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To develop and validate a European passenger transport information and booking system across transport modes

FINAL REPORT

June 17th 2014

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Executive Summary

Highlights

The establishment of a well-functioning marketplace for MultiModal Information and Ticketing Systems (MMITS) will significantly contribute to achieving the ambitions of the *White Paper on Transport.* Comprehensive and unbiased MMITS that provide location-independent search, booking, payment, and trip entitlement issuance, are highly likely to be attractive for users, in turn providing an attractive marketing and sales channels for travel providers.

The modal shift facilitated by MMITS will lead to further, positive effects, with estimated costs savings of around 13 billion EUR per annum, and allow investing in infrastructure and capacity, thus further increasing efficiency. Especially public transport can benefit from joining MMITS by creating and making available completely new travel options to existing and new users.

There are no technical show-stoppers to achieving interoperability between travel provider systems through an architecture that enables MMITS solutions, although, clearly, there are specific technological challenges.

The key drivers of MMITS are:

- Industry collaboration through initiatives such as FSM and Shift2Rail IP4
- Further deregulation of the rail sector in the EU
- EU intervention to support industry initiatives and innovation programmes like Shift2Rail
- EU regulations to ensure non-discriminatory access to travel information
- Clarification of multimodal conditions of carriage and passenger rights in a multimodal journey
- Improvement of the physical connectivity and infrastructure to facilitate connections and transfers between transport modes, increasing the number of available and attractive travel options
- Availability and development of technologies that enable the establishment of MMITS solutions with reasonable investment levels, including new search and mobile internet technologies.

Recommendations to the European Commission:

- *Increase support for industry initiatives, while in parallel establish a credible regulatory alternative should the market fail to deliver desired results*
- *Ensure that access to schedule, fares and availability information is available to all players in the market for multimodal travelling on a non-discriminatory basis, based on agreements that govern access to and use of information that can be deemed sensitive*
- Any regulatory intervention must distinguish between carriers subject to free competition and public transport operators working under public service contracts (PSO). Carriers in free competition should under normal circumstances e.g. not be subject to mandatory third party retailing.
- There should be no EC regulation regarding a specific technological solution for non-discriminatory information provision
- Passenger rights and conditions of carriage have to be defined for multimodal trips
- Clear interfaces have to be defined and a regulatory framework has to be set to stimulate local public transport operators' participation in MMITS without disadvantages.
- The competitive behaviour of transport operators participating in and/or controlling a MMITS has to be supervised strictly, and the introduction of a "code of conduct " should be considered.

Background

The *All Ways Travelling* consortium (AWT), led by Amadeus, has delivered Phase 1 (the study part) of the project pursuant to the tender. The consortium comprises Thales Group, IATA, BeneRail, UNIFE, Zeppelin University, and Amadeus. The project established an Advisory Panel at the outset of the study, which was open to participation by all interested stakeholder associations, and included CER, ECTAA, EPF, inter alia. The Advisory Panel met three times during the project, in addition to stakeholder meetings held by DG MOVE. All stakeholders were invited to provide inputs to the study in the form of statistics and other information, and this has been taken into consideration by the consortium to the extent it has been possible to integrate, given the time and resource constraints of the project.

The study part has been managed by Zeppelin University, to ensure that the considerations and recommendations are balanced, unbiased, and subject to required methodological integrity. As such, the study does not represent the views or wants of any single consortium member, but that of a cross-industry consortium including a leading European academic institution.

Following a methodological approach, the study has considered the factors affecting the potential of Multimodal Information and Ticketing Systems (MMITS) in the EU. Certain limitations of scope were inherent in the tender, while certain other factors have remained out of scope for obvious reasons. The developments related to the 4th Railway Package have therefore not been included in the report.

1. Contributing to the Seamless Transport System

Under ideal circumstances, a passenger should be able to plan and book a trip across Europe using different transport modes as easily as making a common domestic journey using only one transport mode. One-click search, one-click booking, and one-click payment and travel entitlement issuance. To reach this goal, at least three problems have to be solved:

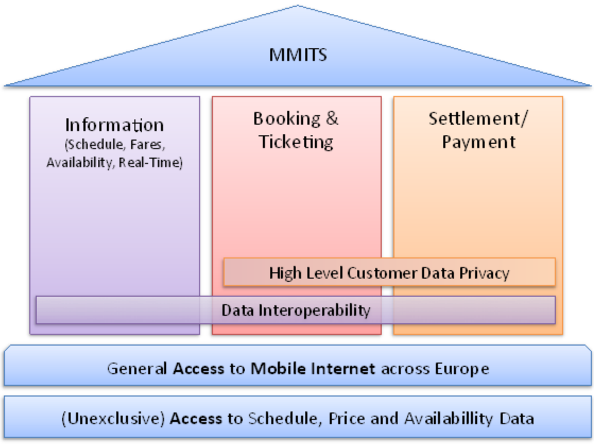
Firstly, a transport information system has to be developed on a European basis that provides accurate data for trips throughout Europe, combining up-to-date information from each relevant transport mode source. This implies the integration of schedule, availability and fare information for air, rail, ferry, long distance bus and manifold local transport services covering 'first, last and middle mile'. Such a trip or journey planner should also provide information on passenger rights and entitlements, facilities for passengers with reduced mobility, and other transport service attributes (e.g. carbon footprint of the trip, door-to-door travel time) in order to allow neutral comparison, in terms relevant to each customer, of the attractiveness of the transport modes available for the journey.

Secondly, the customer should additionally have easy (one-stop-shop) access to online booking, payment and ticketing services, allowing for the conversion of such journey plans into purchased trip entitlements, including additional assistance in the case of delay or interruption of travel services (on-trip information, advice and re-accommodation).

Thirdly, physical integration and connectivity between transport modes must be improved to facilitate passenger flows and establishment of "seamless" journey combinations. This includes capacity optimisation between modes, and particularly increasing rail capacity to accommodate and stimulate modal shifts. This dimension is outside of the scope of the project, and is therefore not addressed in depth in the study.

2. The Pillars of MultiModal Information and Ticketing

An MMITS marketplace rests on the three pillars of Information, Booking & ticketing, and Payment/settlement. To be attractive and widely accessible, MMITS solutions rely on the availability of mobile internet access throughout the EU, and on the quality and comprehensiveness of the information and functionality offered to its users. Non-discriminatory access to transport options, schedule, prices, and availability is therefore a fundamental prerequisite for MMITS, as is the interoperability of information across transport modes

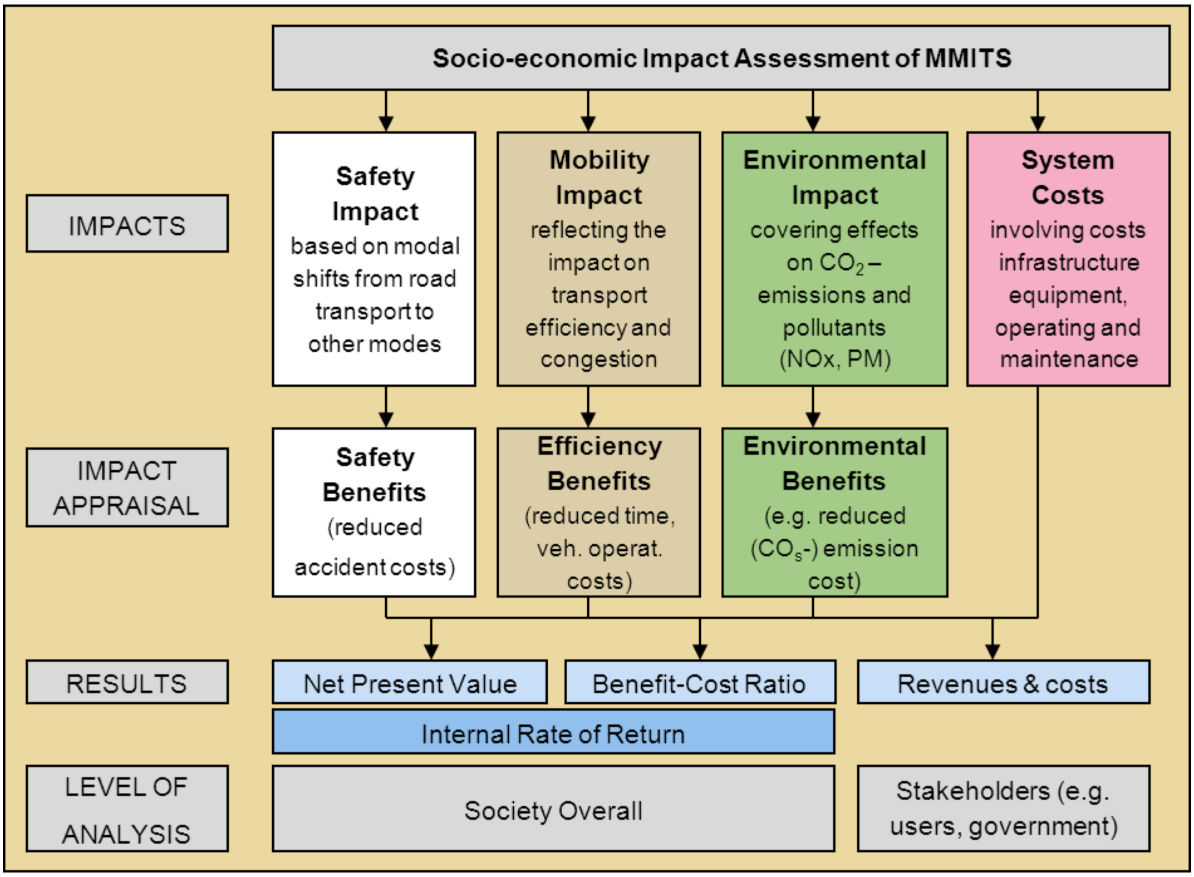


3. The Socio-Economic Impact

It seems obvious that modal shifts supported by widely available and comprehensive MMITS, will have significant socio-economic benefits over time, and thereby improve the quality of life for European citizens. The demonstrators in Phase 2 of the project should add further insights into and knowledge about the impact of multimodal travel.

