Contribution to the "Strategic Transport Technology Plan"

Contribuição para o Plano Estratégico Tecnológico dos Transportes

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RESUMO

A Comissão Europeia, através da DG MOVE – Mobilidade e Transportes, está a preparar o Plano Estratégico Tecnológico dos Transportes ("Strategic Transport Technology Plan" – STTP) que constituirá a estratégia para o futuro da investigação europeia neste domínio. O STTP pretende identificar quais as áreas de investigação estratégicas no domínio dos Transportes que se têm de desenvolver para serem atingidas as metas indicadas no recente Livro Branco dos Transportes da Comissão Europeia designado "Roteiro do espaço europeu dos transportes – rumo a um sistema competitivo e económico em recursos".

O presente documento tem como objectivo mostrar qual pode ser o contributo do LNEC na área dos transportes, com enfoque para os temas da economia de transportes e políticas de planeamento (inclui modelação do comportamento). Considerou-se como base de trabalho o anterior relatório enviado pela *European Conference of Transport Research Institutes* (ECTRI) em Março de 2011, sendo que agora se justifica, em face do conteúdo do referido Livro Branco dos Transportes, conferir um maior desenvolvimento aos tópicos que constam da agenda científica do Grupo de Trabalho do ECTRI "Transport Economics and Policy".

O STTP está em consulta pública até dia 28 de Maio de 2011. As áreas identificadas no STTP, pelos vários Estados-Membros serão aquelas que a Comissão Europeia através da DG MOVE, financiará após o 7º PQ e com o horizonte 2020.

O presente documento destina-se ao Gabinete de Apoio ao 7º Programa Quadro (GPPQ), responsável pela participação nacional no STTP.

ABSTRACT

The European Commission (EC), through the DG MOVE – Mobility and Transport, is currently developing a Strategic Transport Technology Plan (STTP) which will be the strategy for developing future research in the transport domain. The STTP objective is to identify which are the strategic research areas to be pursued to achieve those targets set within the EC Transport White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system".

The present document aims to present a possible contribution from LNEC to the above STTP, with an emphasis in the transport economics and transport policy areas (this area includes by definition planning and behavioural analysis issues). For this purpose, it was considered the previous report sent by the *European Conference of Transport Research Institutes* (ECTRI) in March 2011, noting that it is now opportune, facing the recent Transport White Paper contents, to develop further the scientific agenda of the ECTRI Transport Working Group dedicated to "Transport Economics and Policy".

The STTP is under public consultation until 28th March 2011. The areas identified by Member States for the STTP will be those that will be funded by the EC through DG-MOVE, after FP7 and with the horizon of 2020.

This document is to be delivered to the "Gabinete de Apoio ao 7º Programa Quadro" (GPPQ), responsible for the Portuguese participation in STTP.

1. **Background to Future Transport Research and Innovation**

The European Commission (EC) through DG MOVE – Mobility and Transport is currently developing a **Strategic Transport Technology Plan (STTP) for future transport research, innovation and deployment**. The STTP aims to identify those areas which are important to be developed to achieve specific efficiency and sustainability targets as set by the recent **EC Transport White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system".**

The EC Transport White Paper, published in 28th March 2011, outlines a **long-term vision for Transport in Europe (until 2050)** and adopts a **roadmap of 40 specific initiatives** to be implemented in the next decade such that greenhouse gas emissions (GHG) from transport will be reduced by 60% until 2050 (20% by 2030, below the GHG 2008 level) without compromising mobility and reducing EU dependence on imported oil. As such, **by 2050 it is envisioned that only electric vehicles will circulate in cities - the future home of around 85% of the population in Europe.**

The electric mobility scenario will involve an effective transport policy path until the vision "no more conventionally-fuelled cars in cities by 2050" can be reached. Concerning intercity passenger and freight transport, the Transport White Paper anticipates, until 2050, a 50% shift of road traffic to rail and waterborne transport. Maritime transport will play an active role as shipping emissions would need to be cut by 40% (if feasible 50%) through low carbon fuels and operation improvements (compared to 2005 levels).

