

SOCIO-ECONOMIC EFFECTS OF SOME IT-SOLUTIONS FOR THE ROMANIAN RAILWAYS

PhD. Student, Dipl.Eng. Stelian-Gheorghe BALAN

S.C. ALSTOM Transport S.A- Bucharest

s_balan.ro@yahoo.com

Abstract

Transportations are one of the success-keys for achieving the Single European Market because they contribute to rendering concrete two of the fundamental objectives of the latter: free movement of persons and of goods.

The new technologies developed for vehicles and traffic management shall be essential in diminishing the emissions caused by transportation both within the European Union and in the rest of the world. The race for sustainable mobility has worldwide amplitude. The delayed action and modest implementation of the new technologies could condemn the transportation industry within the European Union to an irreversible decline. The transportation sector within the EU is faced with increasing acerbic competition on the transportation world markets which are in a process of swift development.

The present paper intends to make a brief presentation of the new information and telecommunication technologies implemented in the Romanian railways transportation, as well as an analysis of the economic and social impact of their implementation.

Keywords: railway transportation, information and telecommunication technologies, economic impact, social impact

JEL Classification: L92, L96, R42

Introduction

From all types of transportation existing today, railway transportation remains of high interest due to some certain advantages resulting from the fact that it is the less polluting and most environmental friendly one. These are but a few of the reasons for which, during the last years, by means of European Union strategies attempts are made for developing and implementing some programs for railway transportation to pick back up within the Community, and for generating increased traffic for this type of transportation.

At European Union level arguments are brought in for more efficient exploitation of existing infrastructures and for more ecological transportation. Ensuring energy and environmental sustainability of European transportations is an

objective that cannot be reached but by combining several policies that mutually support and complement each other and by involving an increasingly higher number of actors, representatives of the transports' sector, of public administration and of the citizens.

Advanced information and communication technologies can contribute considerably to achieving competitive and reliable transports by improving infrastructure, traffic and the fleet, by facilitating better monitoring and traceability of goods along transportation networks and improved relationships between enterprises and administrations.

During the last years, the information and telecommunication technology (ITT) pervaded European societies and economies to an extent no one could have foreseen just some couples of years ago. Many observers believe that the quick expansion of computer networks, mobile phones and of other TTI elements is on a very wide scale and with implications that lead even to the change of the European society.

ITT changes the manner in which people work and the typology of available jobs (vacancies). Obviously, the impact of these changes generated by the implementation of new information and telecommunication technologies could be significant for economies and societies. The changes generated by ITT can be done by a series of instruments, including by informing and consulting with workers, social dialogue, identifying in advance the deficit of competencies, of professional training and making sure that any restructuring will take place according to social accountability.

The paper intends to briefly analyze the economic and social impact of implementing information and telecommunication technologies for the railway transportations in Romania.

1. Railway transportation in Romania. General characteristics

Romania disposes currently of a national transportation system (infrastructure, transportation means, transport operators, etc.) which is placed, to a large extent, both from the viewpoint of the functional structure and from the one of delivered services at the level of average standards of the conventional transportation systems from Europe, fit to meet the current necessities of domestic and international users.

As a whole, the public transportation infrastructures' network (roads, railways, waterways, inland waterways, sea and river ports, airports) ensure the linking of all localities of the country to the national transportation network and to the international transportation systems.

After a "disordered" development, when each type of transportation was developed autonomously and independently, during the last years a certain "settling" occurred in developing the various means of transportation in Romania. Forced traffic capacities' surpluses was generated for some sectors of the road infrastructure network (mainly for large city entries and exits) and drastic decreases of the utilization degree of the railways infrastructure network (in many cases for the same transportation connection).

Despite all major changes achieved up to date, the transportation system from Romania still pays tribute to the “inadequacies” of the system in which it was conceived and realized.

The localization of Romania at the crossroads of several ways linking Western and Eastern Europe, as well as Northern and Southern Europe, and the location of the country on the transit axes between Europe and Asia constitutes a reference element for determining the transportation policy.

The Romanian Railways have the role to integrate the national railway infrastructure according to the technical and operational parameters at European level for being a compatible and inter-operable part of the future trans-european railways network.