In general, the market study shows that there is a lack of empirical data on the modal composition of today's multimodal journeys which would be needed to perform a comprehensive cost-benefit analysis and impact assessment. The lack of harmonisation of data across the EU, and the different methodologies employed by member states, hinders a thorough socio-economic impact

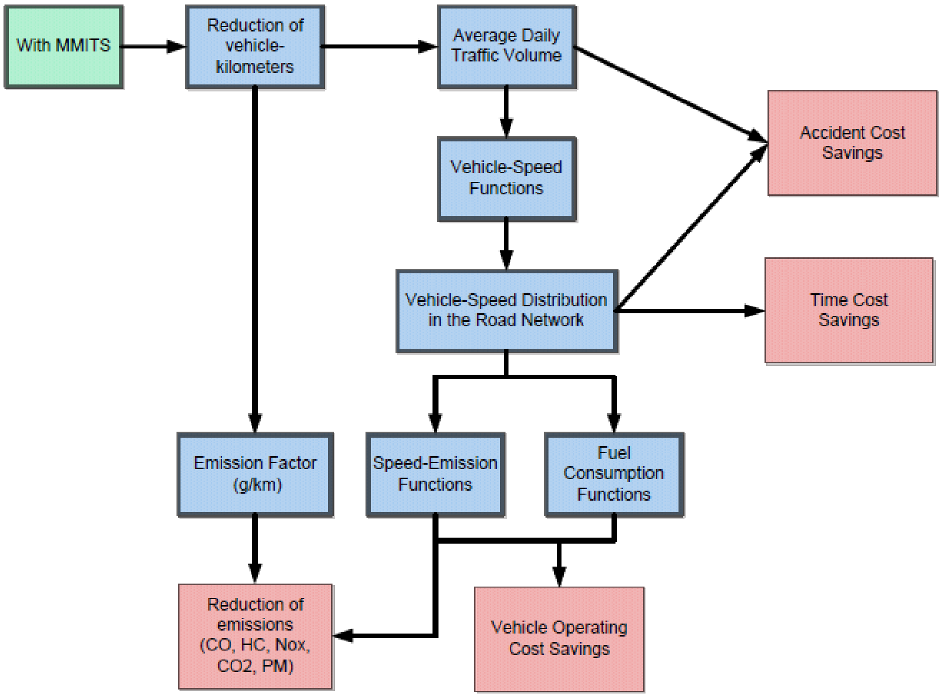
assessment at this stage. The study has been able to identify environmental benefits of between 650 and 2,834 million Euros per annum driven by modal shift to more environmentally friendly modes, based upon the customer surveys that were undertaken as part of the study.



While the data required to perform an accurate study of other benefits are not available, we can make an approximation of the benefits from modal shift on time cost, accident costs, and vehicle operations costs savings, and although this estimate is "speculative" at best, it provides an indication of the potential benefits of modal shift. If we apply the same assumptions in these areas, the additional benefits/costs savings from a 5% modal shift are:

- 10,091 million EUR time cost savings per year,
- 456 million EUR accident cost savings per year,
- 2,018 million EUR vehicle operating cost savings per year.

The total benefits under this structure would be 13.22 billion EUR per year. At this time, we must emphasise, the evaluation can only be indicative of the true potential effects of a seamless transport system in Europe.



Although hard to quantify at present, it is clear that a well-functioning MMITS market, and based on the recommendations made in this report, will have further positive impacts:

- Stimulating demand for multimodal travel options
- Increasing accessibility to and use of metropolitan public transport systems
- Opening business opportunities for SMEs and new entrants into the MMITS market
- Fostering technological innovations
- Accelerating the development of solutions for interconnectivity between transport modes, e.g. at airports and railway stations
- Increasing attention to and requirements for selecting more environment-friendly journey options
- Improving accessibility to transport information and transport options for citizens with reduced mobility or other disabilities
- Stimulating fair competition between MMITS providers and between transport providers due to the improved and unbiased access to information

With the continued growth of travel volumes, MMITS may, additionally, ensure that increased travel volumes are managed more efficiently, by ensuring improved capacity utilization across transport modes.

4. Conclusions and Recommendations

Based on the analysis of all available materials, we are nevertheless able to make a number of concrete recommendations to the European Commission as requested in the tender. One of these is that there is a need for further analysis and gathering of empirical evidence to fully understand today's multimodal travel behaviour. The available evidence today tends only to mirror the individualistic nature of the different transport mode markets, so that we can know how many people take a plane, or a train, or use public transport, but we don't have evidence on the extent to which an airline passenger also took a train to their final destination, or also took a metro or a taxi to get to his or her final destination. Equally, we have no evidence on the motivations for the choice of such multimodal travel patterns.

If multimodal travel patterns are understood, along with the motivations of travelers making those choices, this would add a significant ingredient into refining estimates of the potential of shifts to more environmentally-friendly modes of transport, enabled by a MMITS. This in turn would feed the cost-benefit analysis with more reliable source data.

The EC's Horizon2020 work program appears to offer an opportunity to undertake EU-wide research into actual air traveller's multimodal behaviour and accompanying motivation (e.g. H2020 Mobility for Growth open call MG1.7), and such an exercise should probably be equally extended to rail travellers. Such efforts could provide some of the empirical data on which further and more precise assessments can be made.

While quantifying all the positive effects of a truly seamless transport system in Europe is difficult, it is obvious that such benefits, to the environment, with regard to traffic congestion, and for mobility, are significant and should be pursued.

To realise this potential and reach the political ambitions of the White Paper on Transport, the report makes the following recommendations:

- *Increase support for industry initiatives, while in parallel establish a credible regulatory alternative should the market fail to deliver desired results*

  There are several, collaborative industry initiatives currently underway that aim to provide MMITS solutions, technical standards, and other required elements to support EU ambitions regarding seamless and multimodal passenger transport, many of which are supported by the *European*

Commission. With the momentum and progress we see in initiatives like Shift2Rail and FSM (Full Service Model), it would seem wise for the European Commission to maintain or increase support for these initiatives, while preparing regulatory initiatives that may be required should results of industry collaboration fall short of expectations.

- *Non-discriminatory information provision containing schedule, fares and availability has to be guaranteed to all players in the market for multimodal travelling.*

  Schedule information has to be made accessible for MMITS providers in a suitable format, e.g. as raw data, whereas price and availability information are recommended to be provided on request, e.g. via an API, subject to terms and conditions for use. This arrangement allows taking into account the concerns of players not to provide business sensitive data. At the moment, the market does not sufficiently fulfil this requirement. Therefore, and as mentioned above, in addition to the on-going policy measures, a credible regulatory alternative has to be established by the European Commission by preparing corresponding regulatory initiatives that can be implemented if the market fails to provide a sufficient solution.

- *EC intervention has to distinguish between commercial carriers and public transport operators working under public service contracts (PSO).*

  Whereas information provision is a necessary prerequisite for a MMITS addressing all transport operators, commercial carriers should not be forced by EC intervention to make use of MMITS as a distribution channel for their tickets. Such an obligation seems to be an inappropriate restriction of their commercial freedom. Public transport operators, however, including local public transport, could be obliged to enable third party providers to sell their tickets through a MMITS as part of their publicly funded service obligations.

- *There should be no EC regulation regarding a specific technological solution for non-discriminatory information provision.*

  Possible technological solutions must be developed by the market players on their own, always taking into account that the above mentioned prerequisites, such as information provision, are met.

- *Multimodal, pan-European passenger rights have to be defined.*

  It is important that passenger rights and conditions of carriage are described transparently within MMITS. The terms and conditions of carriage must provide a clear definition of the re-accommodation process, assuring travellers that they are not charged with higher prices if they have to be re-accommodated in case of delays or other incidents during their journey. Liabilities on multimodal travel products need to be clearly defined. To offer incentives to the market for the provision of an adequate solution for the passenger rights problem, the European Commission has to establish a credible regulatory alternative by preparing a legislative action to develop a system of multimodal, pan-European passenger rights within the next years, in the case the market fails to provide a satisfying solution.