One must conclude from the above that besides the expected **role of technology innovation in transport research,** major challenges are expected in terms of transport policy developments. Indeed, **transport policy methods** will be the key to support the **critical path** (to be defined) and the **convergence path towards** the EC Transport White Paper **targets set for the short, medium and long term**, **which will include the internalization of external costs and infrastructure use charges, application of innovative business models, integrated mobility services and incentives for changing individual's behavior towards sustainable mobility patterns, amongst others.**

2. Objectives

This document is the **contribution from LNEC, as a member of the *European Conference of Transport Research Institutes* (ECTRI) and member of its Transport Economics and Policy Working Group**, **to the STTP**. The contents of the recent Transport White Paper [EC 2011] will imply further developments in transport economics, transport policy and analysis that will comprise behavioral modeling using discrete choice models, time series analysis, optimization, econometric models, amongst other methods.

It is considered herein as a reference base the previous report sent by the ECTRI in March 2011 [ECTRI 2011]. Considering the EC Transport White Paper vision, the development of specific topics related to the ECTRI Transport Economics and Policy WG is now opportune.

The present document is to be delivered to the GPPQ – "Gabinete de Apoio ao 7º PQ da UE", which is the Portuguese National Contact Point for the European R&D Framework Program. Since the STTP is under public consultation until 28th May 2011, **it is expected that those areas identified by all Member States will be the ones to be financed after the FP7 by the European Commission through DG MOVE, with the time horizon until 2020 (or later).** The present document focuses on the list of research initiatives (research topics) that are considered as a priority in the short to medium term.

3. The ECTRI Transport Economics and Policy Working Group

The **ECTRI "Transport Economics and Policy" Working Group (TEP) is currently composed by 45 experts of 24 transport research institutes** (http://www.ectri.org/Activities/WGsTWGs/TWGG.htm). **The LNEC I.P. is member of the ECTRI since January 2010 and has an active participation along with the other members.**

It shall be acknowledged that besides the previous ECTRI contribution to the STTP, which was delivered in March 2011, the TEP had previously prepared inputs for the FP7 update through a report entitled "White spots in the European Transport research traced by ECTRI's Thematic Working Groups" which was released to the EC in June 2009.

At present **the ECTRI TEP scientific agenda, in line with its matrix of competences, includes topics on economic evaluation, regulation and financing, transportation policies and has its efforts concentrated in the preparation of FP7 proposals, aiming at helping to build a competitive and efficient low-carbon economy.**

4. Future Transport Research on Transport Economics and Transport Policy

An effective and efficient transport system is a key for a competitive European economy. **Research and Innovation will be the support for transport policy-making and the key to provide cost-efficient solutions for achieving sustainable mobility.**

Mobility and accessibility provision are functional answers for a democratic society. **Interdisciplinary cooperation** with other fields of research namely mathematics and statistics along with social sciences will be essential in attaining effectiveness and efficiency objectives.

The long-term and integrated transport vision envisaged by the EC Transport White Paper will require an integrated policy answer: the STTP and the related research package are expected to help member states to define the critical package of initiatives to converge to those common targets. Therefore, the challenge to the EC concerning funding structure will be to provide a balance between smaller (e.g. demonstration projects for local innovation and social cohesion), larger and targeted projects which can meet common and specific research needs in line with those predefined targets.

The Transport White Paper reinforces the interdependences between Transport and the Economy for delivering a sustainable solution in Europe, aiming to boost economic recovery and the environmental and social performance of the transport and land use system.

Multiple drivers will orient transport policy and research shall be able to tackle these in the most appropriate way. **Besides the global and EC policy drivers that include the internalization of transport external costs, transport policy needs to take into account major drivers (internal and external to the transport system): ageing population and household structure, localization patterns (concentration of population in cities), demand for travel and tourism (eg. from emerging economies), environmental burdens such as climate change, demand for energy and production, technology trends (ICT, electric vehicles, etc.), amongst others.**

All the above drivers represent a research challenge from the methodological and practical perspectives as these will involve theoretical developments (e.g. evaluation methods and tools) and practical implications: demonstration projects and living labs can host behavioral experiments to study the impact of each potential influential factor (and their combinations) on transport, assuming that part of the solution will involve changing individuals' behavior (and their mode choice) towards more sustainable consumption and production in transport. Evaluation of several territorial impacts related to transport policies and intermodality are the key to better integrate transport and land use strategies, aiming at territorial efficiency.

