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URBAN TRANSPORT

TECHNOLOGY OPTIONS IN URBAN TRANSPORT: CHANGING PARADIGMS AND PROMISING INNOVATION PATHWAYS

This Options Brief is based on the STOA project on Urban Transport, which ran from April 2011 to September 2012. Successful innovations (technological and organisational) are needed to enable more sustainable urban transport systems in the future. It is increasingly acknowledged that, especially in transport, user perceptions and attitudes play a crucial role regarding the success or the failure of innovations. Still, many studies and plans for achieving sustainable transport focus mainly on technologies and economic factors.

Against this background, the STOA project emphasises the relationship between innovative technologies and concepts and their users. The overall aim is to highlight promising innovation pathways to a more sustainable urban transport system.

POLICY CONTEXT AND BACKGROUND

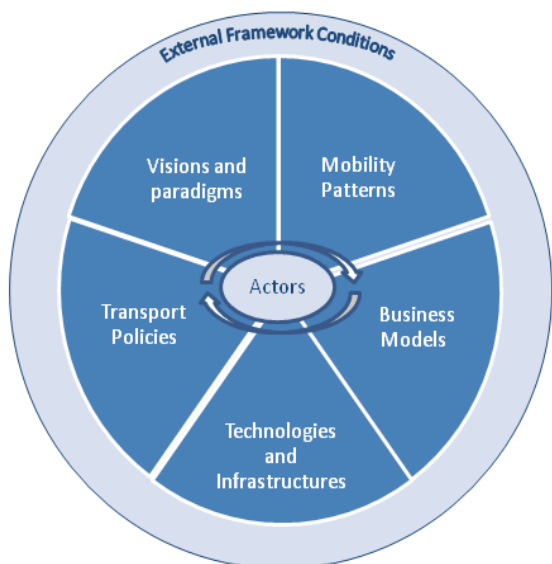
Urban transport is related to a wide range of unsolved problems and challenges that need to be tackled in order to guarantee a high quality of life in European cities and to make the transport system an even more efficient pillar of the European economies. Most challenges in urban transport are induced by motorised transport. Urban agglomerations face increasing emissions of pollutants and noise, as well as congestions and, thus, reduced accessibility. Urban transport accounts for a significant part of total mobility and for an even greater proportion of its negative consequences. Innovations are needed to cope with these challenges.

SUMMARY OF FINDINGS

A transition towards a more sustainable urban transport system requires efforts that deal with the transport system as a whole. Innovative technologies and concepts are crucial, but they need to be incorporated into a larger socio-technical system. Decision-makers should consider the perceptions and attitudes of the users, as well as their dynamics. They should equally question the motivations for travel decisions and modal choice, look at alternatives to travelling and encourage greater efficiency in the transport sector. Three basic strategies for the achievement of sustainable transport can be distinguished:

1. *Changing the carbon intensity of the different transport modes:* increasing system efficiency by using cleaner fuels and propulsion technologies; optimising the efficiency of transport flows.
2. *Changing the modal split:* inducing a shift towards more environmentally-friendly modes of transport.
3. *Reducing the need to travel / e.g. through avoidance of trips, shorter journeys, virtual accessibility (dematerialisation, teleconferencing).*

Many studies prove that the first strategy alone is not sufficient for achieving sustainable urban transport systems. But mainly the second and the third strategy require changes in user habits and, thus, users' acceptance.



HOW DOES THE SOCIO-TECHNICAL TRANSPORT SYSTEM LOOK LIKE?

It is a central argument in this project that a holistic perspective on the transport system is needed in order to understand the potential of technological and organisational innovations in urban transport. In doing so, the following approach can be applied that considers different components of the transport system, as well as the relationships between them:

A **paradigm** basically refers to how people think about problems and how they develop solutions to overcome these problems. It has been demonstrated in the history of transport planning that paradigms change the face of urban transport (e.g. car-friendly city in the 1960s). These paradigms are not static; they seem to be changeable over time by actors in the transport system, at least to a certain extent. In the context of such a paradigm, specific **technologies** are developed and introduced, while others are neglected (e.g. electric drive vs. internal combustion engine). A transport system is also highly influenced by its users. User habits and their perceptions and attitudes towards those technologies are, therefore, of utmost importance for the transport system. Several indicators point at changes in **mobility patterns** within urban areas (e.g. increasing number of younger people with a rather pragmatic attitude towards car-ownership). Along with the technology infrastructure and those mobility patterns,

new **business models** are developed (e.g. car-sharing, bike-sharing), which employ new technologies (e.g. ICT) to offer their users new services. **Transport policies** aim to provide an environment in which the elements of the transport system co-evolve in a more sustainable way. All political levels are of relevance since urban transport is a mixture of local, national and European policy. The sum of those components makes up the features of the transport system.

WHAT TECHNOLOGY OPTIONS ARE AVAILABLE TODAY?