- *Clear interfaces have to be defined and a regulatory framework has to be set to stimulate local public transport operators' participation in MMITS without disadvantages.*

  Local public transport operators mostly provide services under public service obligations contracts (PSO) with local transport authorities. Furthermore, most public transport companies are publicly owned. Under these special circumstances it should be reasonable to require them to join the MMITS ecosystem and to give access to the necessary information. To avoid possible disadvantages, LPT should be compensated to a certain extent for visible standardisation efforts.

- *The competitive behaviour of transport operators participating in a MMITS has to be supervised strictly.*

  It is essential to protect the market against bias, collusion, or monopolisation within the MMITS market that could lead to welfare losses for customers. This should be done by strengthening the oversight of this market by the EU Commission, with regard to competition. The Commission needs to consider establishing a "Code of Conduct" to regulate market behaviour, or expanding the scope of the current CRS Code of Conduct.

5. Customer Needs/Demand Side

Websites of carriers and general search engines are today the most important sources for trip planning information, and 90% of respondents in the survey use internet for search, shopping, and/or booking. Mobile devices are gaining in importance, offering additional services and comfort during the trip (e.g. related to disruption management). Given that we know that at least 35% of trips in Europe are already made using several modes of transport, it seems obvious that further streamlining of information and booking possibilities for European consumers will enhance the total customer experience, and remove the current seamlessness and complexity that impairs consumer choice. The study confirms the criteria for modal choice found in literature:

- Availability/accessibility
- Travel time budget
- Price
- Reliability
- Comfort
- Flexibility
- Ecological awareness

Ecology, not surprisingly, is ranked rather low as a criterion for modal choice, while the availability of comprehensive information is ranked high. The study furthermore confirms the importance of restructuring networks and interchanges, improving information, offering single tickets and making luggage handling easier to facilitate multimodal travelling.

While further research and data are required in order to provide additional insights into segmentation of the multimodal travel market's demand side, current developments, like the proliferation of online and mobile information services in the market place for travel and transport, confirm the potential attractiveness of MMITS. Looking at the explosive development in the use of internet based search and shopping solutions in the travel industry, spurred by the rapid move toward mobile devices on 4G, it seems highly plausible that a comprehensive MMITS will be rapidly adopted by users.

We conclude that an MMITS that provides comprehensive information will meet the demands of passengers and thereby facilitate multimodal travelling. In our survey, the evaluation of the MMITS is positive, but the willingness to pay for a MMITS is very limited, as can be expected.

Our study identifies several viable business model options available for MMITS market actors, including two-sided models where usage is free or even incentivised for the consumer/user. We consider, therefore that an unwillingness to pay by the consumer is not a significant obstacle for the adoption of MMITS usage.

6. Legal Barriers and Limitations

The most important precondition for a properly functioning MMITS market is that each market actor has access to all relevant information, at least price and timetable. Neutral and comprehensive information is required to meet the increasing demands of the consumer. This allows finding connections by using all possible combinations. It is essential that all

MMITS market actors can use this information to offer optimised connections to their customers.

Regulation may be necessary to ensure the access to timetable and price information in a non-discriminatory manner. Regulations for mandatory data provision have been used in the airline industry to stimulate competition as a part of liberalising a market, even mandating non-discriminatory third party retailing for airlines that control a CRS, similar to the mandatory participation prescribed in the EU Regulation 80/2009 (CRS Code of Conduct) for “Parent Carriers”, to avoid bias and to ensure fair competition.

The retailing process, however, is not necessarily connected to information provision. Retailing requires a contract between the carrier and the seller, e.g. to settle payments and to manage commercial risk.

Key Findings

The following measures are required in order to realise multimodal transport which goes beyond the scope of single offers:

- Uniform, multimodal passenger rights regulations, strengthening transparency requirements and carrier obligations
- Regulation may be required to ensure that charges for information provision, access to data, or participation in an MMITS are reasonable and non-discriminatory
- An obligation of all transport companies to ensure non-discriminatory provision of their connection and price data to everyone,
- Increased oversight of competition is required to prevent route monopolisation or bias of MMITS information

7. Information Provision/Access to Data

Comprehensive information is essential for the success of MMITS in the EU, and a common ecosystem might offer the best solution to making information interchangeable. This can be realised via a number of platforms, accessing to multilateral MMITS interfaces as an extension of each transport operator’s existing web services.

The provision of information needs to address concerns of accuracy and commercial sensitivity, especially for commercial operators. This requires solutions that do not only rely on static data but also on API-based requests, at least for pricing and availability. The access to data must be subject to terms and conditions of use in order to avoid any undesirable exploitation by the participants in the ecosystem.

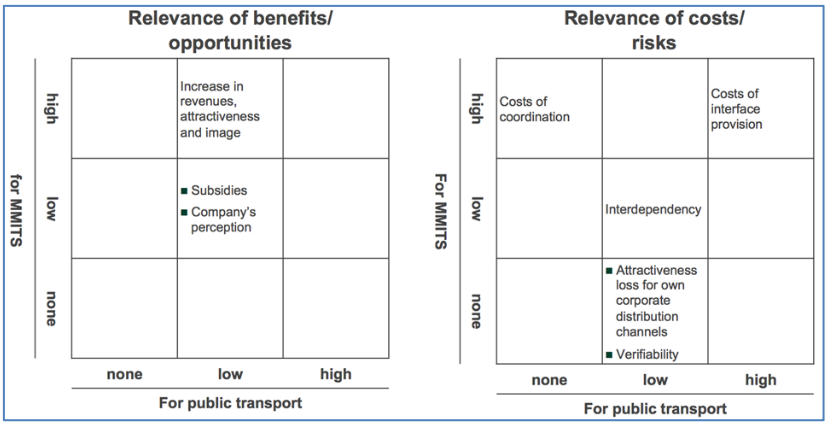
While a MMITS is intended to be a single contact point for booking door-to-door journeys, carriers should not necessarily be obliged to accept any MMITS-provider as retail agents, because retail is based on bilateral contracts. Nevertheless, all relevant European transport operators will have to share their information with other players in the market in order to for an MMITS marketplace to work.

Key Findings

- Three kinds of information have to be availability for planning a journey via MMITS: Schedules, fares, and availability. Furthermore, real time information is necessary during the journey.
- Comprehensive and unbiased information is necessary for MMITS to be attractive
- Information provision is only feasible for commercial carriers if no sensitive data is published. Therefore, schedule information may be published as raw data while dynamic information, like yield-managed pricing, may be accessed via API access.
- Information provision and distribution (selling tickets through intermediaries) are very different, and should be regarded separately.

8. Local Public Transport

It is evident that MMITS services, enabling location-independent search, booking and ticketing across modes, is very attractive for large metropolitan areas and their transport authorities. The incentives may not be as obvious to the transport operators themselves, operating under contracts that oftentimes leaves little room for technology development or investments for future and uncertain needs. It is therefore likely that public transport operators may require financial incentives to undertake development or integration into an EU-wide MMITS architecture as part of their PSO obligations. From a European perspective, the fact that more than 1,000 public transport organisations or authorities will have to be involved in making a pan-European solution a reality, adds complexity. And even if the number is decreasing due to increased collaboration (e.g. through associations), the sheer magnitude and fragmented nature of the public transport sector is a significant challenge.



In order to achieve modal shift, the integration of local public transport in the MMITS is a critical factor. While the revenue from additional passengers using public transport (as a consequence of access to MMITS) may be small in comparison with the total number, the numbers may still be very significant, also for airlines and railways, who may be able to commercially exploit the additional feed potential of public transport. As the time and cost share of local private car use as part of any medium- to long-distance railway or airline journey is increasing due to traffic congestion, parking and road charges, comprehensive and real-time access to public transport information in an MMITS is likely to increase not only the visibility of, but also the attractiveness of, public transport.

For public transport companies the following benefits of MMITS seem to be relevant:

- Increased visibility and broader marketing opportunities for their services
- Improvement in customer satisfaction through the provision of real-time information and in advance booking facilities (→ passengers save time, as no information gathering and ticket purchasing is required at the station)
- An incremental volume of new customers will be acquired which could possibly lead to attractive multiplier effects (→ international travellers) Perhaps there will be extra travellers when airline feeders are replaced by rail.
- Acquisition of new customers (e.g. business travellers) with a higher average revenue than regular customers, due to single tickets and day passes being purchased (in contrast to season passes)
- Improvement of the company's or city's image through the participation in innovative information and communication channels

The attraction of new (international) passengers and the improvement of the transport operator's perception as a leader in innovation are linked to an increased attractiveness of cities because of the integration in a MMITS. Therefore, local public transport authorities should have an interest in providing incentives to public transport operators to participate in a MMITS.

9. Technology

There are no insurmountable barriers seen from the purely technical perspective, but certain key technology challenges will require high levels of industry collaboration if they are to be successfully overcome.

