EVALUATION OF THE SOCIO-ECONOMIC BENEFITS OF IMPLEMENTATION OF THE TECHNICAL SPECIFICATIONS FOR INTEROPERABILITY IN RAILWAY TRANSPORT IN BULGARIA

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Abstract: *The article discusses the methodological characteristics and results of analyses of costs and benefits of implementation of the technical specifications for interoperability in the railway transport in Bulgaria.*
The interoperability of the rail network is a priority of the transport policy of the European Union. Achieving full interoperability of the rail network, however, is a process that takes time and is associated with considerable costs. Therefore, it is necessary to perform a comparative analysis of the costs and benefits of the process of implementation. In this relation, the analyses of socio-economic benefits require their identification and valuation. The article presents the main effects of the implementation of technical specifications and benefits associated with them. In addition, the implementation of key priority technical specifications for interoperability in railway transport in Bulgaria is also discussed.
Keywords: *Cost Benefit Analysis, economic analysis, interoperability, technical specifications for interoperability in railway transport*

PREFACE

The improvement of the competitive position of railway transport in Europe is linked with the implementation of interoperability of railway network. This is an important step in achieving the maim goals of EU transportation policy and liberalization of railway transportation market.

Requirements for implementation of interoperability of the conventional railway network in the EU are determined in Directive 2001/16/EO. Recommendations for the subsystems of conventional railway network are specified in technical specifications of interoperability (TSIs) of EU. The current implementation of TSIs will support further development of international railway markets which is associated with modernization and exploitation of conventional railway network in Europe.

Achieving full interoperability of the rail network, however, is a process that takes time and is associated with considerable costs in a short and long term such as: research and development, staff training, implementation of new systems and maintaining existing, etc. it is expected that the implementation of TSIs can lead to benefits for the rail industry, rail operators and ultimately to passengers and shippers in a medium and long term. In addition, implementation of the TSI is associated with the impact of direct effects on the rail industry, rail operators, infrastructure managers and customers (passengers and shippers). The benefits of these effects are mainly related to the economy of time and climate and cost effectiveness to stakeholders. In the same time, implementation of TSIs affects external effects of railway transport, environmental, climate change, noise and safety. Finally, TSIs causes indirect impacts on other sectors and other geographical areas and social groups, the impact of which is difficult to determine. Assessing the impact of TSIs allows identifying the

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benefits of their implementation from the perspective of all stakeholders. The purpose of the analysis is to identify the value and cost benefits of implementation of the technical specifications for interoperability of conventional rail system in Bulgaria.

METHODOLOGY

The analysis of costs and benefits includes five priority TSIs:

- *Telematic applications for freight services* (TAF). TAF includes requirements for communication systems and information exchange between infrastructure managers, railway companies, service providers, shippers and other stakeholders;
- *TSI Traffic operation and management* (TOM). TOM addresses the procedures and related equipment management and traffic planning, and training of personnel associated with making cross-border services;
- *TSI Noise*. Noise is aimed at reducing noise stopping, starting and moving rolling stock and the noise in the cabin;
- *TSI Freight Wagons* (FW) FW is aimed at ensuring interoperability of freight wagons. They must meet certain requirements for international and domestic traffic.

An assessment of costs and benefits associated with implementation of the second group of TSIs (TSI Infrastructure, TSI Safety in railway tunnels (SRT), TSI People for reduced mobility (PRM), TSI Energy, Rolling Stock (other than freight wagons), Passengers Telematic Applications and TSI Maintenance) are not discussed in this analysis.

The analysis is consistent with the unified EU common methodology but taking in account the specific features related to the implementation of the TSIs.

Couple of alternative scenarios is considered: a baseline for the situation without the implementation of the TSIs and the option of implementation of the TSIs. To determine the net flow is used an incremental approach. The values of benefits are determined by reference unit values for the transport sector in Bulgaria. The real economic flows are presented the necessary fiscal and market corrections. Net present value (NPV) of the flows are set at a discount rate of 5,5%. Net present value of benefits is adopted as a main indicator

The impact of TSIs is consistent with the duration of the transitional period in which the initial investments are concentrated in dual systems and the time required for implementation of each TSI and gradual realization of benefits. Due to the need for gradual implementation of TSIs in the long run, the analysis covers the reference period of 40 years.

Costs and benefits are classified in terms of stakeholders, rail industry, rail operators, infrastructure managers, consumers and society.

The impact of TSIs on the rail industry is manifested in three ways:

- *Direct* impact on short-term investment costs for the manufacturing process, the average production cost, production time and delivery time;
- *Changes* in quality, reliability, availability and security from the perspective of the rail industry;
- *Changes* in market volume, market sharing and competitive structure.

The railway industry has a direct impact on rail services in terms of price, quality, reliability, functionality, delivery time and image. In this process the manufacturers will pass cost savings to rail operators, and they in turn to consumers and shippers.

The analysis covers the main directions of the impact of TSIs:

- *Impact* on cost and travel time users of rail transport;
- *Economic* impacts, leading to further efficiency gains;
- *External* effects that result from changes in market shares by type of transport (modal split) - operating costs, pollution levels, noise levels, global warming, accidents, maintenance of infrastructure and traffic congestion.

