Transport Research

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DOI: 10.2478/v10158-011-0015-7

ABSTRACT: Transport and transport research are significant carriers of economic activities. They play a crucial role in the assurance of sustainable development, and the economic and social growth of Europe. The European transport sector needs to be effective, which means creating an appropriate coordination framework and balancing public and private sources for the support of necessary research activities. Therefore, for the realization of scientific research projects in the following period the use of their results in practice will be of essential importance. The possibility of the application of projects of science and research will be, e.g. in the field of prediction of development of individual fields of transport, in the creation and preparation of regulation, legislation frameworks for the development of the transport system, for organizational and other measures in the field of transport safety, in the realization of support of development of new technical and technological solutions leading to reduction of economic costs of the transport process and in the reduction of negative effects of transport on the environment. Regarding transport and urban planning, after the integration of the environmental and social aspects in the research activities,, the new cooperation could further bring a positive impact on the health of people and the environment.

KEY WORDS: research, development, transport, project.

1 INTRODUCTION

The current transport research is of interdisciplinary and international nature with ties to other important research areas. The R&D projects and research plans are important instruments of the transport policy implementation of the European Union and the individual states. The transport policy defined in the White Paper: "Transport policy of the EU for 2010 - time to decide" clearly defined the basic goal of transport research for the subsequent period, which is the support of the sustainable development of passenger and freight transport (European Commission, 2001).

The Czech Republic will, in the transport research area, in the following years focus primarily on the strategic research of complex transport issues, the increasing role of prediction,, and higher participation in the international research. In accordance with the National Transport Policy, the transport research will intensify the international

cooperation in research and development and it will be gradually integrated into the ERA - European Research Area, it will also increase the cooperation on a national level (MD, 2004).

2 CURRENT CONDITIONS OF EU TRANSPORT RESEARCH AND ITS PRIORITIES

The significance of transport for Europe has risen significantly in the last few years. As described by the EU predictions until 2020, passenger and freight transport will increase, and the same trend is also expected in the Eastern part of Europe. Nevertheless, the awareness of the negative transport impact on the environment and health is increasing in the whole EU, thus the need for further research and development in this area is required (ERTRAC, 2004). Therefore, the EU and the individual states create, support, and realize, apart from their national transport policies, a range of additional research programmes and projects which contribute to achieving sustainable long-term transport development (ERTRAC, 2006).

Sustainable transport appears to be one of the priorities regularly included in general research programmes of the EU. The emergence of many-year funding mechanisms of financing the research and development is embedded in the treaty establishing the European Economic Community in 1957 (part 3, section XVIII, article 166). The main tool of financing the EU is the Framework programme system of R&D which has existed since 1984. On 1 January 2007, the 7FP – Seventh Framework Programme was announced, which grants € 54.585 billion (in prices of 2006) for research subsidies, scientific cooperation, and the mobility of scientific workers, covering the period of 2007 – 2013. The Framework Programme for Competitiveness and Innovation (CIP - Competitiveness and Innovation Programme) with its budget of € 3.621 billion (in prices of 2006) is very similar to 7FP in the innovation areas. Finally, the last part of the triangle of education – research - innovations should become EIT – European Institute of Technology in the future, supported by the European Commission. The Initiative for cleaner and better transport in cities (CIVITAS = City-VITAlity-Sustainability) represents an already existing initiative which helps cities to reach a long-term functioning, clean, and energy efficient transport system. This association was established in 2002 as an innovative project and its activities are also supported in the following framework programmes (6FP, 7FP) (CZELO, 2007). The issue of transport and the environment further appears in the programme of European Cooperation in the field of Scientific and Technical Research (COST) which coordinates the national research support in the European countries participating in this programme. Apart from the COST programme, this issue is also dealt with through bilateral international cooperation (e.g. in the Czech Republic it is coordinated by the Ministry of Education, Youth, and Sports within the KONTAKT programme). The international research support lies also in the information exchange between experts from various countries. It is executed both with EU support within the Framework programmes (Marie Curie Programme), and within research networks associating experts and research institutions. An important subject is the association called Infra Eko (IENE - Infra Eco Network Europe), which focuses on solutions for the locality fragmentation caused by the construction and operation of linear transport projects. Another example is the CEI operation - Central European Initiative, within which the working groups of Transport work with the sub-group Environment, and the group which participated in the "EST goes EAST" programme with an objective to improve the environment on a global level (CZELO, 2007). The European Union has also established an overall legal framework for air protection in Europe. The EU is currently revising this legislation in its CAFE programme - Clean Air for Europe. The CAFE programme also brings information on probable air quality development in Europe, and it takes into account the full