Key defining characteristics of a future MMITS marketplace are:

- Pan European, multi-modal/operator travel solutions will be purchasable in several, comprehensive and unbiased MMITS
- MMITS will enable retail of several options:
  - multiple but concatenated travel service products - (*co-modal*) transport contracts
  - Single, integrated, travel service products under a single transport contract, based upon prior commercial agreements between multimodal passenger carriers (*inter-modal*)
  - A mix of the above
- An increase in the importance of indirect distribution channels and the supply chain 'distribution' and 'retailing' roles (regardless of the nature of the entities performing them)

Provided that the prerequisite information provision and data access environment is established, there remain generic technology challenges (i.e. relevant to all MMITS travel solution retailing), which must be addressed:

- Lack of interoperability between, and within, different transport sectors
- The need to upgrade search technology, whether 'centralised', 'distributed', or, 'mixed'
- The ability of resulting MMITS technology to successfully integrate with and enable other key trends within travel distribution (e.g. IATA NDC within the air sector and parallel trends within Rail)

Whilst the generic search technology challenges probably will be met by technological innovation and brokered by market-place dynamics, interoperability barriers and integration with other, new distribution technologies will be largely dependent on collaboration between the relevant industry stakeholders:

- With respect to 'interoperability', standardisation is increasing at transport sector levels based upon collaboration of key sector players (e.g. FSM in the Rail sector, and Smart Ticketing Alliance covering European Public Transport), but not yet so much at cross-sector levels.
- In this context, third party interoperability services (e.g. as proposed in Shift2Rail IP4) should emerge to bridge at least the gaps in standardisation between the different transport sectors, but, again, must be based upon transversal collaboration of the key transport sector industry associations if such services are to be sustained and evolve to support the MMITS marketplace in the future.
- The integration of MMITS technology with other emerging distribution technologies is, once again, primarily a challenge based upon pre-requisite cross-sector collaboration.

There remain technology challenges which are specific to the type of MMITS retailing:

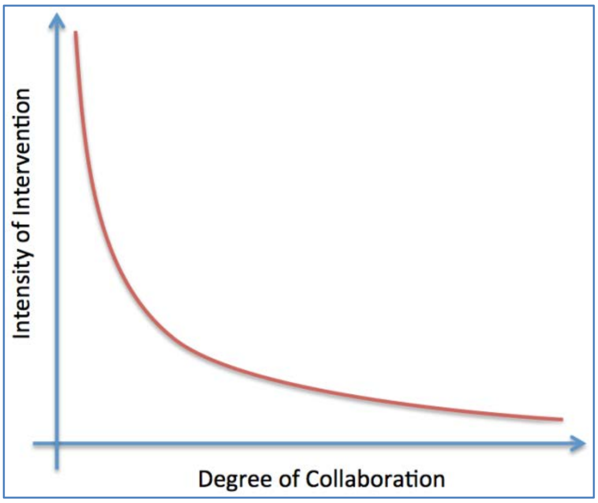
- *Co-modal* retailing will succeed if technology innovation is able to eliminate, or at least significantly reduce, the element of perceived risk inherent in purchasing several travel products under different transport contracts for one trip
- *Inter-modal* retailing requires collaboration between the Transport Sectors to agree a common architecture which facilitates the intermodal exchange of individual travel entitlements information, and their 'in-journey' consumption, in order to support the single transport contract feature of the intermodal sale. Such an architecture would need to be interoperable/compatible with the current, global interline e-ticketing architecture (IATA).

The overall finding with regards to the technology challenges is that the European Commission can play a pro-active and facilitating role to promote the levels of collaboration within and across sectors, where this is pre-requisite for the appropriate technology to emerge.

10. Industry Collaboration and/or Regulatory Intervention?

If industry stakeholders, on a voluntary basis, develop their market solutions in line with political objectives and the rule of law, no additional governmental intervention is required. As such, industry collaboration can effectively (and positively) pre-empt further regulatory intervention. When collaboration is faced with barriers or limitations, government may incentivise and support and/or regulate or force industry stakeholders to achieve political objectives or ambitions. The need for regulatory intervention, therefore, is inversely proportional to the degree of constructive industry collaboration. With regard to MMITS, the

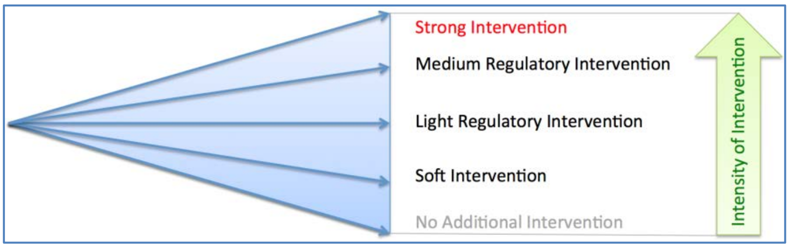
European Commission needs to consider, on a regular basis, how current industry collaboration is in fact delivering on political objectives, and whether or not incentives and/or force have to be applied to ensure that stakeholder behaviour moves in the right direction.



At the start of 2014, industry stakeholders across transport modes have joined forces to drive forward initiatives like the *Full Service Model* (FSM) and *Shift2Rail*, that holds the promise of realising the multimodal solutions that is required by EU policy as described in the White Paper. These and other, related initiatives should be further supported and incentivised by the European Commission.

11. Scenarios

Given the relationship between industry collaboration and the need for regulatory intervention, whether in the form of incentives or in the form of regulations, the study identifies four high-level scenarios for consideration, as described in this illustration. Intervention by the EC might compensate for the lack of or ineffectiveness of industry collaboration, in particular among competitors in the market. While the intensity of intervention can never be put back to zero, it can be minimised if the degree and effectiveness in political terms of collaboration increases.



This is particularly true for the implementation of MMITSs on a large scale.

As a basis for further elaboration and consideration, we have described the four scenarios:

Scenarios	Intensity of Intervention / Regulation
No Additional Intervention (Lower Baseline Scenario)	No additional intervention/regulation necessary. Current regulations are successfully applied and no further regulations by the EC are necessary as the players decide to set up rules on the implementation of a MMITS on their own. Research and development funding continues. FSM and Shift2Rail are implemented successfully. LPT and PSO operators receive compensation for standardisation efforts.
Soft Intervention	Establishment of "European Passenger Transport Guidelines". These guidelines give a voluntary framework to all European transport operators on the implementation of a MMITS. There are recommendations on topics such as information provision, re-accommodation and multimodal passenger rights. The EC and the European transport operators develop the guidelines in a collaborative way.
Light Regulatory Intervention	Establishment of European passenger rights in order to guarantee that travellers can proceed their multimodal journey without additional costs for re-accommodation in case of missing connections. This regulation does not only include rights of passengers but also obligations of carriers, e.g., by defining rules to set fees for multimodal re-accommodation.
Medium Regulatory Intervention	Obligation to provide information for all transport operators. Based on the "European Passenger Transport Guidelines", the EC sets an obligation on carriers regarding aspects such as information provision and booking interfaces for multimodal travelling. In addition, LPT operators have to accept MMITSs as distribution channels.
Strong Intervention (Upper Baseline Scenario)	Obligation on carriers to offer multimodal journey planning across Europe to all travellers. Players in the market are forced to participate in MMITS on a non-discriminatory basis, to facilitate multimodal travelling across Europe.

The status quo fits into the Soft Intervention scenario. If soft policy measures do not prove to be successful within the next two or three years, a regulatory process would have to start in 2017 to come into effect by the end of the decade. Such measures would include an obligation on all transport operators (commercial carriers and PSO) to offer non-discriminatory information, and a multimodal passenger rights regime. In addition, transport operators offering public services should be obliged to enable third party providers to sell their tickets.

This approach suggested to the European Commission is consistent with the general European transport policy as laid down in the White paper on transport policy from 2011 ("*By 2020, establish the framework for a European multimodal transport information, management and payment system*"). It also appears to be consistent with the European Parliament's view on the 4th Railway Package regarding integrated ticketing.

Setting incentives for the development of a MMITS can also be assessed as an essential part of the European ITS strategy according to the ITS Directive of July 2010, intended to accelerate the deployment of ITS across Europe. Its time horizon covers seven years with the aim to address interoperable and seamless ITS services.

12. Concluding Remarks

A key recommendation of the report is that very specific research is undertaken on current multimodal travel behaviour patterns and accompanying traveller motivations, in order to provide further insight into the potential and barriers of multimodality in general, and the impact of a well-functioning MMITS market to support it. The Phase 2 “proof of concept” will be part of this, and key to demonstrating the possibilities and benefits of multimodality. While acknowledging the imperfections inherent in the study, we are nevertheless confident that the analysis is robust, and that the recommendations made are reasonable and will be effective in terms of realising the White Paper ambitions for a seamless transport system in Europe.

Assuming that seamless travel is fostered by multimodal information and integrated ticketing, it becomes clear that these aspects play a crucial role when making transport more efficient, clean and safe. In consequence, the European Commission started fostering research on multimodal journey planning and booking as these systems are thought to facilitate seamless door-to-door travelling. If comfortable door-to-door travel becomes possible and the travellers are able to compare several mode options (and combinations) according their preferences (e.g. price), and the associated physical infrastructure and capacity adjustments are made, the increased use of public transport will reduce congestion and make the European transport system more efficient and sustainable, and eventually seamless.

