

Technical University of Denmark



Challenges and barriers for a sustainable transport system - state of the art report

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Challenges and barriers for a sustainable transport system – state of the art report

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1 Extended Summary

In the White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system – (European Commissions, 2011) ten goals are described which aim to reduce GHG emission from the transport sector by 60%. Four of those goals are being addressed in the TRANSFORuM project; Goal number 1 - urban transport, goal number 3 - long distance freight, goal number 4 - high speed rail and goal number 8 - multimodal transport information. In more detail the goals focus on the following areas:

- Goal number 1 “Halve the use of ‘conventionally-fuelled’ cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO₂-free city logistics in major urban centres by 2030”.
- Goal number 3 “30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed”.
- Goal number 4 “By 2050, complete a European high-speed rail network. Triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium-distance passenger transport should go by rail”.
- Goal number 8 “By 2020, establish the framework for a European multimodal transport information, management and payment system”. (European Commission, 2011, page 10-11).

The overall aim of the TRANSFORuM project is to facilitate the implementation of these goals. Thus, one important task for the Transforum project is to produce concrete implementation-oriented outputs, including recommendations and roadmaps of joint actions for key actors and stakeholders involved in the shaping of the European transport system.

The Transforum project is therefore dependent upon a correct and adequate understanding of the barriers related to the four White Paper goals in focus. This is of key importance for the development of relevant recommendations and roadmaps that can facilitate a successful implementation.

The aim of this work package was to investigate the most important barriers which might prevent, or slow down, the implementation of the White Paper goals 1, 3, 4 and 8. The method used was a literature review. The main results can be summarized as follows:

Goal number 1: Many of the barriers are on the political and institutional level including EU but also the national, regional and the local level. On the national level funding/finance to support the necessary infrastructures is many times in short supply. On the regional level decision makers might support the overall goal of sustainable mobility but at the same time not always having clear plans to implement the same or indeed being reluctant to replace the car-based paradigm with a more sustainable one. There is also an uncertainty about how to engage with the public and get them to accept a more fundamental transformation that is necessary to reach this goal. This is an important issue since it is difficult for politicians to develop policies without the support from their voters. Another important barrier is on the technical level and the uncertainties related to new fuels and corresponding new technologies. The

literature suggests that there is a shortage of data which clearly show the potential and performance of alternative fuels and technologies. This will also influence customers and their willingness to buy a vehicle using sustainable fuels.

Goal number 3: In this case an important barrier is the lack of an integrated approach. For instance on a European level transport policy faces a range of barriers including the diversity of transport infrastructure, equipment and regulation across Member States which prevent full interoperability of the rail network. Similar problems can also be seen on a national level since some rail lines have not enough capacity left over to cater for more freight. When it comes to waterborne transport, there is a great need for more integrated planning approaches in order to release the potential of inland waterways. The sometimes poor quality of transshipment possibilities and/or intermodal services is a barrier which is not compensated by a lower cost. There are other barriers related to delays and lack of flexibility, which for the industry could be very costly. An important barrier is the willingness and ability to pay for infrastructure investment and other technical amendments. Furthermore, the railways, waterborne and intermodal operators need to become more efficient and more customer friendly policies.

Goal number 4: In some respect the barriers related to this goal are similar to Goal number 3. Large investments are needed to develop the infrastructure but also to finance its operation and maintenance. The development of HSR is dependent on subsidies since it very rarely makes any profit. At least not in the short term using conventional cost benefit analysis. Public acceptance therefore becomes very important but in some parts of Europe the opposite can be seen, with protest movements opposing HSR. The argument is not only about cost but also the impact new lines will have on the landscape. Politicians are therefore under strong pressure and have actually stopped, or at least put a halt, further development. The lack of international standardization discussed in relation to Goal 3, also apply to this goal, especially if we consider HSR to be international rather than national. The advantage with HSR is that it is fast but that raises another issue related to location. A barrier could be that the total journey time is not much shorter than conventional trains, if it is located in an inconvenient place.

Goal number 8: This goal is about information, management and payment systems which should make the use of multimodal transport more (cost)-efficient and thus more attractive. In order to achieve this goal access to and exchange of reliable data is vital. The lack of a common EU standard which would support the integration of different information and management systems is regarded as an important barrier. Data privacy and security represent other barriers which have to be addressed. This is further highlighted by the large number of actors involved in the transport system, where access to information also represents a competitive advantage.

2 Introduction

In the White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system – (European Commission, 2011) ten goals are described which aim to reduce GHG emissions from the transport sector by 60%. Four of those goals are being addressed in the TRANSFORuM project; Goal number 1 urban transport, goal number 3 long distance freight transport, goal number 4 high speed rail and goal number 8 multimodal transport information systems.

In more detail goal number 1 focuses on CO₂ emission in urban areas and states that by 2030 the use of conventionally-fuelled cars should be halved and by 2050 completely phased out. In addition to this, it sets out to achieve essentially CO₂-free city logistics in major urban centres by 2030. Goal number 3 aims towards a shift of modes for long distance freight and that 30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. Goal number 4 focuses on the implementation of a European high speed rail network and states that the length of the existing high-speed rail network should triple by 2030 and by 2050 the majority of medium-distance passenger transport should go by rail. Finally goal number 8 deals with Intelligent Transport Systems (ITS) and aims to develop a framework for a European multimodal information, management and payment system until 2020.

The overall aim of the TRANSFORuM project is to facilitate the implementation of these goals. Thus, one important task for the TRANSFORuM project is to produce concrete implementation-oriented outputs, including recommendations and roadmaps of joint actions for key actors and stakeholders involved in the shaping of the European transport system.

The TRANSFORuM project is highly dependent upon a correct and adequate understanding of the barriers and challenges related to the four White Paper goals in focus. This is of key importance for the development of adequate recommendations and roadmaps that can facilitate a successful implementation. This report sets out to map the most important barriers which might prevent, or slow down, the implementation of the White Paper goals 1, 3, 4 and 8.

“Barriers” and “challenges” are common terms in everyday language. In this report and according to the English Dictionary, the term “barrier” relates to something which prevents some form of progress or movement. “Challenge” on the other hand can be something difficult but also something which is regarded as stimulating, something which could be overcome. Thus a challenge is regarded as more positive than a barrier. Our ambition in this report is to focus on barriers only and then, in Deliverable 4.2, to look at them as challenges and present ways in which they can be overcome.

Inspired by earlier work in this field of research (Banister, 2005; OPTIC, 2011; Sørensen et. al., 2013) we have worked with broad types of barriers where we make a division between political, institutional, technical, and/or financial/market-related aspects. The concept “institution” is in this report related to formal and informal “rules” that structure the actions and interactions in society – politically, economically and socially (North, 1991). Hence, when we discuss “institutional” factors in this context, it covers a range of different aspects, including how society is organized, e.g. regulatory frameworks, roles

and responsibilities, how various policy fields are being integrated and coordinated, structures of financing and/or pricing, but also more informal norms, routines and habits in key organisations in this field of policy practice. Some, but not all, of the institutional aspects are directly driven by politics, since politics controls formal legislation and at least a considerable deal of the formal institutional structures of society. On the other hand institutions also provide a framework within which politics takes place.

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3 Goal 1: Urban transport

White Paper goal number 1 aims to:

“Halve the use of ‘conventionally-fuelled’ cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO₂-free city logistics in major urban centres by 2030” (European Commission, 2011, page 10).

In the White Paper, this goal is placed under the heading “Developing and deploying new and sustainable fuels and propulsion systems” which sounds like a goal that is mostly related to technical development and innovation. However, the content of the White Paper makes it clear that the fulfilment of this and the other goals are highly dependent on socio political and behavioural aspects and that there is a need for a “mixed strategy involving land use planning, pricing schemes, efficient public transport services and infrastructure for non-motorized modes and charging/refuelling of clean vehicles /.../ to reduce congestion and emissions” (European Commission, 2011, page 13).