The assessment of impacts is made in the following areas:

- *Impact on the rolling stock industry:*
  - Reduce the average cost of production;
  - Reduction of production time and delivery
- *Impact on infrastructure managers:*
  - Maintenance costs;
  - Rail capacity;
  - Rail infrastructure costs.
- *Impact on railway undertakings:*
  - Operating costs;
  - Operating revenues passengers;
  - Operating revenues freight.
- *Impact on users*:
  - Travel time and costs 'remaining' passengers;
  - Travel time and costs 'modal-shift' passengers (diverted traffic);
  - Travel time and costs 'remaining' freight;
  - Travel time and costs 'modal-shift' freight (diverted traffic);
  - Punctuality rail.
- *External impacts:*
  - Noise production rolling stock;
  - Rail safety;
  - Environmental;
  - Accidents;
  - Road infrastructure maintenance;
  - Congestion costs (Transport user costs).
- *indirect impacts*

To determine the value of the indirect impact a reference rate of 10% is adopted.

RESULTS

The results of calculations of the NPV of benefits for the entire reference period for each TSI are shown in Table 1, Figure 1, Figure 2 and Figure 3.

Table 1

Impacts		NPV M€					
		TSIs					
		TAF	**CCS**	**TOM**	**Noise**	**FW**	**Total**
I	**Direct impacts**	**267,713**	**110,027**	**15,614**	**0,186**	**2,739**	**396,279**
1.1	**Impact on the rolling stock industry**	n/b	**1,255**	n/b	**0,207**	n/b	**1,462**
1.2	**Impact on infrastructure managers:**	**1,830**	**1,551**	**0,505**	**0,003**	**-0,002**	**3,888**
a	Maintenance costs	n/b	0,784	n/b	n/b	n/b	0,784
b	Rail capacity	2,143	1,028	0,523	n/b	n/b	3,694
c	Rail infrastructure costs	-0,314	-0,261	-0,017	0,003	-0,002	-0,591
1.3	**Impact on railway undertakings:**	**93,071**	**58,986**	**0,749**	**-0,028**	**1,375**	**154,154**
a	Operating costs	89,760	47,207	n/b	n/b	1,364	138,331
b	Operating revenues passengers	n/i	11,431	0,645	n/b	0,000	12,076
c	Operating revenues freight	3,311	0,349	0,105	-0,028	0,010	3,747
1.4	**Impact on users:**	**172,812**	**48,235**	**14,359**	**0,003**	**1,366**	**236,775**
a	Travel time and costs 'remaining' passengers	n/b	29,101	8,661	n/b	n/b	37,762
b	Travel time and costs 'modal-shift' passengers	n/b	0,819	0,192	n/b	n/b	1,011

c	Travel time and costs 'remaining' freight	**159,046**	**18,105**	**5,472**	n/b	**1,364**	**183,987**
d	Travel time and costs 'modal-shift' freight	6,500	0,209	0,035	0,003	0,002	6,749
e	Punctuality rail	7,267	n/b	n/b	n/b	n/b	7,267
II	**Indirect impacts:**	**26,766**	**10,996**	**1,551**	**0,019**	**0,274**	**39,605**
III	**External impacts:**	**20,719**	**9,898**	**1,882**	**7,957**	**0,247**	**40,703**
3.1	**Noise production rolling stock**	n/b	n/b	n/b	**8,239**	n/b	**8,239**
3.2	**Rail safety**	n/b	**0,244**	n/b	n/b	n/b	**0,244**
3.3	**Environmental**	**7,964**	**2,596**	**1,046**	**-0,117**	**0,110**	**11,599**
3.4	**Accidents**	**10,856**	**5,489**	**0,592**	**-0,143**	**0,118**	**16,914**
3.5	**Road infrastructure maintenance**	**0,836**	**0,227**	**0,035**	**-0,010**	**0,007**	**1,094**
3.6	**Congestion costs (Transport user costs)**	**1,063**	**1,342**	**0,209**	**-0,014**	**0,012**	**2,612**
	Total:	**315,198**	**130,920**	**19,046**	**8,162**	**3,260**	**476,588**