Final Report:

"All Ways Travelling"

Zeppelin University
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Abbreviations

AO	Airline Operator
API	Application Programming Interface
BCBP	Bar Coded Boarding Passes
BCR	Benefit-Cost Ratio
BSP	Billing and Settlement Plan
BSP	Billing and Settlement Plan
	Booking
B2B	Business-to-Business
B2C	Business-to-Customer
CBA	Cost-Benefit Analysis
CPL	Cash per Lead
CRS	Computer Reservations System
CIV	Contract of International Carriage of Passengers and Luggage by Rail
EC	European Commission
FSM	Full Service Modell
GTFS	General Transit Feed Specification
GDS	Global Distribution System
HVV	Hamburg transport association
HICP	Harmonized Index of Consumer Prices
HKC	Hicks-Kaldor Criterion
ICT	Information and Communication Technology
IDC	International Data Corporation
LPT	Local Public Transport Operator
MUI	Marginal Utility of Income
MS	Modal Shift
MMITS	Multi Modal Information and Ticketing System
MERITS	Multiple European Railways Integrated Timetable Storage
NDC	New Distribution Capability
OR	Occupancy rate
OTA	Online Travel Agency
Paris-CDG	Paris-Charles de Gaulle
PM	Particle-emissions
pkm	Passenger Kilometres
PAYG	Pay as you go

PSO	Public Service Obligations
RO	Rail Operator
RPK	Revenue passenger kilometres
Sw-P.	Software Provider
TA	Travel Agency
TAP-TSI	Telematics Applications for Passenger Services - Technical Specifications for Interoperability
TIES	Ticketing Information Exchange Standard (TIES)
TGV	Train à Grande Vitesse
MSE	(Travel) Meta Search Engine
VKM	Vehicle kilometres
WP	Work Package

1 Overall Approach of the Study

Chapter 1 describes the overall approach of the study. It starts by explaining the ideas of the European Commission and the role of multimodal journey planning and booking within the European Transport Policy as general background. In the second section, we discuss the potential policy options of the European Commission with respect to the development of the market for multimodal planning and booking services. The third part of this chapter summarizes the objectives of our study according to the specifications of DG MOVE. Chapter 1 is completed by a discussion of the terminology used in this study.

1.1 General Background

The European Commission is pursuing the vision of seamless transport both in passenger and in goods transport markets. For passengers, seamless transport across modes and across countries will better meet their mobility needs by ensuring a wider choice of transport services. Seamless transport will also allow European citizens to make better use of the existing infrastructure when travelling. Finally, seamless transport may lead to a shift to more environmentally friendly modes of transport (modal shift) and may help to reduce congestion and environmental damage caused by current transport services utilisation.

The idea of seamless passenger transport in the EU is strongly connected with easy access to multimodal door-to-door travel on a pan-European level. Multimodal travel relies heavily on accurate, reliable and comprehensive transport service information. Under ideal circumstances, a passenger should be able to plan and book a trip across Europe using different transport modes as easily as making a common domestic journey using only one transport mode. To reach this goal, at least two problems have to be solved:

- Firstly, a transport information system has to be developed on a European basis that provides real-time information for trips throughout Europe, combining up-to-date data from each relevant transport mode source. This implies the integration of schedule, availability and fare information for air, rail, ferry, long distance bus and manifold local transport services covering 'first, last and middle mile'. Such a trip or journey planner should also provide information on passenger rights and entitlements, facilities for passengers with reduced mobility, and other transport service attributes (e.g. carbon footprint of the trip, door-to-door travel time) in order to allow a comparison, in terms relevant to each customer, of the attractiveness of the transport modes available for the journey.

- Secondly, the customer should additionally have easy (one-stop-shop) access to online booking, payment and ticketing services, allowing for the conversion of such journey plans into purchased trip entitlements, including additional assistance in the case of delay or interruption of travel services (on-trip information, advice and re-accommodation).

- Thirdly, physical integration and connectivity between transport modes must be improved to facilitate passenger flows and establishment of "seamless" journey combinations. This includes capacity optimisation between modes, and particularly increasing rail capacity to accommodate and stimulate modal shift. **This dimension is outside of the scope of the project, and is therefore not addressed in depth in this report.**

To meet the requirements for integrated information and ticketing capabilities, we need to conceptualise an idea of the institutional framework and the cooperation between the different transport service providers by providing clear definitions of responsibilities, obligations and liabilities covering the connectivity between their services. Companies offering travel and travel management services need incentives in order to improve the coordination of the schedules of different modes. If the goal is a better multimodal product for the passenger, the different players in the industry have to cooperate more intensively.

Against this background, DG MOVE has been seeking external expertise "to develop and validate an European passenger transport information and booking interface across transport modes". In the past, this subject has been addressed by the European Commission in several studies and legal acts elaborating on the desirable attributes and certain issues of a multimodal travel system and their consequent benefits for the traveller:

- The Commission Regulation (EU) No. 454/2011 from 5 May 2011 and the Directive 2010/40/EU from 7 July 2010 provided technical specifications on the interoperability of 'telematics applications for passenger services' and delivered a framework for the deployment of Intelligent Transport Systems.
- In addition, a study on the topic of Public Smartcards (TREN/A4/124-2/2009) and the study "Towards a European Multimodal Journey Planner" (published in 2011) were made public.

- The 1st Smart Mobility Challenge supported these actions for multimodal journey planners. The challenge addressed one very crucial question: 'Why can't I yet plan or book my journey through Europe — switching from air to rail or sea, to urban or road transport — in one single go and online?'
  (cf. http://ec.europa.eu/transport/its/multimodal-planners/index_en.htm)
- The adoption of the requirements and specifications set out in the ITS Directive 2010/40/EU5 in support of EU-wide multimodal travel information services. (to be adopted from 2014/2015)
- Generally, the White Paper on transport policy from 2011 defines a framework for a single, interconnected and efficient transport system across Europe. According to the White Paper, the multimodal travel system will be a core element of future sustainable passenger transport.

After an invitation to tender, the consortium "All Ways Travelling" (AWT) was selected to advise the European Commission on this topic via a service contract that consists of two stages. The first delivery is this study on the framework conditions for an *European passenger transport information and booking interface across transport modes*, hereafter referred to as MMITS, which delivers insights into the prerequisites for the possible future development of information and booking systems, and present a set of recommendations for future action of the European Commission. In a Phase 2, subject to confirmation by DG MOVE, the AWT Consortium will develop a Proof of Concept that should reflect the findings of the study in Phase 1.

According to the task specification of the tender, the project has in Phase 1addressed the following main tasks:

- An analysis of the current traveller information and ticketing services markets that can provide insights in the market structure and the different business models. The analysis should also identify the key drivers and barriers that have influence on the current trends and the future development.
- The description of high-level scenarios for the development of pan-European traveller information and ticketing services.
- A consideration of value added services that may improve the economic feasibility of multimodal ticketing services and offer comparative environmental footprint indicators or additional information regarding passenger rights and obligations.

As an integral part of the AWT Consortium, Zeppelin University has undertaken the task of managing and writing the report.

This study (Phase 1 of the project) addresses the abovementioned tasks. Pursuant to the request of the European Commission, the study goes beyond the purely technological aspects of the topic, and also covers the market and customer perspective in particular. Therefore, questions of customer needs and requirements and the segmentation of customers play an important role. Furthermore, the question of whether such information and ticketing systems can be commercially driven as a business case has been considered and, if commercial viability is unlikely, what can be done to enable their emergence.

The study provides an overview of major potential future business models for the service. The business models analysis will help to validate or to adjust the scope and objectives of the Proofs of Concept, and especially to choose the relevant options proposed by our consortium. Additionally, the study has to address governance and legal aspects concerning the regulation of new services and problems of intellectual property rights and consumer protection.

1.2 Policy Options

DG MOVE is seeking external expertise to develop policies dealing with the future development of pan-European multimodal passenger transport information and booking services. As mentioned above, this is part of a broader policy framework to ensure seamless passenger mobility in Europe. It is also based on the ITS Action Plan, the Action Plan on Urban Mobility and the ITS Directive, which call for the promotion and support of EU-wide multimodal travel information services. Multimodal travel is a key part of the European Commission's strategy for the future of transport. This is confirmed by the White Paper on Transport from 2011 ("Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system"). One of the ten goals of the White Paper is to establish, by 2020, the framework for a European multimodal transport information, management and payment system.

The crucial question concerning multimodal information and ticketing systems is to what extent the market itself will be able to develop and offer pan-European journey planning and ticketing services, and if political intervention is necessary in order to establish multimodal information and ticketing/booking services. In the case of a market based development, there are many considerations that will have to be addressed by the European Commission:

- Supporting and establishing guidelines for cooperation in the travel industry, especially with respect to the exchange of data and the protection of intellectual property, even in the case of voluntary bilateral or multilateral agreements within the industry.