The approach taken resonates well with existing knowledge about urban transport and the barriers related to the fulfilment of a sustainable transport system. Key researchers within this field have stated that the technological developments are of key importance to make the transport system more sustainable, but that even a substantial shift to more efficient vehicles and alternative fuels will not address the problems fully (e.g. Banister & Hickman, 2012). Assessments indicate that new fuels and new technologies may only be able to contribute to around half of the required reduction in CO₂ emissions by 2050 (Hickman & Banister, 2007). In short, sustainable mobility requires not only new fuels and new technology but also a fundamental behavioural change and a transformation of the conventional land use and transport planning paradigm towards initiatives that lead to modal shift and/or reduced travel demand, with less or shorter trips (Banister 2005, Banister & Marshall, 2008; Hickman & Banister, 2007).

In this chapter, we will provide an overview of the most prominent barriers to the implementation of White Paper goal 1, as they are presented in current literature from the field.



3.1 Key barriers for the fulfilment of White Paper goal number 1

3.1.1 The introduction of new fuels and new technologies

There are a range of uncertainties and other barriers related to new fuels and corresponding new technologies. In the literature, the main focus is put on Natural gas and LPG (Liquid Petroleum Gas), Hydrogen (fuel cells), Biofuels and Battery Electric Vehicles (BEV). In this report, we will not discuss natural gas and liquefied petroleum gas (LPG) since it is a type of fuel that does not match the definition of non-conventional fuelled vehicle in the White Paper. Hence, our focus is on; 1) Hydrogen (fuel cells); 2) Biofuels and 3) Electricity although the main focus is on biofuels. Among these, one fundamental barrier is the uncertainty if it is correct to regard these fuel types and associated vehicles as “sustainable”. Hydrogen is one illustrative example: whether it contributes to reduce CO₂-emissions or not depends on its production (Steenberghen & López, 2008). The production of hydrogen requires electricity and the benefits would then depend on the fact if this electricity has been derived from non-fossil-fuels or not. The same obviously relates to the electricity used by BEV.

The literature on this topic suggests that there is a lack of easily accessible knowledge/data about the potential and performance of alternative fuels and technologies– including information about the availability of raw material (wood, potato, sugar canes and maize etc.) (Browne et. al., 2012). The lack of common definitions and easily accessible data for policy makers appears as a key barrier. Clearly, new fuels require new systems for production, supply, distribution, storage and refuelling to be built up. There are barriers related to the time and resources that this may require. As stated by Browne et. al. (2012, with reference to Ralston & Nigro, 2011), alternative fuels may have a high production cost – depending on the source, scale of production, refining process etc. In some cases, the use of alternative fuels will require modifications of existing vehicles, which is not technically impossible, but still a complex and sometimes costly process (ibid., with reference to Bomb et. al., 2007). In essence, a transition to alternative fuels will lead to a range of other complexities related for instance to funding, acceptance and other issues. In general, according to Steenberghen and López (2008) there is a need for a critical mass of demand before such things take off. Other barriers are related to the lack of standardized solutions for supply of the new fuels.

In the case of biofuels, a key barrier is related to the fundamental uncertainty of feedstock availability (ibid., Browne et. al., 2012). The goal-conflict between growing crops for food-production and for energy-use but also tropical deforestation has led to an unstable situation in the production and created uncertainties regarding the long-term availability of biofuels. In essence, this barrier can be described as a type of competition for land use and brings into question if the production of biofuels is always sustainable. In addition to this, farmer’s attitudes to various crops and their willingness to enter into long-term supply contracts for specific types of crops is proving another problem which could have an impact on production (Steenberghen & López, 2008).

Another barrier mentioned in the literature is related to the limited availability of alternatively fuelled vehicles on the market. Browne et. al. (2012) notes that in the case of Hydrogen fuel electric vehicles,

there is still only a very limited selection of “niche applications and demonstration programmes and commercial availability is not expected to happen before 2020 due to technological bottlenecks such as; storage, material availability, durability and high costs” (Browne et. al., 2012, p 144 with reference to Frenette & Forthoffer 2009). To sum up, they note that the low commercial availability of alternatively fuelled vehicles, and –the low visibility and low public awareness hinder the demand (Browne et. al., 2012). This is an issue of importance also when it comes to city logistics. Current research argues that the limited battery capacity and thus a too short operational range of electric vehicles is one of the key barriers for CO₂ free city logistics (Van Duin et. al., 2013).

3.1.2 Political (EU-level)

Several writers have noted that there is a great potential to produce renewable energy and to develop the technical solutions needed, but that politics often get in the way (Gillingham & Sweeney, 2012, Jacobson & Delucchi, 2009). One reason behind this is related to goal conflicts and/or conflicts of interest that initiatives for new fuels, new technologies, other modes of transport and other ways to plan cities and regions tend to trigger.

Some of the implementation barriers are related to EU policy and legislation in itself. Lack of a common European standard for biofuels as a problem is usually mentioned in the literature (e.g. Steenberghen & López, 2008). In the case of biodiesel, one specific policy that is referred to is the 1993 Blair House agreement (part of GATT), which imposes a limit on the amount of rape meal that could be produced as a by-product from industrial oilseed crops grown on set-aside land across the EU. This policy limits the availability of biodiesel (ibid.).

It is also noted that current policies related to biofuels are affected by agricultural political concerns, closely related to issues such as food security, food prices etc. Steenberghen and López (2008) question if “a strong biofuel policy in Europe will effectively be able to serve fully the EC’s transport energy-related targets” (ibid., p. 585, see also Browne et. al., 2012). In other words, there are potential goal-conflicts between various political issues and concerns here – both at the EU-level and globally. In practice, this stand out as a fundamental uncertainty and hence a key barrier that affects the implementation of White Paper goal number 1.

For instance, if Biofuels and Battery Electric Vehicles (BEV) should be a sustainable alternative to petrol driven cars then the source used needs to be produced from carbon-free fuels¹. The share of energy from renewable sources in general more than doubled between 2005 and 2010 but it is still only 12.5% of the gross final energy consumption. The aim is to increase this to 20% in 2020 (Sturc, 2012). However, if this shall succeed then it is important that national member states co-operate. According to Hassan and McKenna (2013) some countries might fail to achieve this goal and one important reason is that it would make the EU globally uncompetitive since renewable energy many times results in increased energy prices for consumers.

¹ At present coal account for around one third of EU’s production of electricity (http://ec.europa.eu/energy/coal/index_en.htm)

There are other aspects of EU-policy that add to the complexity of trying to implement the White Paper goals successfully. On the one hand an increase in mobility is sometimes seen as a key strategy and part of EU member states social and economic development. This is also reflected in the White Paper which states that “curbing mobility is not an option” (European Commission, 2011, page 6). On the other hand an increase in mobility is in contradiction with the goal of sustainable mobility, which requires the need to reduce the amount of travel (Banister, 2000, 2005; Richardson & Jensen, 2003). White Paper goal 1 thus illustrates the sometimes quite difficult conflicts of interest that evolve around the content of the White Paper as such. In this paper, we regard them as a clear indication of the need to further develop modes of communication that are truly energy-efficient and that may provide access to desired functions without necessarily imply a need to move physically.

3.1.3 Political (national, regional, local)

National policy-making often has the power to support the transition to new fuels and new vehicles, for instance by certifying prices, adjusting the tax levels, subsidies or other policy measures or by promoting new priorities in urban and transport policy and planning. One of the key barriers is the fact that new investments or policy measures to support certain fuels, vehicles and/or transport modes along with the development of systems for distribution, refuelling and other necessary infrastructures are related to investment costs for society. Here, there might be a lack of funding/finance to support the most cost-effective solutions (Brand, 2008; May & Crass, 2007). At the national level, different ministries (transport, environmental, planning, industry, finance etc.) might have different goals and perspectives of what priorities to make, and political controversies often arise around matters related to transitions to sustainable transport in general (May & Crass, 2007). There are often strong lobby-groups around who influence decision-making related to fuels and new technical solutions (Brand, 2008; May & Crass, 2007). Regionally and locally, there may be specific economic, industrial or other conditions that make it easier to promote certain fuels and vehicles and not others. In practice, the political situation is often unstable, with changing government policies and/or restrictions to, for instance, future supply of alternative fuels (Steenberghen & López, 2008).