Main challenges in research are thus directly related to transport policy development but its efficiency will be dependent on the effective operation of governance models and institutional reforms which will need to merge services to gain critical mass.

Any transport decision and policy should only be implemented, or even be considered for implementation, after a rigorous study has been carried out. Theory and methods such as those from mathematics (including statistical models), transport economics and other engineering and social sciences are the tools for building a robust decision support framework within transport and therefore an interdisciplinary cooperation is necessary.

Transport research will be oriented by the following directions:

- **Customer-orientation and the need to create value to society in the short and long term**: this will require understanding transport user needs (household and individual perspectives) and act accordingly**, screening and eliminating barriers that hinder efficiency in the use of public resources** (e.g.: provide adequate support for evaluation of local and regional transport investments). Simplified policy procedures shall encompass organizational requirements, **provision of information to decision makers, legislation and regulation to deliver more sustainable mobility**, protection of most vulnerable road users and the promotion of green mobility such as walking, cycling and public transport while **allowing for innovation in deploying new transport services as integrated mobility products** (e.g.: electric bike-sharing and car parking outside congested areas). Solutions to deliver safe transport and quality in public transport at **affordable costs to people and businesses** shall be better investigated through innovation and technology. Integration of markets and pricing (e.g.: transport and renewable energy) shall be explored.
- **New holistic planning and policy approaches**: these will require a paradigm change (**from uni-modal to multimodal transport services and from vertical to inter-sectoral based institutional structures**). The role of transport coordination bodies can help to deliver efficiency and effectiveness in policy action, but the proper transport institutional framework and governance models shall be delivered for each context. This will include the **evaluation of specific transport management procedures and risks** (eg. Public-Private Partnerships, Contracts, Agreements, etc.).
- **Cost-effectiveness and cost-efficiency focus**: this will require the use of appropriate *ex ante* and *ex post* performance indicators to **support the whole life-cycle of policy making and implementation. Improved Cost-Benefit analyses and other evaluation methods shall support policy in a regular basis, and this will require further research on integration of theory and methods (and their validation),** in order to identify strategies for sustainable cost reductions and also to schedule the implementation

strategies and measures in the short, medium and long terms according to their impacts in time and space**.**

Transport policy and technology drive a specific research direction which is expected to be centered on **behavioural research methods involving naturalistic and controlled experiments using discrete choice (revealed and stated preference data)** along with other approaches **(developing of new improved tools)** and their **application** (e.g.: through Living labs). Hence, the EC funding of demonstration projects will be important as it will **stimulate methodological innovations in transport economics and policy** and these can be the key to **promote desirable changes** in vehicle ownership models for specific segments (from private to public transport modes), car technology replacement (towards electric vehicles), sustainable transport choices for intercity and short distance trips, etc. and thus can provide an effective means to support policy and social acceptability.

An important component on transport economics is model building: this enables to understand, amongst others, the individual transportation decisions of passengers and firms, the implications that these decisions have for the allocation of society's scarce resources of transportation, forecast transport demand, revenue and expenditure, etc. In these situations it is relevant to employ econometric models which are theory based statistical models that help quantify assumed causal relationships between measured variables. It is also relevant to assess the transport demand for any future period of time. The latter can be achieved through time series analyses, which include methods for analyzing a sequence of data measured at successive times in order to extract meaningful estimates and other characteristics of the data. These models can also be used to forecast future events based on known past events to predict data before they are measured.

It is vital to employ mathematical methods developed in the field of discrete mathematics for the optimization of transportation systems as these methods, in particular the ones belonging to the theory of optimization, enable a better use of resources by using existing technology. The general concepts of the theories of optimization and discrete mathematics offer tools to formulate many tasks arising in transportation planning. They provide algorithmic frameworks that can, at least in principle, be applied in this area. The research done in recent years has shown that some standard combinatorial optimization problems such as set partitioning or multicommodity flow arise frequently and can be used in many settings including: airline industry, rail transport, public transport, vehicle routing and traffic control.

The EC Transport White Paper suggests the need for transport research to address specific areas and a full list of initiatives is described in its annex. The four areas are there outlined: an **Efficient and Integrated Mobility System, Innovating for the Future, Technology and Behaviour, Modern Infrastructure and Smart Funding, and the External Dimension.**

The list of initiatives for the STTP needs to be ranked considering its expected impacts (in terms of efficiency, reduction of GGH emissions, etc).

