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## ON THE DIFFUSION PROCESSES OF M-SERVICES IN REGIONAL BUSINESS ENVIRONMENT

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**Key words:** *Diffusion, m-services, knowledge biography, adoption models*

**Abstract:** *The proposed contribution deals with investigation the issue of diffusion research focused on diffusion and adoption models at firm level in transport. Diffusion theories are aimed at exploring issues as how, why and with what intensity there are new knowledge or technology or innovations spread. The purpose of this article is to analyse diffusion processes and describe inter-firm and intra-firm diffusion and differences between them in transport industry in relation with m-services. Theoretical review of m-services adoption models at the transport firm level are stated, and factors that influence e-services adoption and diffusion in each of them.*

### 1. INTRODUCTION

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. Diffusion has a special character because of the newness of the idea and the message content. The newness means that some degree of uncertainty and perceived risk is involved. The term diffusion is sometimes restricted to the spontaneous, unplanned spread of new ideas and the concept of dissemination is used to describe diffusion that is directed and managed.

The main elements of the diffusion of new ideas are:

- innovation
- communication channels
- time
- social system

The paper deals with the methodology for examining diffusion processes in regions and the diffusion processes of e-services in the transport industry. M-services emerge set of applications and services people can access from their internet - enabled mobile devices.

Technology diffuses slowly both across and within countries resulting in significant lags between the time of invention and the time when a technology is initially used in a country. Even when a technology has arrived in a country, it takes years and decades before it has diffused to the point of having impact on productivity. This leads us to study why technology diffuses slowly, and what explains cross-country differences in its speed of diffusion.

## 2. THEORETICAL BACKGROUND

The effects of innovation on economic development were first systematically studied by Schumpeter (1934), who stated that innovative activities by firms often require costly and time-consuming processes in order to gain competitive advantages.

Some innovations diffuse from their first introduction to widespread use in a few years; another may level out at longer time. Rate of adoption is the relative speed with which an innovation is adopted in a social system. According to Rogers (1995) there are several characteristics that affect the rate at which they are adopted, namely: relative advantage, compatibility, complexity, trial and observe abilities. Innovations requiring an individual-optional innovation-decision are generally adopted more rapidly than innovations that are adopted by an organization.

Diffusion research has achieved a prominent position today. According to Downs and Mohr, “innovation has emerged over the last decade as possibly the most fashionable of social science areas” (Rogers, 2003). However, some scientists complain that diffusion of innovations is too big to ignore but unlikely to be given full recognition. Despite this criticism, we should not forget that the diffusion has reached a point at which its contributions are highly regarded.

Dissemination of m-commerce services can be considered as the diffusion of innovation or technology change, so it is possible to use some of existing models for modelling diffusion in specific industrial and regional conditions. So, there is highly needed to identify factors affecting diffusion and thus subsequently develop sufficiently accurate model.

Empirical studies on technology adoption consider adoption by countries or cities or firms as independent. There is a link between country’s technology adoption patterns and the country’s characteristics. But this empirical approach ignores the possibility of cross-country or cross-industry interactions in the adoption process. Adopting a new idea requires acquiring knowledge which often comes from interactions with other entities. It seems more likely to be knowledge transmitted between agents in countries that are close than between agents located far apart. The adoption intensity of a new technology in a country increases when nearby countries have a high adoption level.

In the case of the m-commerce diffusion, an individual cannot adopt new services until an organization has previously adopted it. Therefore it is necessary to identify also regional factors influencing behaviour of m-commerce consumers, as well as behaviour of m-commerce operators.

Various models have been developed to model innovation diffusion. Among them, there are two models, the external and internal influence models, which have received strong empirical support. The external influence model assumes that adoption is driven by information from a source external to the social system and adoption is related to the number of individuals in the social system that have yet to adopt the innovation. The internal influence model assumes that adoption is driven by communication within social system and that the expected number of adopters is related to the number of factors that have already adopted as well as the number of potential adopters. [8]

There are many theories used in diffusion research concerning technology adoption. The most used theories are the technology acceptance model (TAM – Davis, 1989), theory of planned behaviour (TPB – Ajzen, 1985), unified theory of acceptance and use of technology (UTAUT – Venkatesh et al. 2003), diffusion of innovations (DOI – Rogers, 1995) and the TOE framework (Tornatzky and Fleischer, 1990). One of the most commonly employed models is the Technology Acceptance Model, which explains and predicts an individual’s acceptance behaviour toward a new technology. While this theory is useful for understanding