At the local arena, the political barriers related to conflicts of interest and goal conflicts are in many respects linked to general trends and development paths for cities and regions. Regions and cities have in many cases adopted visions and plans supporting the overall goal of sustainable mobility, and there may be promising local initiatives with new fuels and new technology, for instance in the publicly owned vehicle fleets (such as local buses) (Isaksson & Storbjörk, 2012). However, when looking at the big picture of mobility trends, preferred modes and the way cities and regions are being built, the overall tendencies often points towards a general increase in both personal mobility and car-use in total (European Commission, 2012). There is a fundamental barrier for local, regional and national policy making to develop processes that may be effective in generating and implementing more sustainable and energy efficient transport futures which goes beyond the focus on only a transition to new fuels and new technologies and also involves issues related to spatial planning and design, modal split, accessibility based on sustainable transport etc.

This is a challenge for local decision makers, and it illustrates one of the fundamental barriers to change; the lack of strategic capacity to enact such a long term transition. There is a great deal of specialized knowledge around, regarding specific policy measures and other initiatives that may enact sustainable mobility. A major problem is however that implementation is often inefficient or turns out to be politically controversial. In concrete situations, local decision makers might find it difficult to get the necessary acceptance if they try to challenge the car-based mobility paradigm (see Hrelja et. al., 2012; Isaksson & Storbjörk, 2012).

3.1.4 Public and stakeholder acceptance

Today it is not controversial to suggest that a significant reduction of CO₂ emissions from transport in the EU is dependent upon behavioural change. In practice there is “little sign that people are aware of the scale of the challenge and are prepared to make the necessary changes” (Banister, 2007, p. 1539). This is, in itself, a key explanation to several of the political barriers. It is difficult for politicians to develop policies and to try to implement them without support from their voters and key stakeholders.

A main barrier is thus related to the need to gain public confidence and acceptance among key stakeholders (Banister, 2008; Jones, 1998; Whittles, 2003). Early involvement of citizens and stakeholders in the planning and implementation process, as well as good communication skills, are issues of critical importance for successful policy implementation (Banister, 2008; Isaksson & Richardson, 2009; Little, 2011). Another related issue is the lack of dialogue between customers and innovators/companies that produce new fuels and/or new vehicles. If people shall be interested in learning how to use new fuels and/or new vehicles, it is crucial that companies try to understand customer needs in more depth. According to Blanks (2013) companies in general do not spend enough time on understanding the changing needs of their customers, or as he calls it “customer development”. Instead they tend to focus too much on product development and as a consequence the product might fail to reach the market or get a good turn over.

3.1.5 Institutional conditions

Another theme widely discussed is the potential barrier that is caused by institutional and organisational factors. The concept “institution” is here related to formal and informal “rules” that structure the actions and interactions in society – politically, economically and socially (North, 1991). Hence, when we discuss “institutional” factors in this context, it covers a range of different things, including how society is organized, e.g. regulatory frameworks, roles and responsibilities, how various policy fields are being integrated and coordinated, structures of financing and/or pricing, but also more informal norms, routines and habits in key organisations in this field of policy practice. Some – but not all – of the institutional aspects are directly driven by politics, since politics controls formal legislation and at least a considerable deal of the formal institutional structures of society. Alternatively institutions also provide a framework within which politics takes place.

Several writers mention institutional aspects as a key barrier, in relation to the White Paper goal 1. In practice, it may be about ineffective organizational structures in national contexts, counterproductive roles, excessive (de)centralization, poor policy integration, split responsibilities for transport modes and for land use. Other institutional barriers might be related to conflicts between the public and private sectors. There may also be process barriers that lead to obstacles in specific situations – depending on the specific institutional setting (May & Crass, 2007). Some of the examples mentioned in the literature are directly related to the introduction of new fuels and new vehicle technologies. For instance, the need for common international standards regarding fuels and their production and vehicle technologies and design have been highlighted (May & Crass, 2007; Steenberghen & Lopez, 2008).

3.1.6 Urban and transport planning

Several studies from the last decade have illustrated the key role of urban and transport planning for a transition to sustainable mobility. In relation to White Paper goal 1, a large number of studies have discussed the barriers related to institutional conditions – for instance the remaining dominance of a car-based mobility paradigm and have also demonstrated how this is inscribed in the discourses, perspectives, norms and routines that permeate everyday policy practice. This constitutes a considerable barrier to modal shift (Falkemark, 2006; Flyvbjerg, 1998; Hrelja et. al., 2012; Isaksson & Storbjörk, 2012; Low, 2009; Richardson et. al., 2010). Another issue of major importance is related to the existing spatial structures and transport infrastructures in cities and regions, which themselves constitute prerequisites for more or less energy-efficient transport flows for persons and goods (Cameron et. al., 2004). Generally speaking, there is a need for more integrated strategies and a closer link between transport planning and management and urban design that manage to include both issues related to personal mobility and freight/supply chains (Allen et. al. 2012; Tiwari et. al., 2011). Within the field of logistics, there is probably a need also for innovations when it comes to the supply chain and the configuration of the service network (Van Duin et. al., 2013). The findings resonate very well with Hickman and Banister's (2007) general conclusion on the importance of a major change in the way transport and urban planning is carried out – which includes also a shift of mindsets and priorities among transport and urban planners.

At least during the last two decades the literature also suggests a need to better integrate land use planning and transport planning, so that cities can develop physically in a way that supports sustainable mobility (e.g. Cervero, 2004; Banister & Marshall, 2008). In practice however, such a shift has proven to be difficult. Several studies have demonstrated the existence of internal barriers within the key planning organizations (Hrelja et. al., 2013). Such internal barriers may be caused by a lack of adequate processes, habits, routines etc. within the organization. Different groups of professionals may have difficulties to understand each other's perspectives – or integrate new perspectives, which make implementation of new policies slow (Gillingham & Sweeney, 2012).

3.1.7 Market demand

Several writers have demonstrated that individual attitudes and social norms often are the reason for unsuccessful implementation of White paper goal number 1 (Gillingham & Sweeney, 2012). One of the key barriers here is related to the lack of information; a well-functioning market is dependent on good access to information on both the demand- and supply side. In the current situation however, potential customers (both decision makers and end users) may not always be aware of the access, the price, the performance and the potential long-term benefits of new fuels/vehicles or of innovative services (Gillingham & Sweeney, 2012). Another type of barrier here is related to the need to provide better information. Some writers stress the need for a better energy labelling system across Europe, including clearer information to end-consumers about the fuel consumption and CO₂ emissions of new cars (Steenberghen & López, 2008). In the case of biofuels it is noted that the availability of information is mixed across Europe and that there is a lack of consensus among experts if it can be seen as a sustainable fuel or not from an economic, social and environmental perspective (ibid).

Pricing is another aspect of barriers related to the market situations. The basic function of a price is that it shall mirror the costs of a product. Since there are uncertainties regarding the performance of several of the new fuels, it is difficult to know what the correct price should be. Of key importance is of course also to make sure that all externalities get integrated in the price and that different fuels are treated equally in this respect (Gillingham & Sweeney, 2012). However, the problems related to internalisation of externalities are problems both for the “new” fuels but also in relation to conventional fuels where externalities are still not fully internalized due to a variety of reasons related to both methodology and politics. Attempts to internalise externalities in the price for conventional fuels are often delicate matters for politicians, since it can be highly controversial among both industry and citizens (Banister, 2007).

