device installed in the vehicle before starting the trip. With the help of the device for electronic issuance of train documents, the train and control staff loads the bar code which is forwarded to the database of the railway and road carrier via the Internet.

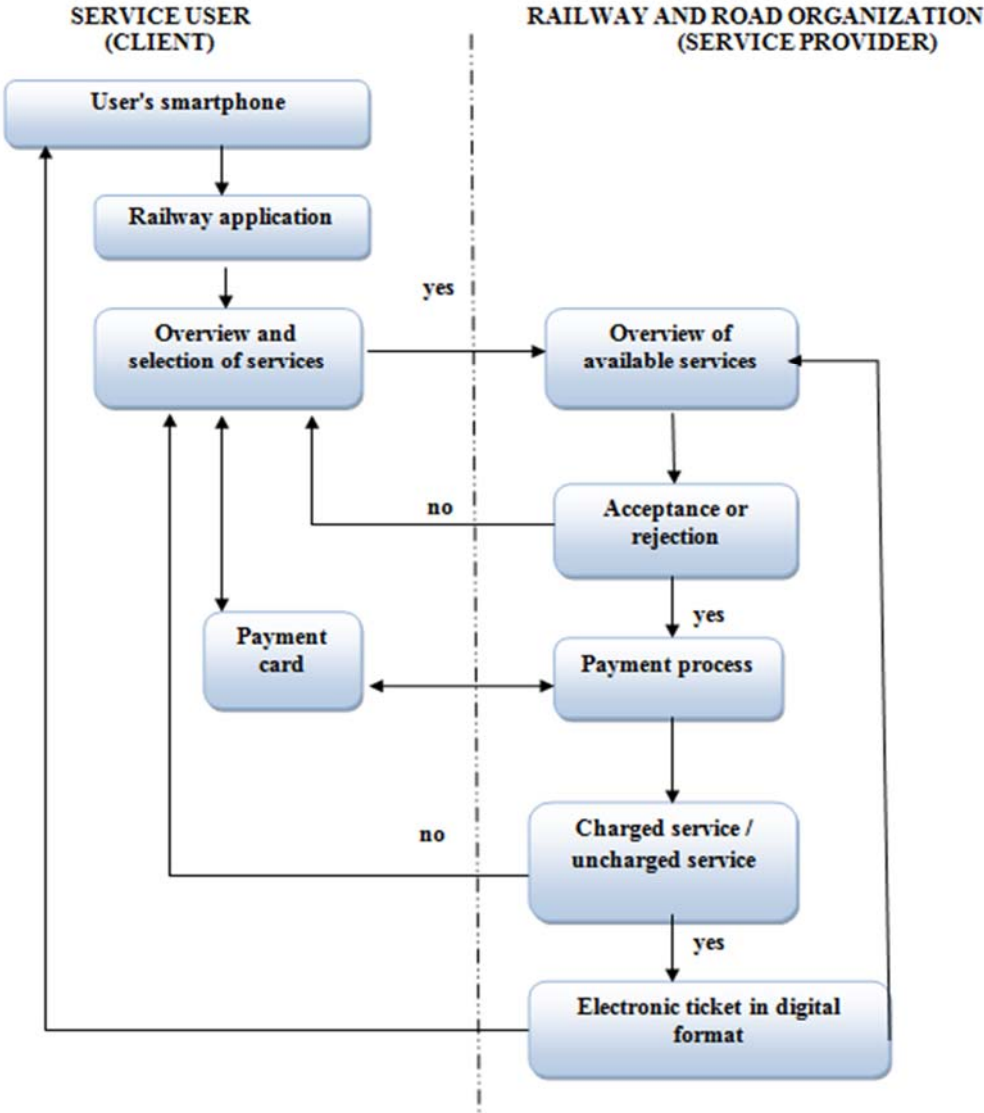


Figure 2: Model realization process

CONCLUDING REMARKS AND FUTURE RESEARCH

Computer sciences belong to multidisciplinary fields, in other words, they are increasingly represented in all worlds related to the development and improvement of the quality of life. This example shows an innovative digital business model that integrates transport companies in order to increase the quality of transport of service users. After testing, the application increases the competitiveness of transport companies through its implementation. The user of the service from anywhere and at any time of the day, can satisfy his needs by connecting from his computer, tablet or smartphone, pay and receive an electronic ticket in digital form.

Future directions of research must be focused on testing an innovative model with service users through a simulation of the purchase of an electronic ticket. After that, based on the obtained results, real and everyday use can be approached.

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