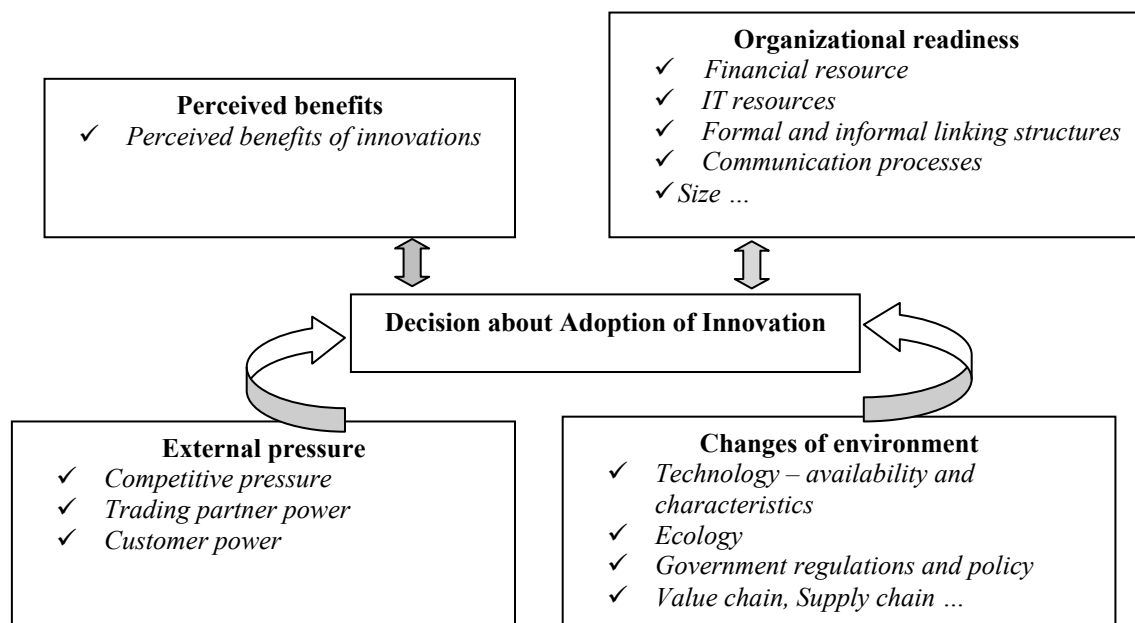
individual's acceptance, it is not suited for investigation of organizational-level acceptance. The adoption decision on a firm level is generated as a strategic firm-level initiative.

From these theories only DOI and TOE framework explain adoption process at a firm level. Besides these two models there are also institutional theory and model of Iacovou et al. which can help to better understand this issue. Roger's diffusion of innovation theory can be used to study individual acceptance of a new technology, but it can be also used to explore the adoption on a firm level. This theory considers the innovation in relations with independent variables, namely:

- individual characteristics of the organization,
- internal characteristics of organizational structure
- external characteristics of the organization

The different approaches and models discussed the influencing aspects of innovation processes as well as the regional and industrial aspects of adoption processes of innovation. Figure 1 show the approach that is used by the team of the Department of Communications of the University of Zilina. It reflects the several aspects of adoption of innovation, e.g.:

- intra-firm aspects (organizational readiness)
  - the ability to accept and adopt the innovation
- inter-firm aspects (changes of environment – market, policy, technology)
  - the structure of industry
  - the policy and regulation
  - the challenges in the other industries (mainly in ICT industry – technology, services, applications, networks,...)



**Fig.1 Aspects influencing the process of innovation adoption**

### 3. METHODOLOGY OF RESEARCH

In addition to quantitative models, nowadays increases utilization of qualitative inductive approaches. Their advantage is the ability to describe complex events, participants and decisions that affect creation, dissemination and utilization of knowledge in different regions. (Rehák, 2011)

To monitor innovation adoption including the knowledge dynamics it is possible to use qualitative research based on case studies – knowledge biographies of enterprises in the

context of all aspects influencing the processes of innovation adoption (see Fig. 1). Aim of their creation is:

- Analysis of adoption process of innovation including its dynamics and connections within the enterprise and among enterprises themselves;
- understanding the complex of events, participants and flows that determine dynamic, which is necessary for ensuring change of product, process or organization (innovation was seen as easy observable results of knowledge dynamics, what means that innovation in broader sense presents "red thread" of knowledge dynamics of enterprises).