In any case, the price of new fuels and/or alternative vehicles normally tends to be higher than for conventional ones. Researchers within this field note that the costs for alternative fuels and vehicles are expected to fall in the future, due to technical developments etc. This is however highly dependent upon the realization of economies of scale in both vehicle and fuel productions. The problem is that the current market makes the development of alternative fuels and vehicles risky. This in turn has resulted in problems in attracting private investors since they feel unsure about getting a good return on their investment. Hence, there is no guarantee of sufficient demand at the end of the development phase, ending up in a “catch 22” situation (Steenberghen & Lopez, 2008).

No matter if the price is “right” or not in strict economic terms, there are other barriers that hamper the market for alternative fuels and vehicles to take off. For instance, Steenberghen and Lopez (2008) note that fuel cell- or hydrogen-based vehicles can potentially match the performance of conventional technologies (and in the case of fuel cell-technology even offer advantages in some cases). However, everything else being equal, these new technologies do not offer enough advantages to shift user choices (Steenberghen & Lopez, 2008). Of course, individual decision making is driven by a range of other motivations than just performance and price. Individual and social norms, habits, emotions etc. are central (Gillingham & Sweeney, 2012).

3.2 Conclusion

To achieve the White Paper goal on urban transport mixed strategies are required. They will include approaches to make the transport system more efficient – for instance by land use planning, pricing schemes and information, to shift to public transport and non-motorized modes, and to improve transport by non-conventional fuels and vehicle technologies.

Thus, the barriers to achieve the White Paper goal on urban transport are to some extent related to technical issues – this is the case for instance when it comes to the need for a more rapid development of non-conventional fuels and vehicle technologies that may function on a broad market. However, the main difficulties within this field are not about technology but about politics, institutional conditions and public acceptance and the uncertainty about how to engage with the public and stakeholders to get them on board in the more fundamental transformation that is necessary in order to reach the goal.

A general impression is that more could be done within the political-administrative system to decide on joint strategies in relation to the goal, mostly at the national, regional and local level, and to a more limited extent at the EU level. Such strategies should include both matters related to what types of fuels and technologies to go for, but also the more general idea of a sustainable urban transport system for the future.

The goal requires more fundamental transformations of the way cities and regions are being planned. Thus, the key barriers here are closely related to policy and planning as such, and the priorities that are being made in long term strategies for urban and regional development which relates, for instance, to the organization of housing, work places, norms of mobility etc. There is a need for policy makers to develop a more strategic and visionary capacity to tackle the barriers related to the White Paper goal 1. This will probably include new models for planning and decision-making and also new ways to interact with the public and other stakeholders. It is critical that policy makers manage to interact with citizens and other stakeholders and develop suggestions that are acceptable, attractive and effective. The coordination between different administrative levels is an important matter in relation to this task.

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4 Goal 3: Freight transport

White Paper goal number 3 states that:

“30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors. To meet this goal will also require appropriate infrastructure to be developed”. (European Commission, 2011a, page 10).

An important part of the solution is thus intermodal transportation which according to the Economic Commission for Europe (UN/ECE, 2001) can be defined as the:

“Movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes” (page 17).

Waterborne transport covers maritime transport (i.e. short sea shipping) and inland navigation.

During the last decade, countries within EU have witnessed a steep increase in freight transport. According to recent statistics, freight transport increased from 3060 billion tonne-kilometres (tkm) in 1995 to 3824 billion tkm in 2011, which corresponds to 25%. The largest increase was for road transport (34.6%), followed by air (25.9%) and sea (22.8%). However, freight transported by inland waterways and rail increased much more slowly with only 15,6% and 8.8%, which means a loss in the market share for these modes (European Commission, 2013).

Today freight transport over 300 km stands for 11% of tonnes lifted and 56% of tonne-kilometres. Total intra-EU freight transport amounted to 3700 billion tkm in 2010. Road transport over 300 km contributes to 965 billion tkm. Assuming that road transport, in a business as usual scenario, would continue to increase by 2% annually (average increase 1995-2009) this would mean that in 2030, according to the 30% target, 430 billion tkm should be shifted from road to rail and to waterborne transport. By 2050, this required shift would be more than 800 billion tkm. In comparison, total rail freight in the EU-27 in 2010 amounted to 390 billion tkm while inland waterway transport amounted to 147 billion tkm.

4.1 Key barriers for the fulfilment of White Paper goal number 3

One of today's main policy barriers for the European Union is improving the functioning of a transport system that is still patchy. Rather than a truly European transport system, several barriers exist to the seamless movement of passengers and goods across borders, e.g. technical, administrative and legal obstacles (European Commission, 2011a). There are also other barriers related to funding of increased capacity and quality of services. In this chapter we will discuss these barriers. A key aspect for the fulfilment of the White paper goal 3 is of course the relative attractiveness of rail and waterborne in comparison to road freight. Next year the European Parliament will decide if cross border restrictions and length restrictions of trucks shall end. If that goes through trucks will be allowed to be up to 25 metres long and weigh 60 tonnes. According to Doll et al. (2008) this could undermine the likelihood of more freight being transported by rail. This means that it's not enough to discuss the quality and capacity of rail and waterborne as such. We will bring up this issue below, in particular in the sections "Developing infrastructure – Capacity and funding" and "Getting prices right".

4.1.1 Political (EU, national, regional and local)

The EU transport policy faces a range of barriers including the diversity of transport infrastructure, equipment and regulation across Member States. This fragmentation has been recognised as a barrier to the seamless transport of goods across Europe since the beginning of the development of a common transport policy. The effort to integrate the railway system of the European Union has a long history. The four "Railway packages" constitute key elements in this area. The first was passed in 2001 and recently the fourth was proposed (European Commission, 2013). These initiatives concern technical, administrative as well as regulatory integration. As a consequence markets for rail freight became open for competition in 2007 (at least in theory). The technical integration is slower, for instance the European Rail Traffic Management System (ERTMS) is not expected to be fully implemented before 2030. The technical differences include diversity of control-command systems, track gauge, traction power supply voltages and maximum axle loads. According to Tsamboulas (2008) there are 37 different combinations of rail gauge, tunnel clearance and power systems in Europe.

Community efforts have also been made to approach free maritime movements around Europe and to remove barriers for using inland waterways (European Commission, 2011; PLATINA, 2013). One such was the multi-annual Integrated European Action Programme for Inland Waterway Transport (NAIADES). It recommended a range of things, for instance improvements in the infrastructure and maintenance of the network and development of better transshipment facilities around inland waterway ports and nodes (Schinas and Dionelis, 2011).

Despite this several barriers still prevent full interoperability of the rail networks of various countries. To a great extent this is the effect of the inertia in the historic structure with national railway companies almost totally relying on domestic rail services. Although the EU has launched several policy initiatives as mentioned, the actual implementation in member states have been slow (European Commission,

2011). One reason for the slow progress may be that often it pays off for a country to lag behind in implementation. The reason being, that the railway company of that country may gain new markets abroad while still having almost exclusive control of domestic services. Deregulation of rail also includes new regulations and authorization processes. There are similar barriers for international services in waterborne transport, like customs procedures in ports. The main competitor, truck transport, has meanwhile experienced a simplification regarding international haulages.

Much recent research has been directed towards assisting the European policy goals of liberalisation, harmonisation and interoperability on the European rail network. Liberalisation and harmonisation call for standardised systems for non-discriminatory charging for network access and allocation of train slots that can be implemented effectively on pan-European rail freight priority corridors. The different rates of progress between countries in rail market deregulation and in the emergence of intra-modal and intermodal competition have been shown to be significant impediments to implementing such corridors (TRKC, 2010).

An overarching problem which is put forward by stakeholders and other experts is the lack of an integrated approach for achieving the White Paper goals (TRANSFORuM, 2013). This holds within a policy level (between policy areas) as well as between policy levels, e.g. uncoordinated strategies/policies between EU level and national level. Finally, an obstacle for dedicated action towards the goals is the common lack of long term commitment. In contrast, the Swiss master plan for transport has been put forward as a good example of a long term stable strategy which is not changing every fourth year (TRANSFORuM, 2013).