- Support and promotion of initiatives leading to standardisation and harmonisation in order to facilitate multimodal travel planning and booking across the different modes. Example of standardisation and harmonisation could be data formats, interfaces and/or service architecture, e.g. initiatives like Shift2Rail.
  This can be understood as a "light-handed regulation" whereby the European Commission will not determine the rules for standardization and harmonization, but will provide incentives for cooperation to the industry. If cooperation does not deliver the expected outcomes, the Commission may provide additional regulatory activities.
- There is a need to define passengers' legal rights and transport providers' conditions of carriage for multimodal trips, as such rights and conditions vary between transport modes. Transparency and predictability are critical to passengers' trust in and attraction to multimodal services. The need for such transparency and clarity of passenger rights, whether legal or commercial, is not only related to a truly intermodal journey, but is equally important in any co- or multi-modal environment,

If the European market in general fails to implement a service that provides multimodal information and ticketing, the European Commission will have to look for additional policy measures to prevent market failure. Market failure in economic terms exists when the allocation of goods and services by a free market is not efficient. Market failure itself is not a fault of the market players, but may be an implication of the classical reasons like externalities, public goods, subadditivity of costs and information failures. Market failure can also be induced by adjustment lags, market turmoil and bounded rationality of the market participants. Market failure is frequently a reason for policy intervention. There will be a set of policy options representing a gradually increasing level of intervention:

1. The option for the EC not to intervene additionally, but trust in a market-based solution, where current regulations are successfully (e.g. FSM and Shift2Rail are implemented successfully).
2. The use of some kind of soft intervention, with policy measures promoting the cooperation among the players in the travel industry like the establishment of "European Passenger Transport Guidelines" guidelines that give a voluntary framework to all European transport operators on the implementation of a MMITS.
3. The establishment of European passenger rights in order to guarantee that travellers can proceed their multimodal journey without additional costs for re-accommodation in case of missing connections.
4. In the case that the market does not deliver desired outcomes, apply heavier intervention like the obligation to provide information/data access for all transport operators.

5. The strongest policy option could be an obligation on carriers to offer multimodal journey planning across Europe to all travellers. Players in the market are forced to participate in MMITS on a non-discriminatory basis, to facilitate multimodal travelling across Europe.

Beyond the regulative interventions, a further “soft” policy option could be financial support to the providers of multimodal trip planning and booking services or their development. Financial support to the industry may be taken into account if the industry itself is not able to offer this service in good time and the social benefits clearly outweigh the system costs.

Making use of such policy options should be based on a precise analysis of potential market failure regarding the European market for travel information and booking systems on the whole. At first glance, it seems to be important to distinguish between travel information on the one hand and ticketing/booking on the other hand, because the technological complexity and issues of cooperation are relatively different between these two levels. From a legal point of view it is also important to distinguish between commercially run transport operators, and transport operators working under public service obligation.

1.3 Objectives of the Study

DG Move has defined the objectives of this study on the basis of the general goals of European transport policy, which have been substantiated in the directives and recommendations regarding multimodal journey planning. According to the tender specifications provided by DG MOVE, the following objectives are crucial for the outcome of the study:

- In general, the study should discuss the economic and social impact of the provision of pan-European multimodal travel planning and booking services, their target audience, and the potential of information systems to contribute to the policy goals of modal shift.
- The study has to identify the market developments and future trends that affect the provision of such services.
- Special attention should be paid to the barriers of implementation. Potential barriers will not only be the well-known technological problems, missing standards and a lack of access to data, but also insufficient incentives for the key players in the market to contribute cooperatively towards a common solution. Therefore, a further objective of the study will be to explain possible conditions of market failure that might justify intervention by the European Commission.

- The study should also be able to offer potential solutions for the barriers identified on a political level. Political strategies may address the cooperation between private firms and the public sector and partnerships between the transport industry, transport service retailers and the telecommunications industry.
- Finally, the recommendations of the study should identify additional EU action where necessary, particularly in the context of the ITS Action Plan and Directive.

To answer the expectations stipulated by the objectives mentioned, the All Ways Travelling consortium defined a set of work packages for the study. The structure of the work packages and the planned approach for execution of the work packages will be introduced in chapter 2.

1.4 Terminology

In accordance with the official documents provided by DG MOVE, the principal task of this study is to develop a concept for multimodal pan-European passenger transport information and booking service. The official documents, especially the tender specifications, always use the term "multimodal" (sometimes written as multi-modal) to describe the characteristics of the service requested, notwithstanding that, in the title of the invitation to tender, the wording "across transport modes" is used. We do not find the terms "inter-modal" or "co-modal" that are quite often used in industry discussions and documents in the official EC documents.

IATA, for example, distinguishes between multimodal and intermodal services. Using this terminology, multimodality simply implies that passengers use different modes for a trip, whereas passenger intermodality means that a passenger is able to travel using different modes of transport in a combined, seamless journey.

In spite of this rather sophisticated distinction, we should stick to the term "multimodal" in the sense of DG MOVE, because any other set of terminology is not in line with the intention of the European Commission. From the perspective of DG MOVE it is quite clear what is meant by the concept of multimodality, because the topic is always treated from the perspective of the customer.

In a multimodal setting, passengers should have the chance to obtain travel information and the necessary booking opportunities regardless of the travel mode they want to use or to combine. If the idea of seamless passenger transport in Europe is realized to a full extent, customers will not only be able to obtain complete information for door-to-door-travel, covering any relevant mode of transport, but also to book one single ticket for the whole journey or at least a series of tickets that is interoperable in terms of the travel mode, thus ensuring the smooth development of a journey. This is what is meant by the term "multimodality" from the customer's perspective, and what should be provided by a Multi Modal Information and Ticketing System (MMITS).

Things may look different from the perspective of system providers. When looking at the solutions available on the market today, there is no such system running that offers information, booking, payment and ticketing, covering the three relevant modes air, rail and bus for the long distance travel and integrating local transport activities at the first and last miles. To provide such comprehensive intermodal ticketing services to the customer, two different technological solutions may be pursued as discussed with respect to the POCs in our tender documents:

- One approach would be a common architecture for payment and ticketing, to which each operator's system is linked. Such an **integrated architecture approach** would represent **real interoperability** and allow travellers to buy a **single integrated ticket** across three or more transport modes.
- A second approach, called the **pragmatic approach,** will only give an impression of interoperability (**virtual interoperability**). In this case the system makes multiple payments and issues multiple tickets, while managing these transactions "behind-the-scenes", so that it appears to the traveller as a one-click shop transaction.

If both the integrated architecture approach and the virtual approach lead to the same level of service quality from the traveller's point of view, both solutions should be labelled as multimodal from the user's point of view. But if one solution - perhaps the virtual approach - offers disadvantages relevant for the travel behaviour of customers, then this should be taken into account in the assessment of the benefits of multimodal ticketing. Disadvantages of the virtual approach could result from the fact that the one-stop-shop solution does not work as a perfect substitute for the single ticket, and the user may face additional transaction costs resulting from the multiple tickets and payment transactions.

In fact, the structure of these two solutions is quite different when seen from the travel industry's perspective. Whereas the pragmatic approach mainly requires investment by the entity that offers multimodal tickets to develop all the keys to the different transport operators, the integrated architecture approach is based on the collective effort and commitment of operators to a common architecture. Because of the completely different governance requirements of these two models, we have to distinguish them with respect to terminology. The suggestion made by the All Ways Travelling consortium is to label a product as "co-modal" if it follows the logic of the virtual approach. If there is a single payment and a single integrated ticket following the common, integrated architecture approach, we may call it "intermodal".

1.5 Supplement: Gathering Information and Access to Expert Knowledge

The execution of the study is based on different sources of information and data. First of all, we have reviewed research that has been conducted in the past, commissioned by the European Commission itself. This activity is part of Work Package 1, as well as the collection of any other research material on the different topics within the study. We have reviewed as much as possible of the existing and available information concerning our topic in order to gather all kinds of information relevant to our research objectives. Moreover, we have reviewed all available research with regard to relevance and contribution to our research questions, and critically assessed the validity of the material.

In addition, our research plan has relied on gaining relevant information and expert knowledge from the partners of our Consortium, the Advisory Board and other stakeholders from the industry. A set of workshops and bilateral expert interviews has been held during the the study. An initial workshop with experts from the consortium was held on June 27/28th at the AMADEUS site in Sophia Antipolis, France, covering work packages 2 and 3. During the following weeks, additional interviews with experts from the consortium were held to fill in any remaining information gaps concerning work packages 2 and 3. Several shorter joint working sessions within the Consortium were held, and one further 2-day workshop in autumn in order to discuss the content of Work Package 6 (barriers and limitations).

The Advisory Board has met the Consortium three times during the process to share knowledge with us, also via bilateral interviews with experts appointed by the Advisory Board. Stakeholders have had a real opportunity to participate and influence the study, not least by joining the stakeholder meetings organized by the European Commission.

Constructive inputs and advice have been provided in individual interviews of experts from the group of stakeholders and other players within the industry on an on-going basis during the project.