Methodology of knowledge biography lies in following six steps:

1. Finding suitable candidate for knowledge biography
2. Establishing initial contact
3. Initial verbal interview with representative of the enterprise
4. The second interview in the enterprise
5. Interview with external participants of knowledge dynamic of enterprise
6. Assessment of knowledge biography and creation the knowledge model [3]

Within the evaluation of knowledge biography was recommended to create several types of maps:

- Map of the knowledge process – milestones in the creation, processing, utilization and dissemination of knowledge in the enterprise. It is created based on information included in knowledge biography of the enterprise. Horizontal division identifies location where was realized the process of creation, processing, utilization and dissemination of knowledge (internal or external) and a vertical division represents various phases of knowledge process. The time indicated in the map represents different stages of meeting the demands of knowledge process in the enterprise.
- Map of the innovation process phases in the enterprise – represent phases in the process of creation, processing, utilization and dissemination of knowledge throughout the life of knowledge and innovation. It is related to horizontal and vertical field of map.
- Time-spatial map of knowledge processes in the enterprise – is produced using 3D presentation and represents time and spatial map of relations and processes in knowledge management.

Within the several projects were produced knowledge biographies and biographies of adoption processes of transport and logistics enterprises in the Slovakia, in the Žilina region. This number represents sample, when achieved results of research are representative (with reliability estimate of 90 % and statistic deviation of sampling of  $\pm 10$  %). Example of produced knowledge biography is in the next chapter.

#### **4. M-TICKETING IN SLOVAK BUSINESS ENVIRONMENT**

One of the well-known e-services for mobile devices and for travellers is m-ticketing. This service has various advantages for travellers as well as for transport companies. Travellers no more need to queue or use their home computers to buy travel tickets. For companies it may be a tool for reducing ticketing costs, creating opportunities for value added services or reducing the costs on the deadhead. It is possible to illustrate the processes on the several companies in Slovakia but for this paper is including only the Railway Company Slovakia (ZSSK). It is one of transport companies in Slovakia that implemented m-ticketing service. ZSSK is a leading company in providing services in rail passenger transport. It is a joint stock company, whose founder and hundred-percent shareholder is the Slovak Republic. The state's rights as the shareholder of ZSSK are represented by the Ministry of Transport,

Construction and Regional Development of the Slovak Republic. M- ticketing in ZSSK is called eMIL, which means ‘electronic mobile internet rail ticket’. The innovation process is divided into four phases (see Table 1).

Description of the time flow of knowledge in the company serves as a basis for creating three maps: map of the actors involved in the adaptation and knowledge process, map of the adaptation and knowledge process and time-spatial adaptation and knowledge map. Figure 2 illustrates the map of adaptation and knowledge processes.

Regarding factors that affect the diffusion process during the first diffusion phase; there was effect of the three factors confirmed: socioeconomic characteristics, communication behaviour of the decision-making unit and felt needs. ZSSK is a large company and knowledge acquisition did not occur by chance, but due to the previous experience of the team. The second factor is the communication behaviour. ZSSK has built a number of networks with partners. Due to the nature of offered services, the company will reach out to many people. Regarding felt needs, we can confirm this factor. The company follows trends in a society, they want to be modern and innovative and not stay back in their industry.

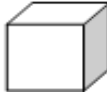
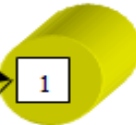

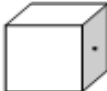
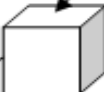


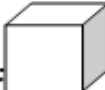






During the second phase of the diffusion process, especially the perceived usefulness influenced their decision or persuasion to adopt the service. Benefits of the service for the company are operation costs reduction and for customers it is the character of the services, which is more comfortable and available any time at any place. System didn’t seem difficult, since the maintenance and operation covers external firm and it is not necessary to interfere with its functioning. There was found also one factor which affected the company – compatibility; there was no need to buy anything, it was completely compatible with existing technologies and reason for further appraisal. In the words of team members who worked on the eMIL project, decision to adopt it was influenced by several factors. From the external environment it was the increase of mobile phones usage and customers’ positive attitude to new electronic forms of purchasing. The company has a positive attitude towards change.