Although the liberalisation seems to bring mostly positive effects, it may still cause some short-term obstacles. National service providers that previously have cooperated in building up international services have now become competitors.

Some other national or international barriers are the low degree of cooperation between involved actors, unclear responsibility for intermodal transport and lack of standardisation and harmonisation. Another related problem is that local authorities have no or little education in this area. It is also unusual that cities have staff allocated to work with freight. This in turn results in insufficient support (Lindholm, 2010; Lindholm, 2012). Lindblom (2012) argued that the reason for this is that many local authorities do not see that this is within their remit and that it is the market that should solve the problem.

4.1.2 Quality of transport services

Several studies claim that rail transport often is cheaper than road transport (Eng-Larsson, & Kohn, 2012). However, direct costs are not the only criteria for transport solutions. There are other costs which can be described as “logistic costs” or “inventory costs” (Blauwens, et. al., 2006; Eng-Larsson, & Kohn, 2012). An example of a logistic cost is terminal handling fees, the time it takes to load and off-load goods as well as loss and damage to goods. Indeed as Blauwens, et. al. (2006) pointed out if transportation cost was the only factor then fewer people would use road transport. Hence, intermodal

transport can only become competitive if the service fulfils a number of different requirements which are related to the quality of the service. Some of the criteria which can describe the quality of the service is; punctuality, flexibility, time and safety. Even though most of the examples in this section refer to rail freight, the argument is very similar to the case of inland waterways. Writers within this field point out the need to identify and solve capacity problems, eliminate bottlenecks and apply more customer friendly services to raise the overall quality of the service (Schinas and Dionelis, 2011).

4.1.3 Punctuality

Punctuality is something which is regarded as very important by customers. It has been argued that rail traffic across borders provides low quality with regard to transport time and, in particular, punctuality (OECD, 2008a). Poor maintenance of infrastructure in parts of the union is one reason for this. Another contributing factor is that railway companies who do not deliver in time face no penalties (OECD, 2008a). A further reason for delays is that most railway companies in the past did not face any competition in their basically domestic markets.

On some parts of the network the amount of trains has reached a ceiling with small opportunities to increase the number of trains. The scarce rail capacity results in a system very sensitive for disturbances. If one train gets delayed this rapidly spreads to a great number of other trains in the system. Thus, a sufficient capacity is needed to up-hold a satisfactory punctuality. That freight trains will have to compete for rail capacity and the increasing number of passenger trains need to be considered in this context.

4.1.4 Flexibility

Research has shown that operator's perception of intermodal transport tend to be rather negative and one reason for this is the lack of flexibility but also factors related to transit time and reliability (Eng-Larsson, & Kohn, 2012). Since rail traffic needs to be scheduled carefully the allocation of freight and passengers trains has to be done very early, sometimes one year before it is put into practice. Considering the varying nature of transport demand this obviously can cause problems (Smidfelt-Rosqvist & Dickinson, 2012). Another problem related to lack of flexibility is that rail operators can be too rigid and inflexible. For instance, the market might need quality single wagons which the railway operator cannot provide since they regard them as too expensive (OECD, 2008a).

4.1.5 Transport time

In general road transport is faster than both rail and waterborne transport. Low priority of freight trains compared to passenger trains affect the mean speed of the latter negatively. For intermodal transport extra time is added for transshipments at terminals. Furthermore, terminals often stand for a significant part of total transport costs. Thus intermodal transport is often considered a viable solution only if the distance is long enough to compensate for the extra cost and time of transshipments. In general distances above 400 km are regarded as the market suitable for intermodal transport (Tsamboulas,

2008). However, for instance the InnovaTrain concept in Switzerland has shown that intermodal transport may be competitive on shorter distances as well (InnovaTrain, 2013).

4.1.6 **Damage to goods**

The number of loadings and off-loadings is not only something which causes delays but it can also increase the risk of damage to goods (Eng-Larsson et. al., 2012). This is a common notion amongst especially smaller transport operators (Trafikanalys, 2012).

4.1.7 **Institutional condition**

The potential to increase transport volumes on rail or waterborne with only marginal improvements is not insignificant (TRANSFORUM, 2013). This holds especially for inland waterways (PLATINA, 2013). Writers within this field note that there is a big potential to be released also through smaller investments. However, in order to reach goal 3 of the White Paper a capacity increase in the order of 150% would be needed until 2050. Raising funding for long term investments in green corridors, hubs and ports, will thus be a major barrier.

The financial crisis with large public deficits and the ageing population of Europe will increasingly restrain public spending on infrastructure in the future. Innovative financing concepts like Private Public Partnerships have been proposed as part of the solution, but it is disputed whether such solutions are better than public financing. One of few effective policy options would be to reallocate funding within the total infrastructure budget, from roads to railways and waterborne transport. Indicative figures show that much could be accomplished if funding for investments were reallocated so that total rail investments become almost as high as road investments, without increasing total infrastructure spending (Nelldal & Andersson, 2012).

Mixing slow and fast trains reduces capacity substantially. Therefore, using separate tracks for fast passenger trains on the one hand and freight trains and commuter trains on the other hand, can increase capacity by a factor three to four, compared to a single track in each direction. Such solutions reduce cost per transport unit, but only if the transport volumes are large enough. And the problem of raising funding still remains. In addition to the barriers mentioned local opinions are increasingly resisting towards new infrastructure projects (TRANSFORUM, 2013).

No matter the exact type of investment or measure, there is also an overall need to develop a more comprehensive approach to freight logistics, where different transport modes can be linked together in energy-efficient chains with better transshipment facilities. This, however, requires new and more integrated practices of planning (Schinas and Dionelis, 2011).

4.1.8 **Getting prices right**

Revising taxes and charges in freight transport in order to internalize effects of emissions, noise, infrastructure wear etc., is another major barrier. This has been an important part of the White Papers

on transport from 2001 and 2011 (European Commission, 2008; European Commission, 2011). An obstacle for achieving efficient pricing in transport is that fuel taxes, like all tax issues, are under the authority of member states governments. For international sea and air transport international negotiations on “carbon taxes” or the like has only resulted in the inclusion of aviation in the EU Emission Trading System. As a consequence aviation now pays for its carbon dioxide emissions, but only a fraction of what road transport pays per kilogram. Heavy vehicle fees have been implemented in countries like Switzerland, Germany and the Czech Republic, but have been blocked by private sector interests in other countries like Sweden.

There also seem to be synergies here since increased public revenues from taxes on emissions, noise, infrastructure wear etc., may enable an increased funding of infrastructure for rail and waterborne transport.

Problems may occur if the efforts to internalise external effects are not going at the same pace for competing modes. A case in point is the sulphur directive for maritime transport that is taking effect in 2015 (European Parliament and the Council, 2012). The aim is to internalise the effect of sulphur emissions, which in itself is positive. However, it may in some cases lead to a shift from shipping to road freight, since in many countries the external effects of road freight are only internalised to a limited extent.

4.2 Conclusions

It could be concluded that a general barrier to the implementation of goal number 3 is the perceived lack of an integrated approach to reach this goal. All policy areas and policy levels need to work in a common direction. More specific barriers are in particular related to getting the prices right and improving capacity for rail and waterborne. Here synergies need to be utilized, since pricing may enhance the possibilities for infrastructure funding. Even so it is likely that a re-allocation of funding within transport will be necessary, from road to rail and waterborne. The quality of intermodal services, with regard to punctuality, flexibility and transport time, need to be improved. Increased capacity and maintenance will help, but the railways and intermodal operators also need to become more efficient and adapt more customer friendly policies. There are still more barriers that may be crucial, like the increasing local opinions against new infrastructure and the attitudes of some local authorities who seem to think that the problems should be solved by the market.