The railways infrastructure is currently in a difficult technical state because of some important delays in realizing the maintenance and reparation cycles for the rails, installations and buildings, but also with respect to realizing modernization works, as these postponements were generated by the chronic absence of necessary funds. Because of the impossibility of ensuring the financial funds required for the current maintenance works of the railways infrastructure during the last years, the traffic capacity was diminished.

The inter-operability of the conventional railways network (TEN-T also outside the TEN-T network) with the European railways transportation network shall be done by implementing in the rail and on board of the motor rolling material of the required elements of the ETCS monitoring system, by modernizing the centralization installations of the railway stations by implementing electronic centralization systems, and by developing the information system for all railway stations placed on the inter-operable railway network from Romania; developing the telecommunications’ network for ensuring the support for data transmission, and implementing the national integrated traffic management center on Romania’s territory, revamping the installations for the power supply of the contact rail.

These actions shall lead to a better coverage of the transports’ market and improved accessibility of the travelers to the main transport routes by interconnecting the latter to the regional services and increasing the load degree of wagons with passengers on the main and regional transportation routes.

2. Economic and social implications of ITT implementation in railways transportation

Technological innovation shall constitute an important source of contributions for solving transportation issues. The systems of railways traffic management can optimize the use of the network and improve safety.

“Intelligent transportation systems” presuppose the use of ITT in the field of transportations. Such applications are developed for various transportation means but also in order to favor their interaction (including intermodal platforms).

If in the field of air transportation, SESAR¹ shall constitute the framework for implementing a new generation system for air traffic management, and for inland waterways the river information services (RIS)² are available, in view of managing the use of waterways and the wares' and passengers' transportation, for the railways network is gradually implemented the European Rail Traffic Management System (ERTMS) and the telematics applications for freight (TAF).

The European Rail Traffic Management System-ERTMS is a major industrial project developed by six members of the UNIFE association (Association of the European Rail Industry): Alstom Transport, Ansaldo STS, Bombardier Transportation, Invensys Rail Group, Siemens Mobility, and Thales in close cooperation with the European Union, and bodies interested in the railways and GSM-R industry.

2.1. Implementation of the ERTMS/ETCS system in Romania and its generated economic effects

Developing the national plan for implementing in Romania the ERTMS/ECTS system began from the strategy in the field of signaling installations based on the current endowments and future modernizations within the limits of the funds allocated for the field.

Thus, for large stations was regarded as necessary the implementation of the electronic integrated management systems (the types SIMIS W-SIEMENS and ETSTW L90 RO – ALCATEL, - ALCATEL compatible for the linking to the ERTMS/ETCS system), (CED), and for the small stations were realized two digitalization variants of the operation posts for the electro-dynamic centralization installations (CED).

The implementation of the ERTMS/ETCS system has as basis a range of specific requirements for each rail administration, and for Romania the requirements can be classified as follows:

- ▶ *superior requirements*, that cover the essential necessities for the ERTMS/ETCS system from which: hardware requirements; capacity (for instance, number of trains/hour and direction); maximum speed (200 km/h);

- ▶ *operational requirements*, that describe the necessity of the ERTMS/ETCS system from the viewpoint of the operations performed on the railway;

- ▶ *functional requirements* of the ERTMS/ETCS system.

With respect to implementing the speed control system for ETCS-type trains, Romania opted for ETCS Level 1 for the rail Bucharest North-Ploiesti West, ETCS Level 2 for the rail Bucharest North-Constanta while concomitantly maintaining the installation for the in-point control of trains' speed (INDUSI).

Implementing ETCS level 1 provides for a series of important advantages: interoperability; increasing the safety degree; increasing the comfort degree for

¹ SESAR: *Single European Sky Air Traffic Management Research* (The research programme about the air traffic management within the Single European Sky).

² River Information Services (RIS)

passengers by optimizing the brake-time, diminishing specific consumptions of traction power; diminishing the usage of the brakes.

The important advantages related to the implementation of a electronic centralization installation are: realizing all possible traffic and maneuver routes for a given configuration of the station, which provides increased flexibility to traffic management; ensuring the possibility of changes and tunings during operation without requiring significant periods of time in which the system is stopped; increasing the safety of rail traffic; ensuring a maximum level of reliability of the installation that would allow, thus, for diminishing the activity and costs of maintenance, and rendering efficient the activity of preventative and corrective maintenance by computerized assistance, including by diagnosis and defect localization functions; decreasing the costs for systems' exploitation by diminishing the elements requiring periodical tuning such as the relies; ensuring the technical support for developing rail traffic management by embedding the centralization installation as sub-system in ERTMS/ECTS.