Major contributions to anticipated, as well as to already observable changes were made by developments in three fields of technology:

1. Discussions are often focussed on fuels and propulsion technologies. Many alternatives to oil-based fuels are already on the market, such as Compressed Natural Gas (CNG) and biofuels. CNG is still a fossil fuel, but can bring environmental benefits compared to conventional fuels. Biofuels are discussed critically for their environmental impacts on a life-cycle basis. In particular for urban transport, an electrification of the propulsion system is expected to take place.
2. Information and communication technologies (ICT) are increasingly penetrating the whole transport sector. ICT contribute to a better organisation of transport, to easier access to public transport systems, or to major improvements in the transport of goods. The application of ICT is not "sustainable" in itself, but it might allow for changes in behaviour and in logistics. A prominent example is an e-ticketing application for public transport that connects different modes of transport and brings them together in one single payment system. For urban freight transport, ICT play a crucial role, too. The "smart truck", for instance, uses RFID tags to screen permanently its state of charge; supported by an on-board route planning system, the parcels are delivered according to the optimal route.
3. In addition to these solely technical developments, new business concepts are

emerging that are made possible by technology and are enablers for technological advancement at the same time. Services such as car-sharing or bike-sharing individualise collective transport and become more popular in urban areas. Car-sharing shows constant growth rates in several European countries. The system is strongly based on modern ICT applications that make booking and access to cars via smart cards comfortable. On the other hand, car-sharing is discussed as an enabler for alternative propulsion technologies, since it allows choosing a specific car for specific purposes. Also bike-sharing is successful. Both examples underline that combination of advanced technologies and innovative business models allows for new forms of mobility patterns. There seems to be even more room for further innovations.

WHAT ARE SUCCESS FACTORS ON THE WAY TO A SUSTAINABLE TRANSPORT SYSTEM?

Formulate a common vision on how transport futures should look like: There is evidence that paradigms and visions can influence the development of socio-technical systems significantly. Innovations that meet societal norms and values (e.g. prestige factors, convenience) are rather adopted by users than by those who only target rational economic considerations.

Identify suitable measures to achieve that vision: These measures need to be politically and technically feasible. Several experts suggest a "working hierarchy" of modes for urban transport according to their degree of sustainability.

Support the development of "niches": Besides promotion of traditional modes of transport, it is important to create space for new actors and to develop and experiment with emerging alternatives. It should be considered to run those experiments with specific user groups, such as young people, since they show greater openness for flexible forms of transport. Also people older than 60, since they seem to be more car-oriented than the generation before. The degree to which an idea could be tried out is crucial, since this will lead to less

uncertainty. Those trials need to be accompanied by interdisciplinary research.

Integrate different actors and policy sectors: The support of all actors in the transport system is crucial, even though interests may be diverse and divergent. It should be a fundamental aim of politicians to stimulate new combinations of actor co-operations.

Combine policy measures in a flexible way and communicate them properly: The packaging of policies in a flexible and adjustable way is crucial in order to be able to react dynamically to new developments. Packages should combine push-and-pull measures comprised of regulatory and pricing instruments, spatial policy, information, as well as research and development.

Encourage public participation: The involvement of the public already in the design of policy packages is important, since acceptability is a prerequisite for sustainable transport.

Improve data collection: It is important to understand behaviour and to explore under which circumstances cooperation and support can be obtained. In addition, it is important to explore the changeability of travel behaviour and the underlying reasons for that.

WHAT ARE THE BARRIERS TO THE DEPLOYMENT OF SUSTAINABLE TRANSPORT?

Five main categories of barriers could be identified:

Resource barriers: including financial and physical barriers. Examples are budget restrictions or geographic structures.

Institutional and policy barriers: problems that relate to (un-)coordinated actions between different organisations, levels of government or policy sectors.

Legal barriers: related to the adjustment of laws and regulations in order to provide adequate framework conditions for sustainable urban transport.

Social and cultural barriers relate to the public acceptability of measures. Especially

unpopular policy measures, such as restricting car-use, are often rejected.

Side effects: can have serious consequences for other activities, so that implementation becomes too complicated (e.g. traffic calming could also cause inconveniences to public transport).

Even though effective implementation lies with local, regional, and national authorities, the European Union has the capability to formulate a common vision of a future transport system, which is to be carried out on a local level. White Papers are an important instrument to influence general policy objectives – and, indeed, many facts indicate that the paradigm of sustainable urban transport has influenced transport policies in many European cities.

WHAT ARE THE FACTORS THAT INFLUENCE END USER ACCEPTANCE

Transport users' behaviour, attitudes and perceptions are important for the successful implementation of innovations in transport technology and services as well as for the acceptance of policy measures. In turn, end user acceptance and behaviour is influenced by new developments and policies.

Several indicators point to changes in transport-related habits and preferences. Younger people in urban areas seem to have a rather pragmatic attitude towards car use and ownership and seem to be more willing to try out new forms of transport. During this project, group interviews with young adults in three different cities (Karlsruhe, Copenhagen, Budapest) have revealed that environmental concerns are relevant for them, but not an important factor for their daily mode choice. More than anything else, they desire a transport system that is flexible and convenient – and this is increasingly applicable to cycling. Since only limited data is available on this, further research is necessary. Especially to identify a major trend would require data generated at regular intervals.

HOW DOES THE OUTLOOK AND THE NEXT STEPS LOOK LIKE?

To picture a vision of a future transport system is crucial for realising a transition

towards more sustainable transport. The EU is in the position to take a leading role in this process since it can help to formulate that vision, in inspiring learning processes and encouraging other actors. Reaching a sustainable mobility paradigm is more than implementing several but separated policy measures. Particularly they should be combined into an integrated strategy that consists of a variety of policy measures that complement each other. Further, more empirical research on the dynamics of users' perceptions and attitudes is essential.

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Authors:

Jens Schippl; Maike Puhe (ITAS-KIT)

ITAS: Institute for Technology Assessment and Systems Analysis

KIT: Karlsruhe Institute of Technology, Germany

as members of the European Technology Assessment Group (ETAG).

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For further information, please contact:

Peter Ide-Kostic, STOA Unit
Directorate G, DG Internal Policies
European Parliament
Rue Wiertz 60 - RMD 00J016
B-1047 Brussels

Tel.: +32 2 284 4175

Fax: +32 2 284 4984

E-mail: STOA@europarl.europa.eu

Website: <http://stoa.europarl.europa.eu/>