2 Work Packages

In order to fulfil the tasks of our study on pan-European multimodal information and booking services, we have split the work to be done into work packages following content-related discussions. The structure and the arrangement of the work packages were developed to address the various aspects of the topic, stemming from the objectives determined by DG MOVE. We defined the following seven work packages in terms of content, which will be subsequently explained in this chapter:

1. Previous relevant work of the European Commission and international scientific studies
2. Customer needs/demand side
3. The market for information and ticketing systems in Europe – status quo and key drivers of future development
4. Potential scenarios of the emergence and development of pan-European multimodal information and ticketing systems
5. Economic and social impacts (cost-benefit analysis)
6. Analysis of potential barriers and limitations
7. Summary of findings and political conclusions

The profound analysis of a Multi Modal Information and Ticketing System includes different perspectives of multimodality. Therefore, a methodological approach is needed to reasonably integrate these perspectives. However, research has not yet provided a theoretical framework that helps to understand multimodal travelling in its full extent. In consequence, the aim of the following work packages is to develop conclusions addressing the issue of multimodal travelling. Therefore *grounded theory* is applied to build an appropriate theoretical framework on multimodal travelling. Grounded theory, allows the integration of several different methodological techniques into one framework generating newly created hypotheses in scientific fields. It has to be clear that grounded theory is not a theory that gives strict instruction on how to analyse data. It is rather a research style that helps to develop a framework of research and to derive logical conclusions.

2.1 WP 1: Previous Relevant Work of the European Commission and International Scientific Studies

As was indicated in the tender specifications, the consortium has attempted take into account the relevant work already undertaken by the European Commission as it related to multimodal travel information and ticketing. Therefore, AWT has defined an initial work package that will allow us to gather the status of the discussion on the European level. The first task within this preparatory work package summarizes the main findings of the following papers and actions undertaken by the Commission:

- Consultation Paper 'Development of an Integrated Ticketing for Air & Rail Transport' supported by the EU (2008)
- Study on Public Transport Smartcards –Final Report-TREN/A4/124-2/2009
- Study "Towards a European Multimodal Journey Planner" (2011)
- 1st Smart Mobility Challenge for multimodal journey planners, launched by Vice President Siim Kallas in June 2011

We have also considered the recommendations and findings of several scientific projects at EU level dealing with multimodal journey planning and, in part, with ticketing. The most important contributions stem from the following projects:

- EU-Spirit (5FP project)
- eMOTION (6FP project)
- WISETRIP (7FP project)
- i-Travel (7FP project)
- ITISS,
- IFM (7FP project).

The results of these research projects are summarized, pointing out the principal objectives and results of the particular study. A similar approach is taken with regard to the following studies and regulations:

- Integrated Ticketing on Long Distance Passenger Transport Services
- TAP-TSI
- Eroptima (Tickego)
- Optitrans
- Co-Cities
- EDITS

Besides this documentation, AWT has collected other research and consulting work related to the topic of multimodal trip information, planning and ticketing. The knowledge gathered through these studies is used in work packages 2 and 3.

2.2 WP 2: Customer Needs/Demand Side

Pursuing the idea that the aim of a pan-European multimodal transport information and booking service is mainly to serve customer needs and to facilitate travelling across Europe, the study provides an analysis of customer needs and benefits with respect to the findings and conclusions of previous studies. Given the importance of evaluation from the perspective of travellers and its quantitative relevance, our research plan in WP 2 includes the following steps:

1. Analysis of the statistics for European travel activities from the past decade. As a result, we want to develop the segmentation of European travellers using several criteria:
    a. Country pairing
    b. Country characteristics (at least the central or peripheral regions)
    c. Trip characteristics and travel mode (business or leisure)
    d. Trip complexity (number of trips included).
2. In-depth analysis and evaluation of existing research and consulting concerning the travel activities of people in Europe and the potential benefits of a Multimodal Information and Ticketing Service. The analysis should include current forecasts on the future growth of the European travel market and the development of modal splitting.
3. Interviews and discussions with experts from our consortium and the advisory board to obtain a picture of the development of customer needs, with the aid of the travel industry and travel management industry.
4. Interviews and discussions with stakeholders from the demand side to obtain a picture of customer needs using information drawn from organizations representing customer affairs.
5. Quantitative customer survey to evaluate mobility behaviour and customer expectations on a multimodal journey planner. The customer survey will be performed as an online survey covering a selection of European countries. From the survey, we will try to gain knowledge of the empirical relevance of criteria for trip decisions and the significance of a multimodal journal planner for modal choice. The survey will address the potential benefits of users from this service and also the modal shift

topic. An important issue will also be the general acceptance of such a service by potential customers.

The analysis of the demand side of the market addresses the following main topics:

- Quantitative analysis of the European travel market with respect to travel patterns and trip characteristics
- Projected growth of the travel markets on the different levels (cross border, national, regional); the current volume of the multimodal travel market in Europe and the likely growth of this market
- The potential contribution of multimodal information services to the objective of modal shift
- Expectations and needs of travellers with respect to multimodal trip information and ticketing systems; criteria influencing the choice of travel mode
- Shopping habits of travellers with respect to travel activities and the relevance of payment features

As we know from previous studies of the market, customers use multimodal trip information services because they want to plan their trip and because they have different needs in terms of information. With reference to previous studies as mentioned in WP1, the most important assumptions with respect to information and planning are:

- Customers need and require comparable information on door-to-door travel time, travel costs for the different modes available and all possible combinations of modes when planning their travels.
- Travellers want reliable timetable information with up-to-date information before starting their trip. This should include the expected departure and arrival times and take into account congestions and delays.
- Customers want real-time information during their trip in case of delays, disruptions, or other incidents affecting the level of service quality during the trip.
- Customers are interested in relevant additional trip information (maps, further route information, points of interest, emissions).

Additionally, passengers may favour *one-stop shopping* for all bookings, a single ticket and a single fare instead of dealing with multiple tickets and payments, which generate a certain level of uncertainty, or additional transaction costs. We will analyse the potential benefits of a one-stop shopping solution from the customer's perspective. In any case, the analysis of customer needs has to take into account current developments and future trends on the European travel markets, which seem to be of relevance with respect to trip planning and booking activities by passengers.

The Zeppelin University research group has performed the research tasks of WP 2, also involving Marketing Chair (Peter Kenning), in particular during implementation of the quantitative survey. Workshops with experts from the consortium have been organized in cooperation with the project manager of the consortium..

2.3 WP 3: The Market for Information and Ticketing Systems in Europe – Status Quo and Key Drivers for Future Development

Work package 3 addresses the “supply side” of the market for trip information and booking. Because of the complexity of the industry’s supply chain, we have to proceed stepwise.

Firstly and based on the findings of WP1, we will provide an overview of the existing multimodal solutions in the market which are accessible to the public, in order to obtain an impression of the level of service quality currently available to travellers. The analysis must distinguish between services offering only travel information, payment or booking and integrated information and booking systems in the sense of a Multi Modal Information and Ticketing System. It will in particular address the current benefits and shortcomings of the different systems. Our analysis must be completed by a brief description of the structure of commercially and non-commercially run travel management.

When analysing the solutions currently available in the market, we must distinguish between truly intermodal approaches (intermodal products backed by commercial agreement between the travel providers involving 'through fare' or 'combination pricing rules'), and co-modal approaches, which involve the sale of single-mode products, combined or packaged at the distributional or retailing end of the supply chain. We must also address the distribution channel in the market today with particular regard to the different value chains.

The second task of WP 3 is a critical assessment of the key drivers for the future development of multimodal information and ticketing systems. In any case, the analysis must distinguish between the development of services which provide only trip information and solutions with integrated information and ticketing services.

Our analysis must take into account the following aspects:

- **Technological aspects**: we will try to give a forecast on how the technological background of the market may develop according to certain trends. These considerations mainly address the question of in which direction the providers of trip planning and ticketing services may move, and which technological solutions will be available within the next years for the purpose of offering integrated services. Our analysis will address the different technological approaches (particularly intermodality and co-modality) and their prospective growth.

  Relevant to this context is the discussion of the future role of data standards with respect to the current fragmentation of standards between the travel sectors. This is, for example, based on the different use of vocabulary, such as different 'codes' for the same location.
- **Business model & value chain:** Besides the different data standards, we must consider the question of different business models and companies' roles in the value chain of each travel mode. Therefore, we will analyse the existing business models of the market players and define their specific role in the value chain regarding products, distribution and retail. We will also analyse the supply chains of the main transport modes. Consequently, we will be able to provide a comparison and attempt to arrange the players in a common multimodal value chain in order to elaborate possible collaborations.
- **Socio-economic impacts**: Besides the technological aspects, we will also be addressing the economic and socio-economic factors influencing the market.
  - One important aspect is the structure of the travel market itself. This is also true with respect to the market for travel management services. The analysis of the travel market includes the long distance travel markets (essentially air and rail but also the potential for bus/coach) and the short distance markets (urban transport), and identify the key players promoting solutions for multimodal trip planning and booking solutions. The analysis addresses the local, national and European level of the market.
  - At first glance, the structure of the market looks rather complex. Therefore, the complexity and the disparity of interests (especially at a local level) will have an influence on the future development of the market, and this fact needs identifying and assessing. The analysis covers the prospective development of distribution systems in the travel industry and their influence on the market for multimodal solutions.