**Table 1.** Phases of the innovation process in ZSSK

<b>Process step – phase</b>	<b>Event (description)</b>	<b>Time period (year, month)</b>		<b>Localization (city, country)</b>
<b>Phase 1 Creation of the idea</b>	Working on the new ticketing system called IKVC, gaining of experience and knowledge. Creation of the idea.	2004-2006		Bratislava, Slovak Republic
<b>Phase 2 Previous conditions</b>	ZSSK decided that mobile payments would be a part of a new ticketing system IKVC.	2006	2006-2011	Bratislava, Slovak Republic
	ZSSK was asked if they would like to implement SMS tickets. ZSSK rejected the offer.	2008		
<b>Phase 3 Implementation phase of the project</b>	Final decision to adopt the innovation.	2011		Bratislava, Slovak Republic
	Communication with external partners. Testing, working on the system development, graphic solutions and banking system.	October/ November 2011 – February 2012		
<b>Phase 4 The service launch</b>	Introduction of eMIL, start of the marketing support.	01.02.2012		Bratislava, Slovak Republic

## **5. CONCLUSION**

The article analyses the processes of knowledge, innovation and adoption at the basis of most used theories and models – Diffusion of technology, TOE framework, Institutional theory and Iacovou et al. model. The models are adapted on the Slovak regional business environment and transport industry. There are determining aspects of an enterprise's context that influence the process by which it adopts and implements innovation: technological context, organizational context, environmental context as well as the external pressures in industry and the general changes of environment. The process of m-ticketing diffusion was divided into four phases: knowledge, persuasion, decision, and confirmation. The results of this article show that socioeconomic characteristics of the company e.g. communication behaviour and felt needs influence on the knowledge phase of the diffusion process. Persuasion is determined by company's perceived usefulness, perceived ease of use and compatibility. Final decision to adopt m-ticketing is influenced by customers and company's positive attitude towards change. Proposed model can contribute to understanding of the drivers of acceptance of mobile ticketing by a firm.

Process step	Strategic aspects of the innovation process in ZSSK	Economic decision making in ZSSK	Milestones	Entry of external partner in the innovation process
<b>Creation of the idea</b>  2006	  The emergence of knowledge		  New idea prepared for adaptation	  Offer from mobile operators to adopt M-ticketing
<b>Knowledge adaptation, Implementation phase of the project</b>  2011	  Internal elaboration of the idea inside the company	  Project initiation	  Further elaboration of the idea    Service ready for implementation	  External partners: Hewlett-Packard, ČSOB and Exam Logics Trans Monogrammel
<b>The service launch</b>  2012	  Planning of further increase of the service efficiency – voluntary registration of passengers	  Marketing support	  The service launching    Operation	  Ministry of Transport, Construction and Regional Development of SR    System operation and maintenance

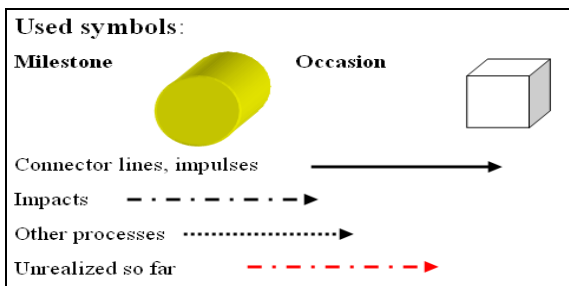


Fig. 2 Map of the adaptation and knowledge process

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## ИЗСЛЕДВАНЕ НА ПРОЦЕСИТЕ ЗА РАЗПРОСТРАНЕНИЕ НА М-УСЛУГИ В РЕГИОНАЛНА БИЗНЕС СРЕДА

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**СЛОВАКИЯ**

***Ключови думи:** разпространение, м-услуги, биография, модели за адаптиране*

***Резюме:** Настоящата статия представя проблеми, свързани с разпространение на изследванията сред отделните фирми от транспортния сектор. Теориите за разпространение на информацията са свързани с изследване на въпроси за това как, защо и с какъв интензитет се предават знанията и технологичните новости в транспорта. Целта на разработката е да се анализират процесите на разпространение на информацията на вътрефирмено и междуфирмено равнище и разликите между тях в транспортния сектор в зависимост от м-услугите. В тази връзка е направен преглед на моделите за приложение на м-услугите в транспорта и е отчетено влиянието на факторите при приложението на електронни услуги.*