Transport economics and policy research are oriented by major drivers that act globally (these are subject to updates, considering their expected impacts on the development of regional and local economy), but some examples of integrated projects can be suggested as follows:

- Resilient Cities and Cost-Efficient Multimodal Passenger Transport System and Services;
- Environmental Externalities from Passenger and Freight Transport and Future Carbon Markets;
- Real-time Information to Multiple Transport Users for Reducing Social and Private Costs, Mode Choice Optimization (include "crises response");
- New Integrated Pricing Systems (Energy – Transport – ICT) for Congested Urban Areas;
- Strategic Governance Transport Models and Evaluation Frameworks for Delivering Effective Policy Action;
- Improved Policy Tools for Evaluating Transport Users' Behaviour (development of mathematical models, discrete choice, etc.);
- Door-to-door Mobility Solutions for Social Cohesion (Seamless, Reliable, Cost-efficient, Clean and Safe, etc.).

5. Policy and Organizational Requirements

Following the STTP, each Member State is expected to facilitate the research and innovation chain (including market take-up and standardization) and promote the efficient use of resources which will involve the establishment of new working platforms (cooperation). This can be achieved through starting a bottom-up approach to derive the correspondent National Strategic Transport Research Plan – National STTP (e.g.: to be coordinated by a ministerial team lead by the Ministry of Transport, Economy and Innovation and the Ministry for Science and Technology). Research Institutions related to Transport will need to set (and revise) appropriate internal strategic research plans, sharing a common long-term vision to both the STTP and National STTP.

The role of **Research & Development & Innovation (R&D+I) Platforms** is of utmost importance and these shall be formally set by the National STTP authority considering human resources and expected funding. These shall be centered in a **multimodal perspective** (all transport modes, passenger and freight) **integrating a multidisciplinary team**, able to **share resources and adopt a common vision for developing the target areas**, especially to combine technical measures with behavioral measures and then enforce their complementarities. The objectives of these local Platforms are as follows:

- To integrate all transport actors and stakeholders (research and academia, industry, public transport authorities, etc.) which are supposed to cooperate towards common objectives, such as resource efficient transport and sustainable mobility;
- To address the full cycle of research, innovation and deployment;
- To foresee adequate transport investments for a competitive economy without compromising sustainability;
- To set a local observatory where all transport related databases shall be integrated such that data collection costs can be reduced to all.

The Institutional dimension is a key for a sustainable and competitive Europe and, hence, governance models lead by Strategic Transport Plans shall help to implement inter-sectoral integration. Research and innovation partnerships will need to be formally established.

In line with the Transport White Paper, one key R&D+I Platform to be set can be designated as follows:

- Transport Economics and Efficient Transport Policy Delivery for Sustainable Mobility (TE4SM Research Platform). Passenger transport, along with freight transport and urban logistics are to be addressed.

The TE4SM Platform will focus on key policy goals and measures (market and regulation-oriented policies, etc.) that will help on the definition of the critical path and progress evaluation over time towards defined targets related to cost-effectiveness and cost-efficiency in all technology areas. Noting that this Platform will have significant impacts to the functioning of society and the economy, it is proposed that this will be at the centre of all other possible R&D+I Platforms that will deal with other potential technology areas (examples):

- Smart Systems, Energy and Markets for Electric Vehicles (vehicle to grid technology, in-vehicle technology, etc);
- Intelligent Transport Safety, Security and Risk Evaluation;
- Integrated Transport and Land Use Systems for Multimodality and Mobility Management;
- Green, Intelligent and Intermodal Aviation (it includes intelligent hubs for passenger and freight, greener airports and efficiency in aviation-rail connectivity at the strategic level);
- Maritime Transport Activities, Trade and Greenhouse Gas Emissions (it includes the study of international regulatory policy measures, environmental externalities such as noise and air emissions from shipping activities, carbon markets, etc).

The setting of interdisciplinary R&D+I Platforms at each Member State will require a strategic plan to achieve specific Protocols between research, academia, industry, small and medium enterprises and the relevant stakeholders, aiming at delivering a competitive and resource efficient economy in Europe.

AKNOWLEGMENTS

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