effects of all legislation for emission limits and future economic development. The programme is drawn together with the integration of all major European stakeholders, a common basis of knowledge, which will lead to the production of future policy proposals for air quality improvement in Europe. The Assessment and Reliability of the Transport Emission Model project and Inventory Systems (ARTEMIS) were implemented within the EU and their goals are to develop and harmonize the emission model for road, rail, air, and water transport to provide consistent emission estimates on national, international, and regiona, levels. Transport Research Laboratories based in Wokingham in Berkshire in Great Britain were the project coordinators, and 36 organizations from 15 member states of the EU dealing with transport research (ARTEMIS, 2007) take part in this project. ETERG - The European Transport Emissions Review Group was formed within this project. ETERG offers beneficial approaches and methods for data and information transfer "to and from" projects and national representatives.

The projects dealing with research of alternative fuels and their application in practice have an indispensable role. The questionnaire survey between parties concerned within the VIEWLS project – Clear Views on Clean Fuels revealed three major motivating factors influencing the introduction of fuel: firstly, a reduction in greenhouse gas emissions (87%); secondly, diversification of energy sources (77%); and thirdly, a lower dependence on fossil fuels and their import (76%). Financial profit is the least important of all factors (43%). The PREMIA, a completed project, - Effectiveness of measures to accelerate the market introduction of BIOFUELS and HYDROGEN, evaluated the efficiency of the support programme of the introduction of alternative fuels on the EU markets. The subsidies for energy crop used in power supply industry, investment subsidies, loans and subsidies for factories for bio-fuel production and petrol stations, standards in bio-fuel distribution, tax holidays, obligation of petrol stations to sell bio-fuels, and obligation to purchase vehicles running on alternative fuels by public sector institutions are included in the main measures concerning the support of bio-fuels which were found effective according to REFUEL study (Brůhová – Foltýnová, Máca, 2007) These results should be complemented by planning the road ahead for bio-fuels focused on a detailed assessment of the impact of bio-fuel objectives and strategies on the development of the bio-fuel market. The ACCEPTH2 project - Public Acceptance of Hydrogen Transport Technologies, based on the public attention paid to the extensive demonstrable projects of hydrogen buses - followed the public acceptance of hydrogen technologies in transport. A questionnaire survey carried out in 4 cities (Berlin, London, Luxembourg, and Australian Perth) revealed the total unconditional support of the introduction of hydrogen buses on a large scale on the one hand, which, however, is not reflected in the willingness to pay the increased fare in such buses, in spite of the fact that the fee increase was on average only € 0.35 per user (Brůhová – Foltýnová, Máca, 2007). The selected European institutions dealing with transport research and development are mentioned in the following Table 1.

The European Commission also declared its support to approaching the determination of transport infrastructure fees on the basis of marginal social costs in its White Paper on European Transport Policy. Considering this issue, there are several projects, such as a study of the infrastructure in general, characterization of external expenditure by interaction between road users, calculation of traffic accident costs, and expenditure on the environmental damage (environmental externality) which are, supported. Within the MC-ICAM project - Marginal Cost Pricing in Transport - Integrated Conceptual and Applied Model Analysis) the optimal ways of implementation of the effective charging, in which the users bears the full marginal social costs of their activities, were examined. Within the DESIRE project - Development of European Service for Information on Research and Education, two pricing scenario, on the basis of the driven distance were evaluated.