2.2. Other ITT implementation in Romanian Rail Transport and its generated economic implications

In the modernization program of rail telecommunications was included also the integrated exploitation management digitalization project for the Romanian Railways – IRIS [14].

The *IRIS Program (Integrated Railway Information System)* is a component of the Railway Rehabilitation Program financed by BIRD, the aim being to increase the competitiveness degree of Romanian railways in the context of free access to the European railways 'system.

The main objectives of the project were to optimize and automate a number of key-activities within the railways and building-up an information infrastructure able to support subsequent developments. The first stage of the IRIS, designed to cover with applications and information systems vital activities for the entire railway system, was finalized in the year 2003, comprising four major components: railways' infrastructure management application; rail vehicles management application; freight transportation management application; and the application for monitoring trains' traffic. Thus, IRIS delivers an integrated digitalization solution, including complex hardware equipment for data banks and software applications connected to a national network with two levels – WAN and LAN.

In January 2005, the modernization of IRIS was initiated. One of the components of this new project aimed to modernize the network, in particular improving the users' access to the IRIS resources and benefitted of a new hardware and software infrastructure with direct results in diversifying and increasing the quality of provided services, preparing the national railways network for the interoperability with the European network.

With respect to the *infrastructure management application (IRIS-IMA)*, its objectives for the exploitation and management levels are: railway infrastructure's components management; management of the maintenance activities; management

of repair projects for the railway infrastructure; maintenance costs' control; railways' cadaster.

Among the *advantages* of implementing this system can be counted: the doubling in the numbers of passengers; superior quality of the services delivered to passenger; correct tariffs; secure reservation; issuing standardized tickets at European level with clear information; safe and swift financial management; major diminishment of manual effort; obtaining various statistics as efficient decision-making support; modeling the specific technological processes for the Romanian Railways; comfortable use; 100% availability, ensuring safety and confidentiality of the system's data.

Taking into account the importance of providing Internet services on the railway the Romanian Railways Company for Passengers has implemented wireless internet in the year 2006 for business-class passengers. The technical endowments for ensuring the wireless connection based on mobile phones were not separately purchased but together with the entire package of facilities specific to modernized passengers' wagons, among which: access for persons with diminished mobility; circuits for video casts and interior arrangement elements that provide a particular comfort degree.

Installing optic fiber cables and digital transport equipment on the rails Bucharest-Craiova, Bucharest-Constanta and Bucharest-Brasov leads to obtain some particularly important advantages such as: developing the railway activity by using modern phone and data communication under conditions of maximum safety; implementing in very good quality conditions the applications of the IRIS program in other 74 railway stations; rehabilitating railway communications at the Western border, respectively on the rail Timisoara-Jimbolia; rehabilitating railway communications on the rail Eforie-Nord – Mangalia for which an increased demand of digital services is shown; rehabilitating railway communications on the rail Salva-Sighetul Marmatiei for which the air infrastructure was in an advanced state of tear due to frequent storms.

2.3 Social Impact of Implementing the TTI Products and Services in Romanian Railway Transportation

The technological changes from the railway transportation sector had consequences on the skills of the personnel. Due to the evolution of technological processes and to the market development, several occupational classifications from Romania within the sector are no longer up to date. During the last years, within the Romanian railway systems were implemented a series of new ITT products and services, from among which:

► **IRIS** – a very complex system – is part of the restructuring program of the railway transportation system from Romania. This project, having as purpose the realization of an information system, aims a harmonization of a procedural nature. It should be regarded as an “instrument” made available to the users – specifically the railway companies CFR S.A., CFR Marfa (Freight) and CFR Calatori (Passengers) – for providing assistance in their effort to provide services of superior quality.

The IRIS system, regarded in its entirety, can be considered as an integrated collection of various applications, as each of them could be defined as complex information systems.

For the good functioning of these applications were trained in several centers hundreds of future users of the system and in many railway entities were installed hundreds of data processing equipment's to which are added the complex communication links that allow for quick and safe access to information.