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5 Goal 4: A high speed rail network

White Paper goal number 4 aims to:

“By 2050, complete a European high speed rail network. Triple the length of the existing high speed rail network by 2030 and maintain a dense railway network in all Member States. By 2050 the majority of medium distance passenger transport should go by rail” (European Commission, 2011, page 10).

The definition of a high speed rail (HSR) varies but according to The European Union Directive 96/48/EC, Annex 1 it should include a set of criteria:

- Specially built high-speed lines equipped for speeds generally equal to or greater than 250 km/h;
- Specially upgraded high-speed lines equipped for speeds of the order of 200 km/h;
- Specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case (Eurostat, 2013).

The HSR network has more than doubled in length between 1995 and 2008 but despite this it only represent 3% of the European rail network in 2008 (European Commission, 2010). Although on traffic over medium distances (i.e. London–Paris, Paris–Brussels and Madrid–Seville) high-speed trains accounted for approximately 40 % of traffic during 2010 (European Commission, 2010).

As stated in goal number 4 the European Commission wants to see further increases in HSR and has therefore invested large sums of money to upgrade 15.000 km of railway lines to high speed. This is part of a large Community trans-European transport network (TEN-T) which aims to promote growth and competitiveness. In the current MFF (multi-annual financial framework) the EU is allocating €26 billion (current prices) to transport under the Connecting Europe Facility (CEF). This in turn is hoped to stimulate further investment by Member States helping to achieve the aims and objectives of TEN-T (see TEN-T, 2013).

In Europe several HSR lines are to be built and others are planned, in order to change modal split in favour of railways (de Rus, 2009). However, for each country that advocates HSR lines and projects,



models and methods are different and HSR investments are concentrated in few European countries². Governments are practically the only investors and some of them have become reluctant to invest more money into HSR (Steer Davies Gleave, 2004). For instance, this year France abandoned its plans to double its network of HSR (The Independent, 2013). The same also applies to Portugal according to The Portugal News online (2013). Instead of HSR Portugal is going to invest the money in a freight rail link. Although this will, according to recent news from Portugal Economy PE probe (2014), depend on the “need expressed by business and on European Union finance”.

In this chapter we will present the reasons why this has happened discussing some of the barriers which could prevent or delay the implementation of the 4th goal. As stated by the White Paper goal HSR can also run on conventional tracks which of course would be easier and less expensive. The problem with conventional tracks has been discussed in chapter 2 demonstrating that they already today have a problem with capacity and delays which in turn would severely limit train speed. Another problem is that HSR require special track constructions if they are to travel at a speed greater than 220 km/h (see also Peterman, Frittelli & Mallett, 2013). Thus the use of conventional tracks has several drawbacks. Hence, when discussing barriers and especially cost, mainly HSR running on separate tracks will be considered in this chapter.

5.1 Key barriers for the fulfilment of White Paper goal number 4

5.1.1 Political (national, regional, local)

To build HSR requires large investments and therefore decisions are taken at the highest levels of Government. Sometimes National Governments are reluctant to invest in rail infrastructure which can be described as a political barrier.

There are a variety of tools that are designed to help decision makers understand the economic effects of HSR but also its impact on other important issues including sustainability, health and well-being, natural and cultural environment (see Booz & co, 2009).

One such tool is the economic appraisal report which according to the European Commission all countries should carry out. The problem is that the guidelines are fairly broad and according to Steer Davies Gleave (2004) the risk is that the appraisal only tries to convince the Commission that the project shall start and not that it is a sound way to handle own resources. The same applies to cost benefit analysis which all EU countries, except for Italy, carry out before starting any major transport projects. Instead of assessing the wider economic impact it is merely used to assess when and how. Steer Davies Gleave (2004) concluded that the appraisal, in at least some countries, is skewed towards certain policy

² I.e. trains in Germany, France, Italy, Portugal and Spain are able to travel at speeds over 300 km/h. Some countries use tilting trains at a speed up to 220 km/h, for example: Switzerland, Sweden and United Kingdom.

objectives. This of course might increase the likelihood of a HSR project starting if the appraisal is positive, but it could also be the opposite.

This can also be illustrated by what is happening in England right now who are planning to build a new HSR network from London to Birmingham and then to Manchester and Leeds, known as HS2 (see Department for Transport, 2013). Before the bill is passed it has to pass through around 70 parliamentary constituencies. At the moment many local groups are opposed to the scheme and are lobbying their MPs to vote against the plans. The arguments are that some areas will lose out to London and/or that it will destroy the landscape. The political pressure is high and some Conservative MPs are worried about losing the confidence from their constituencies and are indicating that they might vote against the bill (BBC, 2013). A similar situation has been reported from Italy where some people are protesting about the proposed HSR line connecting Italy with France. According to D'Alimonte, a professor of political science at Rome's LUISS University, the local resistance have gained strength by combining forces with protest movements at the national level (see Blomberg Business week, 2012).

Other examples of resistance which this time resulted in a legal barrier happened in USA. A Californian Governor (Jerry Brown) has signed an \$8 billion bill which will prevent the state to build a track through different communities. As a consequence of this the state might have to use conventional lines which would make the journey slower (San Jose Mercury News, 2012).

5.1.2 Technical

In preparation of the aforementioned HS2 network an appraisal was carried out and the conclusion was that it will only be possible if it served long distance journeys (Booz & co, 2009). For many smaller EU countries this highlights the need for international travel.

Considering that HSR have fewer stops it is important that they link two larger cities with enough demand and the right distances in between to make it viable. This could however, be a problem if it is only regarded as a national mode of transport and not an international mode linking different European cities with each other. However, the lack of international standardization has prevented the integration of a European HSR network or indeed rail networks in general (see chapter 2). The railway system cannot be fully competitive without the prior removal of technical and operational barriers (The trans-European high speed rail system, 2004). According to De Rus and Nombela (2007) almost every country has developed their own specifications and each train is different in terms of length, composition, seats, weight, power, traction, tilting features, etc. To deal with this problem and ensure the interoperability of the network a number of legislations have been passed. They include technical specifications such as; rolling stock and infrastructure (see Mobility and transport, 2012)³.

³ Please note that some trains already operate across borders such as the Eurostar and TGVs from France to Italy. This has been achieved through cooperation and the development of new technology, which enable the operation of trains on lines with different technical specifications (for example Alstom's Atlas ERTMS3 system: <http://www.alstom.com/transport/products-and-services/rail-signalling/atlas-signalling-solution>).

A further problem related to international travel was highlighted by Calvo, de Ona and Nash (2007). According to EU regulations rail infrastructure operators have to adopt prices for using their networks. These prices are set differently throughout Europe and there is wide variation as well as uncertainty in their use. Nash and Weidmann (2007) argued that these variation and uncertainty works against encouraging international rail service, because it is hard to determine exact prices. The European Commission (2013) concluded that “under the current system, there are no incentives for European and intermodal cooperation” (page 5).

5.1.3 Operational and organizational

One important benefit of HSR is that it is fast and saves time. However, in order to achieve this local transport systems and traditional rail networks need to be well integrated with HSR. A journey by HSR might be quick but as Givoni and Banister (2011) stress, HSR cannot exist on its own.

The total journey time is an important factor influencing modal choice (Blainey, Hickford & Preston, 2012). When considering HSR the location of the station and how easy it is to get to the same will have an impact on the total journey time (Blainey, et. al., 2012; Givoni & Banister, 2011; Harman, 2006). One way to solve this would be to increase the number of stations. However, as Harman (2006) pointed out this would increase the time of the journey itself, something which is not always compensated by greater gains to the smaller communities. One stop “costs” between 5 to 10 minutes which might not sound that much but if we add the time to get to and from the station the HSR might not be a great deal faster than other trains and other alternatives. This in turn would make it less attractive and according to Givoni and Banister (2011) if passengers have to make a trade-off between time spent on the train and time spent on access then they might choose reduced access time.