Whereas the traditional charging for the use of the infrastructure (predominantly motorways) could take traffic to lower class roads, the charging based on the driven distance along the whole transport network, seems to be more suitable for demand management. However, we should note that this slightly complicated system brings more problems considering the technology, cost acceptability, and fee collection. Within the UNITE project - Unification of accounts and marginal costs for Transport Efficiency, the calculations of costs on the individual transport modes and methodological improvements and estimates of marginal costs for the main categories of costs and benefits of individual types of passenger and freight transport were made. Based on estimates, the total infrastructure costs for Western Europe acount for approximately 1.5% of GDP, congestion expenses 1%, external costs of traffic accidents 0.5%, air pollution 0.6%, noise 0.3%, and global warming 0.2% of GDP ((Brůhová – Foltýnová, Máca, 2007).

Table 1: Selected European institutions dealing with transport research.

Name of the institution	Country	Name of the institution	Country
Transport Research Laboratories (TRL)	UK	Scientific and Technical University of Lille (USTL)	F
Technical University of Denmark (DTU)	DK	Swedish Environmental Research Institute (IVL)	S
INFRAS AG Forschung (INFRAS)	CH	Swiss Federal Institute of Technology (ETHZ)	CH
Institut National de Recherche sur les Transports et leur Securite (INRETS)	F	Swiss Federal Laboratories for Materials Testing and Research (EMPA)	CH
Technical University Graz (TUG)	A	Technical Research Centre of Finland (VTT)	FIN
Aristotle University Thessaloniki (LAT)	EL	Centrum dopravního výzkumu, v.v.i. (CDV)	CZ
Organisation for Applied Scientific Research (TNO)	NL	TRAFICO Verkehrsplanung (TRAFICO)	A
psi-A Consult (psiA)	A	University of Littoral Cote d'Opale (ULCO)	F
Aeronautical Research Institute of Sweden (FFA)	S	Lund University (LU)	S
AVL List GmbH (AVL)	A	University of Savoy (US)	F
Banestyrelsen	DK	Vlaamse Instelling voor Technologisch Onderzoek (VITO)	B
Bergische Universitat - Gesamthochschule Wuppertal (BUGHW)	D	Fachhochschule Biel (FHB)	CH
Czyste Powietrze Sp (PPW)	PL	RWTUEV Fahrzeug GmbH (RWTUEV)	D
Fraunhofer Gesellschaft, Institut für Atmospharische Umweltforschung (Fhg/IFU)	D	TUEV Automotive	D
Institute for Transport Sciences (KTI)	HU	The Federal Highway Research Institute (BAST)	D

Name of the institution	Country	Name of the institution	Country
National Research Council of Italy (IM)	I	Mariterm	S
Joint Research Centre, European Commission (JRC)	I	Technikum Joanneum (TJ)	A
Paul Scherrer Institute (PSI)	CH	Union Technique de l'Automobile du motocyle et du Cycle (UTAC)	F
Regie Autonome des Transports Parisiens (RATP)	F	Motor Test Centre (MTC)	S
Renault Research Innovation (REGIENOV)	F	Swedish Road and Transport Institute (VTI)	S

Note UK – Great Britain; DK – Denmark; CH – Switzerland; F – France; A – Austria; EL – Greece; NL – the Netherlands; S- Sweden; D – Germany; PL – Poland; HU – Hungary; I – Italy; FIN – Finland; CZ – the Czech Republic; B – Belgium.

Table 2: Selected international projects with CDV participation focused on transport and the environment.

Project	Name
BUGS	Benefits of Urban Green Space
REFUEL	Planning the road ahead for bio-fuels
PLUME	Planning and urban mobility in Europe
COST 341	Habitat Fragmentation due to Transportation Infrastructure
SUTRA	Sustainable urban transportation
COST 351	Water contamination with pollutants contained in road construction layers
COST 633	Particulate matter produced by traffic
EXTRA 2	Euro- methodologies for travel assessment
WALCYNG	How To Enhance Walking And Cycling Instead Of Shorter Car Trips And To Make These Modes Safer
EST goes EAST	Pilot study of border ecologically sensitive area
TITaM	Transport Infrastructure Technologies and Management
ASSET	Assessing Sensitiveness to Transport
SPENS	Sustainable Pavements for European New member States
CERTAIN	Central European Research in Transport
ARCHES	Assessment and Rehabilitation of Central European Highway Structures
Re-road	End of life strategies of asphalt pavements
ECRPD	Energy Conservation in Road Pavement Design, Maintenance and Utilization
SARTRE 4	European drivers and road risk
SPACE	Speed Adaption Control by Self-Explaining Roads
2-BE-SAFE	2-Wheeler Behaviour and Safety
DRUID	Driving under the Influence of Drugs, Alcohol and Medicines