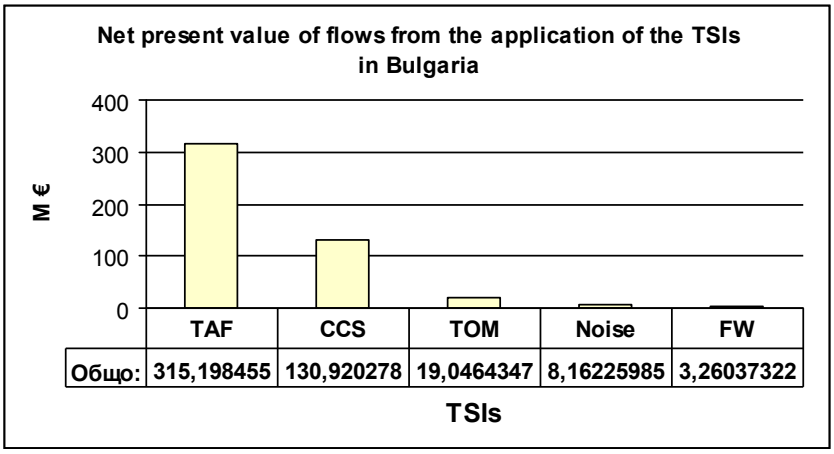

Figure 1. Net present value of flows from the application of the TSI

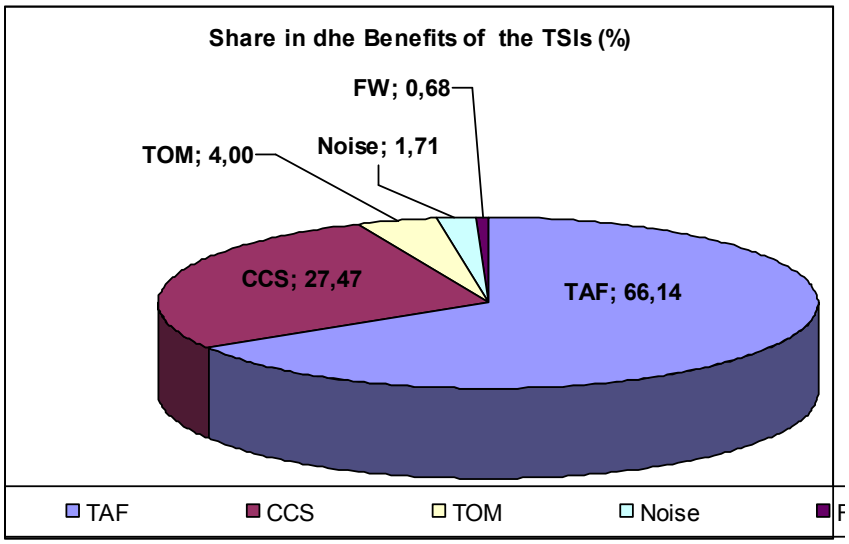

Figure 2. Share in the benefits of the TSIs

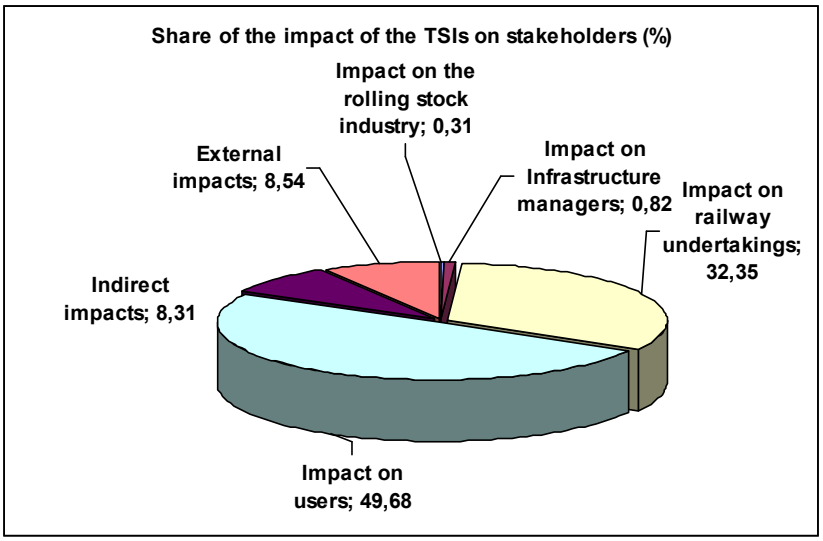

Figure 3. Share of the impact of TSI on stakeholders

CONCLUSIONS

The total estimated net present value of the benefits of the implementation of five priority of TSIs is over 476 M € for the entire period of time. The analysis has considered as a positive the net present value of benefits of all TSIs. The net benefits of implementation of the TSI TAF have a large total: more than 315 M €. They are primarily for consumers as a result of saved time and reduced costs (159 M €). The share of benefits of implementation of the TSI TAF is above 66%.

The total benefits from the application of TSI CCS (about 130 M €) are the next classified. They are divided mainly between the infrastructure manager (about 59 M €) and rail operators (around 48 M €). The share of the benefits of this TSI is around 27%.

The high costs associated with implementation of TSI Noise and TSI FW determines relatively low values of the estimated net benefits. However, future benefits are positive. For TSI Noise and TSI FW they are about 8 and 3 respectively. The benefits of TSI Noise are mainly for the residents nearby railway lines and the benefits of implementation of the TSI FW are mainly for the users and rail operators.

In the structure of benefits for stakeholders the largest share belongs to consumers (over 49%) and rail operators (over 32%).

The calculations for the estimates of benefits have been made in correlation with preliminary assumptions associated with the timing and cost of implementation of the TSIs. This determines the degree of uncertainty of analytical results. The critical variables in terms of increased risk of analysis can considered the cost of capital (reflected in the model by 5.5% discount rate), traffic (deviations from the forecast), period of time (deviations from the timetable for implementation) and estimates of the cost of implementation of the TSIs.

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