The implementation of the IRIS system had implications on:

- **jobs:**
 - partial diminishment in the numbers of jobs: several jobs remained without human activity, others changed into positions without human activity. As result, in some instances the numbers of personnel were diminished by endowing the respective location with PCs. This generated the demand for skilled staff that would ensure the periodical assistance of the PCs for eliminating malfunctions and maintaining the networks;
 - some jobs required permanent personnel assistance which meant that jobs were maintained;
 - implementation of new information and telecommunications technologies implies that the operating personnel has medium and higher education, depending on the complexity of implemented technologies. At the same time, higher educated experts are required for supervising the entire activity, but also experts with interdisciplinary training;
 - implementing the new technologies in the Romanian railway transportation demanded that the personnel from the contracting departments for ensuring the exploitation safety, and also those from the commercial-purchases department underwent improvement training courses. It is also necessary to train experts for the financial-accounting department, for specific registries (for instance, specific software for processing and centralizing data/tickets (ticketing activities), for managing traffic contracts and calculation of tariffs for freight and passengers operators;
 - the enrichment of the job's contents has required the improved training of the corresponding personnel;
 - the personnel corresponding to the eliminated jobs had the opportunity to undergo reconversion trainings by complementariness and, after a period of training, to take jobs in the sphere of specific services;
 - the improvement training courses pursues by bettering professional expertise:
 - a) knowledge gain, and newly employed personnel integration according to the specifics of the railway transportation activity;
 - b) shaping skills with the purpose of ensuring the demands regarding trains' safe traffic, transportations' security and quality of services in railways transportation;

- c) updating knowledge and improving professional training for the main occupation, as well as in secondary occupations in accordance with the occupational standards;
- d) ensuring the possibility of employment in another position/trade of the personnel used in specific or related activities of the railway transportation (social mobility of labour force);
- e) acquiring advanced knowledge and/or detail skills in view of applying modern methods and techniques required for fulfilling job tasks.

- **incomes**

- the personnel remaining on the traditional jobs and participating to improvement training courses either maintained their wage incomes, or in most instances, benefitted of increased incomes, or was employed within wage systems based on competences;
- for newly created jobs, in average, the wages are higher than for comparable positions and jobs but of another technological generation.

► The implementation of the national system of e-ticketing in over 245 railway stations, where each sales point is endowed with a computer and a printer connected to the various systems. Yet, the implementation of this new system presupposes the complete replacement of the personnel due to the introduction of electronic devices, positions that do not require human assistance. This leads, on one hand, to the disappearance of some current operations' jobs and, on the other hand, require the creation of a new category of jobs such as, for instance, supervisor and use advisor (who must provide increased quality services for the customers of the railway stations, in particular information services about the transportation possibilities, tariffs, other services provided by the Company).

► The implementation of the **ETMS signalization system** has as consequence the diminishment by half in the numbers of train enginemen but also training the remaining ones in acquiring knowledge about the functioning and use of the system with its command-control-signaling components. This will allow enginemen to benefit from the European certification.

The emergence within the railway system of some phenomena such as labour force ageing, new work technologies for infrastructure, the globalized competition between transport operators, modernization and emergence of various types of rolling material, implementation of the directives regarding interoperability, etc. underpin the necessity of establishing continuing training centers that has increased advantages both for employees and for the employers.

The average age of the personnel within railway units is rather high. Many employees holding positions of responsibility regarding traffic safety have exceeded the pensioning age. These personnel are necessary because they cannot be replaced entirely, as on the labour market the numbers of the individuals with corresponding skills are insufficient. The most conclusive example is the one of private railway transport operators who employed the retired personnel of the state-owned railway companies. If this situation is taken into account, it results the necessity of increasing the numbers of skilled personnel. In the contrary

circumstances, railway transportation might face a personnel crisis similar to the one in the constructions' sector.

The improved skills and specialization of the personnel is required both for maintaining a corresponding degree of railway transportation safety but, mostly, for increasing competitiveness and productivity of the railway units. This last aspect is crucial: the investment in the human capital is the most profitable investment on long-term both for employers and employees.