At the international level, attention is drawn to transport impacts on inhabitants. Therefore, some European countries (Austria, France, Malta, the Netherlands, Sweden and Switzerland) initiated a joint project in 2003 which included several courses and seminars on the issue of "Transport-related Health Effects with a Particular Focus on Children".

Through this joint initiative and their research the concerned countries want to actively contribute to programmes supported by the EU, mainly by UNECE-WHO - United Nations Economic Commission for Europe - World Health Organization, THE PEP - Transport, Health and Environment - Pan-European Program and CEHAPE - Children's Environment and Health Action Plan for Europe. The goal of all these projects, which focus primarily on road transport, is to make progress towards a unified evaluation of health impacts connected with transport. A range of books were published within the THE PEP project which deals with air quality impacts by transport, traffic noise, transport impact on the population health due to limited physical activity, psychological and social aspects of transport, and economic evaluation. This programme also includes an Internet application for the Clearing House Project (http://www.thepep.org/en/workplan/clearing/ch.htm), whose main objective is the support of price effective instrument for an easy access to information on transport, the environment, and health, including scientific, legislation, and political aspects. The project named HEARTS - Health Effects and Risks of Transport Systems, providing the funds for alternative fuel and environment research, was included in the scheme of UNECE-WHO.

The overview of selected international research projects, with Czech participation in which the issue of transport impact on health and the environment is dealt with, is mentioned in Table 2.

The non-governmental organizations (such as EIROforum and its Members), cooperative associations (such as COST, EUREKA), and other organizations and research associations which conduct and financially support research and development are decisive institutions in European transport research and play an important role in the planning and realization of long-term sustainable transport development (THE PEP, 2004).

3 TRANSPORT RESEARCH IN THE CZECH REPUBLIC

The development of Czech transport research, increase in its competitiveness, and reaching of the level common in developed countries, is based on appropriate human resources and adequate professional workplaces. Regarding the traditional basic transport research in the Czech Republic, organizations are currently dealing with a relatively high average age of researchers, and a high turnover of mainly young researchers. Over the last 10 – 15 years under the influence of external conditions, the transfer of research capacities from organizations typically focused on transport research to private organizations which operate as suppliers in the whole transport chain has occurred. Research istitutes and universities which are not thematically focused on transport are, nowadays, dealing with transport research as well. It is based on the fact that the announced isues of research and development force the applicants to cooperate with several specific research institutes, which rapidly extend the portfolio of cooperating organizations (MD, 2004).

The same process could be found when submitting the applications for European research programmes. The integration of Czech transport research in international research activities, including the use of their results, is one of the priorities of Czech National Policy in the following period. The cooperation will be implemented via the participation of Czech researchers in programmes supported by the EU. It will lead to the integration of a broader spectrum of local research capacities in the European research. The concept of this research space creation puts emphasis and preference on the regionalization of R&D effort. This research regionalization aims to improve research and development at regional universities, and introduce applied research in regional companies, and establish university subsidiaries as they are needed, respectively research institutions in regions with an emphasis

both on cooperation stimulation between the corporate sector and R&D institutions, and the support and development of their own research regional programmes (MD, 2004).