Location of stations and how easy it is to get access to, will also determine if a new HSR link will stimulate economic growth or not. The location choice for firms is dependent on accessibility but if a HSR line will increase economic growth or not is not obvious. According to Nash and Weidmann (2007) HSR will help to make the region more competitive but also stimulate development. Although, as de Rus (2009) pointed out, it is rather ambiguous if the economy will grow as a consequence of investing in new infrastructure. Willigers (2003) presented an economic-geographic survey which showed that a station within walking distance was for most of the firms taking part in the survey the most important factor for the location decision. Willigers (2003) concluded that more research was needed before we can determine the importance of accessibility for corporate location choices.

It could therefore be argued that the demand for HSR is dependent on the location of the stops and that it links cities with large populations. However, the argument against HSR is that the location could create a barrier effect and people living in areas where the line passes have to incur the costs of deterioration but do not received any of the benefits. In fact as de Rus and Nash (2009) stressed it might even cause the regions in the periphery to be worse off. This is also something which lobby organisations in England are using as an argument when they oppose the planned HS2 network.

5.1.4 Institutional conditions

HSR usually requires a high speed infrastructure which costs a great deal more than conventional rails. This can indeed be a strong incentive against a further development of HSR lines. Cost has also escalated and the earliest line built in 1964 between Tokyo and Osaka, cost less than \$5 million per mile. Nowadays, most new routes cost at least \$10 million per mile to construct (Feigenbaum, 2013). In Europe EUR 269 billion will be spent on 14 TEN-T projects developing new lines and/or upgrade existing ones between 1996 and 2020 (European Commission, 2010). The European Union is giving financial support to these projects via the TEN-T budget, the Structural Funds, the Cohesion Fund and the European Investment Bank (EIB) (European Commission, 2010).

Investing in HSR is strongly dependent on a number of different factors; the existing volume of traffic, where the new lines are built, the expected time savings and generated traffic, the average willingness of potential users to pay, the release of capacity in congested roads, airports or conventional rail lines and the net reduction of external effects. Time is an important factor and in the current transport paradigm, travel time is considered to be wasted time and a disutility. This means that travel time needs to be minimised and consequently speeds need to be increased, and this argument has been central to investment in HSR (Givoni & Banister, 2011).

5.1.5 Economics

The cost of HSR can be broken down into several parts: capital, operational and maintenance costs.

Capital costs

Capital costs include infrastructure building costs, stations, the train control system, signalling systems, the purchasing of the vehicles and land use acquisition etc. Campos, de Rus and Barrón (2009), who looked at the building cost of 45 different world wide projects, found that the average construction cost of 1 km of high-speed line amounts to between 6 and 45 million Euro (average 17.5 million). The cost depends on several things including the topographical conditions and if the area is densely populated or not. Land use acquisition which includes; legal and administrative fees, licences, permits etc. could also be expensive and could be up to 10% of total infrastructure costs (de Rus, 2008).

Operational costs

Operational costs include the cost for running the train on a daily basis such as; labour, energy, maintenance of rolling stock and equipment. The cost varies across rail operators depending on traffic volumes and the specific technology used by the trains. But compared with other costs of HSR it is fairly consistent (Feigenbaum, 2013). If we only consider the cost of maintenance of the infrastructure then data from several European countries indicate that the cost per km are, on average, equal to €100,000 per year (de Rus, 2008).

Analyses have shown that the unit energy consumption (in Wh/gross tonne-km) of HSR is less than conventional trains. On some routes, the energy consumption of high-speed trains was lower by more than twenty nine per cent as compared with conventional trains using the modernized lines (with the



speed of only 200 km/h) (Garcia, 2010). According to Garcia (2010) this is due to the intrinsic features of the HSR including; fewer and shorter stops, fewer curves and higher power supply voltage etc.

Maintenance cost

Maintenance costs are the funds needed to keep the train operating correctly. The average maintenance cost of high-speed lines range from 28.000 to 30.000 Euro per 1 km per year (Campos, et. al., 2009).

The cost of maintaining rolling stock can vary considerably since it includes the cost of labour and materials but also train use (de Rus, 2012). To illustrate this De Rus (2012) used an example from the HSR link between Madrid and Seville and estimated the cost of rolling stock maintenance, but also operation, to be 26.4% of the total cost

The cost of the HSR has to include all these costs. Understandably many railway companies need to show that there will be a financial return on the investment (Harman, 2006). The early HSR projects carried sufficiently large estimated rates of return on a financial basis to make them feasible. However, when more and more HSR lines were being built it became more complex and therefore more difficult to assess the precise added value for each new link. Indeed, it has been argued that an investment in HSR is far from cost recovering (Feigenbaum, 2013; de Rus, 2008). In some cases revenues might cover operating costs but they rarely cover both operating cost and maintenance costs (Feigenbaum, 2013). From a financial perspective including capital, operational, maintenance and planning costs Feigenbaum (2013) argued that only “two high speeds train lines are money makers - Tokyo to Osaka and Paris to Lyon while one breaks even - Hakata-Osaka” (page 18). Flyvbjerg, Skamris Holm and Buhl (2002) studied the cost of 258 infrastructure projects and concluded that for rail projects the final cost on average are 45% higher than the estimated costs. However rail projects are not an exception since it is a widespread practice in other transportation projects.

It is therefore not surprising that the majority of high-speed rail lines require large government subsidies. Other subsidies also apply like the low access charges being paid in some countries and as de Rus and Nombela (2007) pointed out, this also varies across the network. For example, in France, the infrastructure charges for HSR lines are substantially higher than for the conventional network (three to four times the marginal cost). A similar access charge system applies in Germany where trains on lines with higher speed pay higher charges.

However, one aspect not always considered is the overall impact and the long term effects on society. Banister (2007) pointed out that it could generate increased demand across the whole network. De Rus and Nombela (2007) stressed that a valuation of marginal social costs is important; this could be the costs of congestion, noise, air pollution and global warming which are more long term. They would therefore argue that “Pricing according to short-run marginal cost, with indivisibilities and economies of scale, leads to insufficient revenues for the recovery of infrastructure capital costs”. “Railway infrastructure managers are expected to pursue economic efficiency when charging for the use of the rail network, but efficiency has a long-term dimension. Revenue adequacy is required for long-term investments “(page 6). Banister (2007) would argue that “the main message here is to place rail

investment (and transport investment more generally) within the context of the wider national, regional and local development objectives, so that the benefits and costs are not only seen in transport terms, but also in this wider context” (Banister, 2007, p. 16). The problem according to de Rus and Nombela (2007) is that the Commission seems to favour a short-run marginal cost pricing and that they expect a full capital costs recovery of investments.

Perhaps when it comes to funds invested by the public to this mode of transport the wider social benefit becomes even more important. Harman (2006) would argue that in those cases a wider economic assessment is required which clearly shows both gains and losses.

5.1.6 Market demand

The market for high-speed rail is different in different countries. This in turn is a reflection of both demographic and socio-economic characteristics (Steer Davies Gleave, 2004). The market demand is larger for distances between 200 and 800 km, with a focus on the range of 300-600 km. If the journey is shorter then HSR offer little benefit (Steer Davies Gleave, 2004). If it is longer than 800 km then it will not be able to compete with air travel. Since the introduction of discount flights the competition with air travel has become more difficult since they tend to be both cheaper and faster than HSR (see Feigenbaum, 2013). Indeed studies have found that market demand is linked to cost (Román, Espino, & Martín, 2009). Their study showed that the demand for HSR is especially sensitive to the cost for air travel but also as previously discussed the time it takes to get to and from the station.

Other factors influencing the demand and traveller's willingness to travel by rail, both conventional and HSR, is related to the service itself, such as reliability, comfort and convenience (see chapter 2). Indeed as Blainey, et. al. (2012) pointed out it is important to understand that we are not talking about one barrier rather than a package of barriers which could prevent traveller's to use the train. This could also explain why traveller's might still choose other modes of transport even if rail travel is the most cost-effective mode of transport for a particular journey.