Continued professional training in the field of railways is beneficial both for employers and employees:

► *Advantages for employers*

- expanding the tendering area for works in the European Union due to the skilled and acknowledged labour force at European level;
- ensuring the quality of performed works;
- employees' compliance with the traffic safety and job and environment security norms (SSM);
- skilled labour force with improved competences in a short time and at low costs;
- a ensuring the required labour force in deficit qualifications or in new ones;
- fiscal advantages for funds invested in the continued vocational training;
- diminishing up to complete elimination of inactivity periods for all employees within the company;
- lower material losses;
- a higher profitability rate of the trading company.

► *Advantages for employees*

- national recognition of gained skills;
- recognition of gained skills within the formal or informal system as part of the qualification;
- the opportunity of obtaining skills based on competences gained in time;
- higher wage earnings;
- eligibility on the national and European labour market;
- mobility in the swift acquisition of competences demanded on the labour market;
- shorter and cheaper courses;
- avoiding or shortening the periods of inactivity or unemployment;
- specialization and over-specialization in certain activities.

Conclusions

Developing the transportation infrastructure shall play an important role in integrating on the Single Market and shall support the valuation of the geographic position of Romania as a transit area at the crossroads of the Pan-European Transportation Corridor IV and of the Pan-European Transportation Corridor IX.

The location of Romania at the crossroads linking Western and Eastern Europe, but also Northern Europe to Southern Europe, as well as the position of the country on the transit axes between Europe and Asia constitute reference elements for determining the strategic options regarding the development and modernization of the transport infrastructure. The opportunity created by the Danube-Black Sea Channel and the Danube river can play a key-role in attracting international flows of freights, in the relations between Europe and the other continents.

The Romanian Railways have the role of integrating the national railway infrastructure into the technical and operational parameters at European level in order to be a compatible and fit for interoperability of the future Trans-European railway network.

The strategy in the sector of railways' transportation of promoting the ITT products and services leads to:

- changing the marketing policy by promoting the social effects/benefits for the beneficiaries (positive externalities);
- improving processes' transparence and information management which facilitate the planning processes and decision-making ones;
- creating new opportunities for externalizing specific economic processes. Externalization promises to increase the productivity of the company. Specialized "e-Intermediaries" support the data exchange between companies;
- flexible personnel policies;
- continuing training programs at the railway operators' level;

Implementing ETCS - level 1 in Romania leads to costs' decrease in exploiting the system by diminishing the elements requiring periodical tunings, provides for better flexibility of traffic management and results in increased railway traffic security, ensuring a maximum level of reliability of the installation that would allow thus for reducing maintenance activities but also for rendering more efficient the preventative and correction maintenance by computerized assistance, including based on functions for defects' diagnosis and localization.

Yet, the current size of the services provided by the digital railway telecommunication networks does not ensure integrally the domestic market required for the railway infrastructure, for the railway transport operators and for the economic agents working in the railway field.

By means of synchronic and a-synchronic railway transmission networks the logistics can be ensured for expanding the IT&C projects of the national and local operators in areas with a low density of services' supply: voice, data, video and added value ones (Internet, teletext, video text, fax and voice mail).

The specific forte of the railway telecommunications networks results from the conditions imposed by the beneficiaries from the railway sphere, where the communications have a decisional character (contribute to trains' traffic security), are secured and operate based on the principle "reserve for reserve".

The technological changes within the Romanian railway transportation sector had consequences on the labour force. Due to the evolution of technological processes, to the market development, many of the occupational classifications

from Romania within the sector are no longer of actuality. Among the consequences are:

- the partial diminishment in the number of jobs;
- the requirement for skilled personnel to ensure the periodical assistance of PCs for eliminating damages or maintaining the networks;
- some jobs required permanent personnel assistance which meant that jobs were maintained;
- the implementation of the new information and telecommunications technologies requires medium- or higher-educated personnel depending on the complexity of the implemented technologies;
- the personnel of the contracting departments for ensuring exploitation, as well as those from the commercial-acquisition departments have to undergo improvement training courses;
- the personnel corresponding to the eliminated jobs had the opportunity to take jobs in the sphere of specific services after pursuing reconversion training, based on complementariness;
- even in areas where the new technologies were not implemented, the personnel reductions were due to inadequate policies, which generated negative effects on the railway infrastructure or on the maintenance and exploitation of the rolling material park;
- wage incomes of the personnel remaining on traditional jobs and participating in training courses either remained the same or, in most of the cases, increased.
- for newly created jobs, in average, the wages are higher than for the similar positions and jobs but of another technological generation.