The National Research Programme is particularly represented by projects which were supported by the Ministry of Transport budget and which reflect the national level of transport research up to 2009. Within the programme Safe and Economic Transport (2004 – 2008) possible issues for research projects were announced, which did not omit the field of transport and the environment. These are particularly the issues focused on the support of alternative fuel development in transport, the evaluation of emission impacts on health, traffic noise, fragmentation of landscape caused by the transport infrastructure, etc. Apart from R&D projects, the research programme "Sustainable transport - chance for future" is also in progress, and is divided into several sub-projects covering the majority of problematic issues and some of them are directly linked to projects classified as the 6th Framework Programme of the EU. Regarding the projects announced other resorts, the projects of the Ministry of Environment, the Ministry for Regional Development, the Ministry of Trade and Industry, and Grant agency of the Czech Republic are closest to transport issues. The instruments for the implementation of R&D programmes are calls for proposals, evaluations, and implementation of the selected projects of the appropriate programme. The system of evaluating the research and development in particular resort respects the world trends and uses new knowledge and the best experience from research evaluation in individual member states of the EU, respectively OECD - Organisation for Economic Co-operation and Development. The fundamental evaluation principles are the multi-criteria approach, professional competence, the specific nature, transparency, independence, and objectiveness.

The authority responsible for the development of transport research and development was the Department of Strategy of the Ministry of Transport which was responsible for the preparation, calls for proposals, administration, and evaluation of bids for research projects. The Ministry of Transport is also the founder of the only transport organization, Centrum dopravního výzkumu, v.v.i., which is directly involved in transport research. Besides CDV, the transport research is also conducted at a number of universities, such as the Faculty of Transportation Sciences of CTU in Prague, the Faculty of Mechanical Engineering BUT in Brno, or the Faculty of Civil Engineering VŠB – TU in Ostrava. The environmental issues of transport are dealt with at Jan Perner Transport Faculty, University in Pardubice, at the department of Operational Reliability, Diagnostics, and Mechanics in Transport, including the Section of the Environmental Aspects of Transport and Diagnostics.

The structure of support of the applied research and development in the Czech Republic, where the transport research belong by its nature, was changed in the above-mentioned form in 2009 when the Technological Agency of the Czech Republic was established by Act No. 130/2002, Sb., on research support, experimental development, and innovations, which became effective on 1 July 2009. TA CR assures, on the basis of this Act, programme preparation and realization of its own programmes of applied research, experimental development and innovation; and realization of programmes from governmental departments , research tenders, development and innovations for project support and public procurement, evaluation and selection of the programme project proposals, providing support for work on the programme projects on the basis of treaties, or decisions about providing support and designing the support, as well as the evaluation and control of the research work and meeting the targets of programme projects and control of the achieved results.

Other activities of the newly established agency is the production of the expenditure proposals of the Technology agency of the Czech Republic and its activity reports, provision of consulting services to project partners and users of applied research, development

and innovations mainly in the fields of law, finance and intellectual property protection, communication support between research organizations and the private sector, and the equity financing of programme projects and dealing with the appropriate authorities of the Czech Republic or the European Union in the field of assessing the compatibility of provided support with the common market (TAČR, 2010).

3 FUTURE TRENDS AND VISIONS OF TRANSPORT RESEARCH

The main global objective of transport expressed in transport policy is to satisfy the transport society needs while respecting sustainable development. The role of the public sector is to assure the quality legislation and economic environment for the transport businesses, appropriate infrastructure for mobility, and the provision of services in the public interest also through investments and operational subsidies (Ministry of Transport and Communications Finland, 2005).

The requirement of sustainable transport development is reflected in the economic, environmental, and social field and evokes a need to set the strategic goals for individual transport modes, as well as for cross-sectional fields for the whole sector. Further transport development in the Czech Republic will be implemented within the EU and NATO – North Atlantic Treaty Organization, and therefore the issues of a international nature and regional development will be emphasized. Regarding this situation, it is necessary to follow the system of requirements on the European, national, and regional, respectively local levels, and define the fundamental objectives and attributes which are then becoming the basic research priorities of the programme (MD, 2004).

The "White Paper" of the EU has clearly defined the objectives of European Transport Policy until 2010. The purpose of producing this document was a disproportion of demands of the society for transported needs and the ability of individual countries to assure the implementation of these increasing needs. The fear of the EU bodies comes from the potential lagging behind of Europe in terms of economic growth under the influence of poor quality transport.

Some of the basic goals of the European Transport Policy are as follows:

- keeping the sustainable development level,
- development of a Trans-European transport network TEN for all transport modes,
- interoperability on technical, technological, and information levels,
- inclusion of externalities in the individual transport areas in prices for transport,
- knowledge of all costs in the individual transport fields,
- development of ITS - Intelligent Transport Systems as instruments of repression, control, organization, information, and management in the individual fields of transport,
- development of cycling and recreational water transport,
- transport safety and quality (European Commission, 2001).