5.2 Conclusion

An important goal of the White Paper is to invest more in HSR. In this chapter a number of different barriers have been discussed which could prevent or slow down this process. The first one is how the appraisal is carried out. It has been found that this is not always based on a thorough cost benefit analysis. This could of course increase the likelihood of investment but it could also work the other way. Especially if the project is opposed by the public or strong lobby organisations. Another important barrier is the lack of international standardization. In order to combat this problem huge investments are required. Location is another important factor which could prevent the time saved on the journey itself being lost when trying to get access to the same. HSR competes with both air and road travel but for longer distances mainly with air. Since the introduction of discount flights this is sometimes difficult especially if the chosen location for HSR stations is not convenient and easily accessible. The investments required to build HSR are very large and most scientists agree that any schemes very rarely

make any profit, at least not in the short term. This in turn means that the Government has to make large investments which in effect are paid by the public via their taxes. Many times the more long term views are not presented. Finally, legal and land use issues can also be an important barrier, these could be created by political opposition but also difficulties to obtain land to build the new link on. In summary, it could be argued that there are several important barriers which could prevent or at least delay the building of new HSR.

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6 Goal 8: A European multimodal transport information, management and payment system

White Paper goal number 8 aims to:

“By 2020, establish the framework for a European multimodal transport information, management and payment system” (European Commission, 2011, page 11).

Multimodal transport refers to the transportation of goods and people by two or more modes of transport (such as road, rail, air, inland waterway and sea). Through the introduction of information communication technology (ICT) the use of multimodal transport can become easier since it can provide the user with an up to date integrated service.

Potter (2010) discussed transport integration and an integrated transport policy which appears to be similar to the White Paper goal number 8. Potter (2010) argued that a common definition is not possible but that it should include the following:

- Locational Integration: being able to easily change between transport modes - services connecting in space;
- Timetabling Integration: Services at an interchange connect in time;
- Ticketing Integration: Not needing to purchase a new ticket for each leg of a journey;
- Information Integration: Not needing to enquire at different places for each stage of a trip (or that different independent sources are connected to appear seamless to users);
- Service Design Integration: That the legal, administrative and governance structures permit/encouraging integration;
- Travel Generation Integration: Integrating the planning of transport with the generators of travel (particularly integration with land use planning)” (page 2-3).



6.1 Key barriers for the fulfilment of White Paper goal number 8

6.1.1 Operational and organizational

One of the main barriers is the incompatible infrastructure that results from the fact that most of the existing transport infrastructure has been designed to serve the national rather than the European economy (Golińska & Hajdul, 2012). These historical limitations have resulted in something described as cross-border bottlenecks. Another problem is the lack of comprehensive standards regarding infrastructure design, power supplies, traffic management and data exchange (Golińska & Hajdul, 2012).

In the last decade the application of Cohesion Fund and European Regional Development Fund has helped to develop the Trans-European transport network (TEN-T). However, if a co-modal logistics chain which optimizes the use of the different modes should be created additional investment in the infrastructure is needed.

Another barrier regarding the fulfilment of White Paper goal number eight includes not only the absence of a common EU standard including privacy standards (European Commission, 2011) but also a lack of technical standards (SUPERHUB). The lack of technical standards means that it cannot be implemented on a regional scale let alone on a national and international scale.

Pedersen and Knoors (2012) stress that “integration between IT systems in transport and logistics remains a cumbersome and resource intensive activity” (Pedersen & Knoors, 2012, page 2). They claim moreover that “this is not really facilitated by the existing standards available: There are many standards with many local variations. For SMEs it is practically impossible to really endorse those standards and engage in full digital collaboration” (Pedersen & Knoors, 2012, page 2). According to the European Commission (n.d) there are still countries with their own national standards which limit access and availability of data. Thus, stakeholders who need to exchange data and share processes with each other have to use expensive integration processes to solve this problem (Pedersen & Knoors, 2012).

In the past, national transport was carried out by state-owned national operators. Transport liberalization led to sharp increase in the number of players involved, competing for the same customers, sometimes even with the same infrastructure. According to Schöller-Schwedes (2009) the main barrier which works against a seamless and integrated transport system has been economic competition between different stakeholders. He also stressed that the information has become less integrated rather than more.

Potter (2010) also discussed integration and argued that the problem has less to do with infrastructure provision and that it is more about the lack of integration. For instance, if we want to achieve seamless travel in the real sense, then customers need information of more than one mode of transport and be able to buy a ticket for the whole journey. However, in order to reach that goal different operators need to co-operate and that will only happen if it makes commercial sense (Potter, 2010).

In order to achieve integrated ticketing, across modes and actors, clearance facilities must be set up which implies trust and the speedy and correct distribution of fares among the operators. At the same time it must be ensured that no operators are discriminated or put at a disadvantage in order to ensure participation. Considering the complexity of fare structures by different operators (e.g. distance based, time based and multiple tickets) this remains a challenge to be solved. Customers may also resent an increased monitoring of the trips they take in view of the recent discussions regarding individual privacy. Tools such as smartphones may also raise concerns regarding security of the transactions carried out and already pose problems if the system, e.g. a smartphone, fails and no other transaction records exist to prove fair payment.

6.1.2 Institutional conditions

The main obstacle on an EU level is lack of legislation which means that carriers who provide static and dynamic data have to pay a duty. Another problem is the lack of institutional and financial support for such centres (SPUTNIC; Transport Research Centre, 2013; TRIP, 2013).

To not get hold of data is another very important problem and this includes reliable rail data but also public and private data (Urban ITS Expert Group, 2013). At present it is almost impossible to implement different tools in Europe since the availability of open data is still very limited (SUPERHUB).

Intermodal passenger transport could also profit from improved information and ticketing services. Limited availability of data exchange standards, privacy and security regulations as well as a lack of trust between the different transport operators and providers are still hampering factors. Alternatively, it can be argued that implementation of too strict standards may curb further development in such a dynamic field. At the moment local and regional solutions seem to be more developed than national ones and it will therefore be a challenge to merge them in the future.

6.1.3 Market demand

Multimodal transport information systems should make it easier to use more than one mode of transport. However, some systems on the market are too difficult to use and instead of making the journey easier it could make it more complex. For instance some ticket machines at train stations do not provide enough information or sometimes too much information.

The problem is that the current information systems for multi- or intermodal travelling are still fragmentary, not adapted to travellers' needs and are not always user friendly. This has a negative effect on market demand which in turn can be explained using market theory which claims that it is dangerous to advertise a product to be of a high standard which then does not live up to customer expectations.

Moreover, the market is growing very quickly and it could therefore be difficult for the customer to be familiar with all the different applications on the market. This is also something which can affect the introduction of transportation management applications (Marchet et al., 2009; Pokharel, 2005). Another

barrier is that small or medium sized companies cannot afford to buy and maintain appropriate solutions compared to larger enterprises.

6.2 Conclusion

It could therefore be concluded that despite various efforts to improve the ICT systems it is still far from achieving the goal of establishing a framework for a European multimodal transport information, management and payment system. The incompatible infrastructure is one important barrier which prevents integration. Another problem is that many different actors are involved who have different requirements. On a European level the lack of legislation is a barrier and that those who provide data have to pay a duty, which of course could be regarded as a disincentive. Access to data is a very important problem because without important data different stakeholders cannot get the information they need. At the same time, privacy and safety issues must be considered. However, the more fragmented the solutions become the more difficult it will be to integrate them in the future to ensure public acceptance. In the end it is necessary also to include the users and their concerns in the development of new systems. On the one hand there is still a generation gap between what is perceived as useful and acceptable. At the same time it must be ensured that certain customer groups are not left out or put at a great disadvantage because they have difficulties in using the new integrated solutions.

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