Selective literature

- 1 C. Alexa, (2001), *Transporturi internationale*, Editura ASE;
- 2 Caraiani, Gh, Stancu I., *Transporturi feroviare*, Editura Lex, 1998;
- 3 F. C. Nemtanu, (2003), *Arhitectura Sistemelor Inteligente de Transport – ITS*, revista Transurb, nr.1/2003,
- 4 F. C. Nemtanu, M. Minea and others, (2002), *Intelligent Transport Systems Handbook*, Triumph Publishing House, Bucharest;
- 5 Gh.Caraiani, (2001), *Tratat de transporturi*, Vol.I și Vol II, Editura Lex;
- 6 I. Zinca, *Rețeaua de telecomunicații CFR*, www.cablu.org
- 7 I.Buciuman, (2007), *Sisteme de management al traficului feroviar*, Agentia Feroviara Europeana, Seminar TAIEX 7 iunie 2007, Bucuresti, www. club-feroviar.ro
- 8 Marin Stancu, *Integrarea europeana a transportului feroviar din Romania*, www.agir.ro
- 9 P. Jesty, R. Bossom, (2002), *Planning a modern integrated (road) transport system using ITS Architectures*, FRAME seminar support, Brno, Czech Republic;
- 10 S.Ongkittikul, *Innovation and Regulatory Reform in Public Transport*, TRAIL Thesis Series no. 2006/5, The Netherlands TRAIL Research School, www. publishing.eur.nl

- *** *Commission Decision of 22 July 2009 amending Decision 2006/679/EC as regards the implementation of the technical specification for interoperability relating to the control- command and signalling subsystem of the trans-European conventional rail system ("the European Deployment Plan"),*C(2009)5607 final, www.eur-lex.europa.eu/LexUriServ;
- *** *Commission Decision of 7 November 2006 concerning a technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European high speed rail system and modifying Annex A to Decision 2006/679/EC concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European conventional rail system,* (notified under document number C (2006) 5211), www.eur-lex.europa.eu/LexUriServ;
- *** *Communication from the Commission to the European Parliament and the Council on the deployment of the European rail signalling system ERTMS/ETCS",* [SEC (2005) 903], Commission of the European Communities, Brussels, 04.07.2005, COM (2005) 298 final, www.eur-lex.europa.eu/LexUriServ;
- *** *Faza de modernizare a infrastructurii sistemului IRIS,* S&T Romania, www.snt.ro;
- *** *How Ertms Helps Making Rail Freight More Competitive,* UNIFE 2009, Brussels, www.unife.eu
- *** *Impact Assessment on the use of Derailment Detection Devices in the EU Railway System,* (2009), Final Report, European Railway Agency, www.era.europa.eu;
- *** *Modern rail modern Europe,* European Communities, 2008, Luxembourg: Office for Official Publications of the European Communities, <http://www.europa.eu>;
- *** *Plan Strategic in Domeniul Transporturilor,* www.mt.ro
- *** *Regulamentul (Ce) Nr. 1371/2007 al Parlamentului European si al Consiliului privind drepturile si obligatiile calatorilor din transportul feroviar,* din 23 octombrie 2007, Jurnalul Oficial al Uniunii Europene, www.anpc.gov.ro;
- *** *Societatea Nationala de Transport Feroviar de Marfa, CFR Marfa S.A.* www.tranp-marfa.htm, tr-tehnic.htm;
- *** *Societatea Naționala de Transport Feroviar,* [www.relatii-internationale CFR.htm](http://www.relatii-internationale-cfr.htm);
- *** *Strategic report on the renewed Lisbon strategy for growth and jobs: launching the new cycle (2008-2010),* Communication from the Commission to the Spring European Council, Commission of the European Communities, Brussels, 11.12.2007, COM (2007) 803 final, PART I, www.ec.europa.eu/growthandjobs;
- *** *Trans-European networks: Towards an integrated approach,* Communication from the Commission, Brussels, 21.3.2007, COM (2007) 135 final, www.eur-lex.europa.eu