The White Paper is not a dogmatic regulation for the EU member states. The responsible institutions, the Ministry of Transport in the Czech Republic, are authorized to transform and adapt the White Paper to conditions of a given country. The paper, adjusted in this way, is then part of transport policies of individual countries.

Various studies show that transport will come to conflict with the sustainable development demands in the future. European road transport networks and urban roads are seriously overloaded, which leads to increased pollution, delays, and other related expenses for users. EEA - European Environment Agency is expecting a certain development in Europe concerning road and air transport, not only because the increase of personal road traffic

at the expense of public traffic is found, but especially due to the growing economics of the EU member states. Moreover, the share of freight transport rises faster than passenger transport in the EU (in the period of 1990 – 2000 the volume of passenger transport increased by 18%, whereas freight transport by 40%). On the other hand, freight transport by rail in Europe decreases annually by 0.6% (ERTRAC, 2006). In all forecasts the EU is expecting this development to continue until 2020 (ERTRAC, 2004). Therefore, the transfer to more sustainable transport modes is necessary, among which are railway, maritime transport for shorter distances, and inland water transport. Therefore, the change in modal split and relieving transport corridors are the main priorities of transport research within the 7th Framework Programme of the European Communities. The EU places particular emphasis on encouraging new investments in Trans-European transport infrastructure, mainly railways, and the development support of an integrated and intelligent European transport system. This partially means achieving a balance between the preferred transport modes via the support of alternative cleaner energy modes, and the development of technologies for inter-modal transport "from house to house". It also means the increase of the existing capacity through research in the field of advanced production processes and traffic regulation systems. The operators and transport infrastructure administrators need to strive to improve the alternative modes and inter-modal transport for end-users (Brůhová – Foltýnová, Máca, 2007).

4 PUBLIC PARTICIPATION IN TRANSPORT RESEARCH

The integration of the public in the decision-making processes, as well as the integration of the public in the transport projects is generally an expression of the democratic decision-making processes. The public involvement is supported by two trends – firstly, from above, through the creation and amendment of corresponding Acts and the continuous reform of the public administration, and secondly, from below, by building a civil society in the form of public initiatives. Both of these trends are intensified, and, up to a certain extent, also determined, by the accession of the Czech Republic into the EU, which supports public involvement. The public integration in transport projects does not have to be only in the decision-making process. The public involvement in the creation of background materials for the decision-making process itself seems to be a more appropriate variation. This concerns various public hearings, round tables, and action weekends, when the political and professional community representatives try to find the priorities of the discussed topics and their possible solutions together with public, through intensive communication with the public. The methods and techniques of such work are well-described in the available literature. Unfortunately, a strong communication culture with the public has not been established in the Czech Republic so far. Comparing to the Western democracies, we have a lot of catching up to do in this respect. Some non-governmental organizations, which put the models of public integration in the decision-making processes into practice, are trying to change the situation.

5 SUMMARY

Transport and transport research are significant bearers of economic activities. They play a crucial role in the assurance of sustainable development, and economic and social growth in Europe. The European transport sector needs to be effective, i.e. creating the appropriate coordination framework, and making the public and private sources equal for the support of the necessary research activities. The use of research project results in practice would be especially important for their realization in the following period. The potential

R&D project application would be beneficial in areas such as the development prediction of individual fields of transport resort, in the regulation and legislation framework design and production, for the development of transport systems, for organizational and other measures in the field of transport safety, for the support of the implementation of new technical and technological solution development leading to a reduction in the economic costs of transport processes, and for the reduction of negative effects of the transport process on the environment (MD, 2004). The new cooperation may also bring positive impacts on human health and the environment after the integration of environmental and health aspects into research activities concerning transport and land use (ERTRAC, 2004).

ACKNOWLEDGEMENTS

The study was supported by the Czech Ministry of Transport within the research project No. 04499457501 “Sustainable Transport – Chance for the Future, part 5 Transport and Environment”.

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Volume 4 2011 Number 3

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