- The development of information and ticketing will strongly depend on the conduct of the abovementioned key players in the travel and travel management markets. Therefore, we have analysed the determinants of cooperation between the parties in the case of travel planning and ticketing services, and how commercial interests and incentives may develop in the future with respect to this topic. Insights from this analysis have been relevant for WP 6 (potential barriers and limitations).

After completing the first steps of the market study, we have addressed the question of whether multimodal information and ticketing services may become a business case for service providers in the market and may affect the current business model of market incumbents. Therefore, we have examined the role of the market incumbents in the travel and travel management markets in the development of commercially run services on the one hand and the possible market entry barriers to newcomers offering services for the public on the other hand. Furthermore, we have identified different, potential theoretical business models. Such business models, at European level, may consist of aspects like potential revenues, cost structure, customer segments and value propositions. In contrast, the business case is the necessary condition for a business model. The business case creates the economic basis for the business model.

Systems for multimodal trip planning and ticketing may work on a commercial basis and form a business case, if there is willingness to pay for the service among the potential customers, and if this willingness to pay can be exploited by the systems or transport providers. Under ideal circumstances, customers may be willing to pay for the information itself and for the booking service, but this seems not to be the case in real-world conditions. Therefore, the business case has to rely on different sources of revenue. One possible solution could be that the price for the additional service is simply hidden in the ticket price. There could also be a media business model: trip-planning devices offering advertising or additional services for the customer that will generate fees to pay for the genuine services, or a two-sided network model. In this part of the study, we will address the structure of potential business models in detail.

In order to handle the different tasks, we have applied certain research methods. One basic approach is the analysis of existing market studies and any other relevant material provided by the partners of the AWT consortium or made available in any other way. This is complemented by a second approach, to collect market experience and tacit knowledge from experts belonging to our consortium and to the AWT advisory board. In order to achieve a systematic course of action, we prepared a two-day workshop discussion within the consortium that gave us the opportunity to find answers to the set of questions raised above.

This workshop was supplemented by bilateral expert interviews with professionals from our consortium. Furthermore, the content of WP 3 was one of the topics of the first stakeholder meeting, held in Brussels on 12 June 2013, to ensure that the consortium picks up every relevant trend in the market.

2.4 WP 4: Potential Scenarios of the Emergence and Development of Pan-European Multi Modal Information and Ticketing Systems

Based on the information gathered in WP 2 and 3, we have been able to draw a preliminary picture of the potential market for multimodal information and ticketing systems in Europe. Therefore, in work package 4 we will develop potential scenarios of what will happen in the future of the market by summarizing and consolidating the knowledge deriving from WP2 and WP3 ("demand" and "supply" side).

In a first step, two extremely contrary scenarios are to be designed. These scenarios will refer to extreme developments that serve as the starting point for the development of potentially realistic scenarios in a subsequent step:

- **Basic Regulation Scenario:** The scenario supposes that the market itself will be able to develop solutions for the customer needs. This assumes that the implementation of multimodal information and ticketing services will take place on a completely commercial basis. Activities by the European Commission will suffice in finalising the current regulatory activities.
- **Full Regulation Scenario:** This scenario follows the assumption of market failure in the European market in general. If the analysis of the current market developments gives an indication that the market will not deliver the services required by the passengers, then there will be a need for comprehensive political intervention to fulfil the vision of seamless transport. In this scenario, action taken by the European Commission could include an obligation for the operators to provide multimodal information and booking services or a commitment to offer open data access.

It has to be taken into account that these extreme scenarios only serve as the framework from which realistic sub-scenarios are developed. An analysis of these sub-scenarios addresses different levels of potential intervention by the European Commission in our study (e.g. promoting industry platforms or defining general industry standards for services). The development of such sub-scenarios is closely linked to the detailed assessment of barriers and limitations influencing the emergence of multimodal information and ticketing services. Therefore, work package 4 will start with a consolidation of the findings concerning market development on the one hand and the sphere of customer requirements on the other hand (WP 2 and 3), thus characterizing a potential market for multimodal travel information and ticketing services. It will be carried out simultaneously with work package 6, integrating the discussion of potential barriers and limitations to develop the relevant sub-scenarios, and will eventually lead to specific policy recommendations.

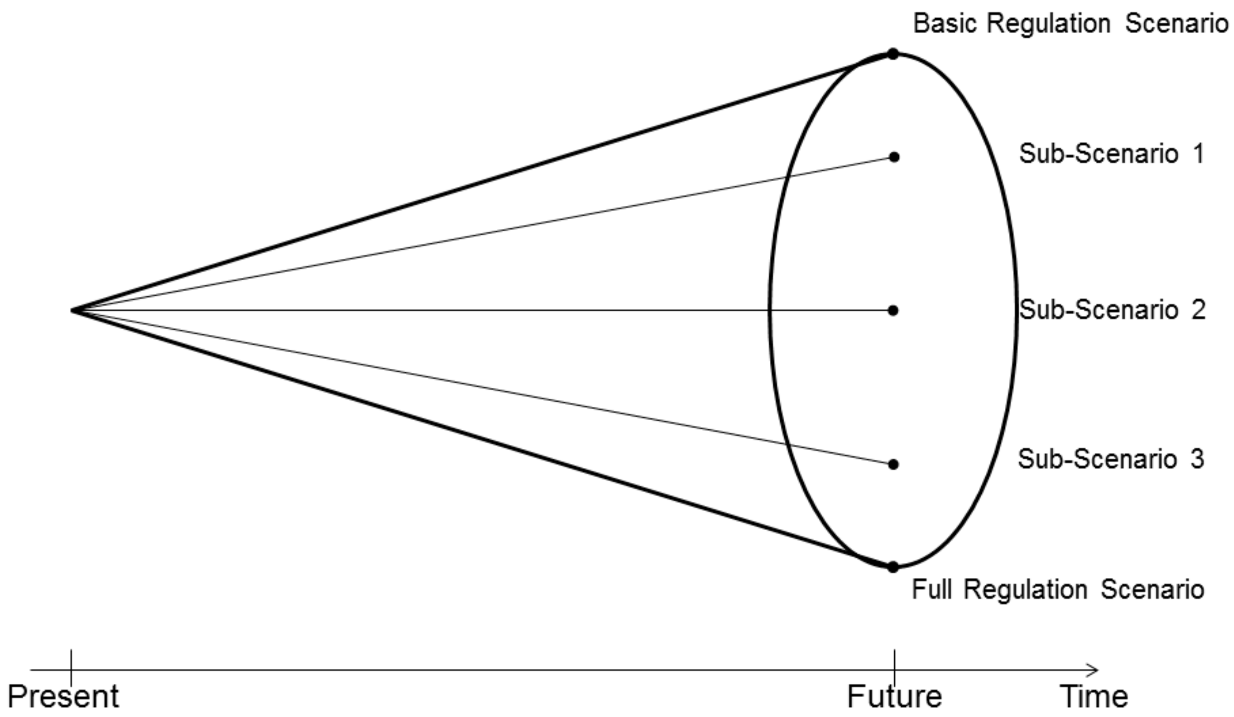

Figure 1: Scenario Funnel
Source: Own figure.

2.5 WP 5: Economic and Social Impacts (Cost-Benefit Analysis)

One of the most important objectives of the study is to assess the economic and social impacts of the provision of multimodal journey planning and booking services. Therefore, we have performed a cost-benefit analysis for the provision of such services. Knowledge on the economic viability of this project is crucial for the successful implementation of the multimodal information and ticketing system in Europe. Considerable investments into technology are necessary from the different key stakeholders such as the transport industry, public transport firms, travel agencies, authorities or the operators of the data back-ends needed for data aggregation and processing.

Those investments will only be made if they pay off within a reasonable timeframe. This may be achieved through fees, the selling of data to third parties or through customers being willing to pay for the mobility information, or increased transport provider revenues. Paying off through money flow is one important aspect, especially for businesses. However, it is commonly agreed that investments in the Multi Modal Information and Ticketing System will also be paid back through improved efficiency as well as through transaction cost savings. Nevertheless, if a modal shift to more sustainable modes can be achieved, this has to be determined as well as the consequential gains in terms of reduction of congestion and environmental damages.

At the level of overall society, the socio-economic impact assessment can make use of different methodological approaches. Depending on the goal dimensions (one goal / several goals) and the degree of impact appraisal, three methodological approaches can be broadly distinguished:

- Cost-effectiveness analysis (CEA)
- Multi-criteria analysis (MCA)
- Cost-benefit analysis (CBA)

The following figure provides an overview over the main methodological differences between the three economic assessment methods. Within WP5, the possible impacts of the multimodal information and ticketing system have to be determined. Establishing a goal achievement matrix enables the determination of which economic assessment method is the best choice for WP5. Using this as a basis, it is possible to derive the economic evaluation criteria. Within the project, it is possible to develop general economic evaluation criteria, which can be used later with real data for the implementation phase of the multimodal information and ticketing system.

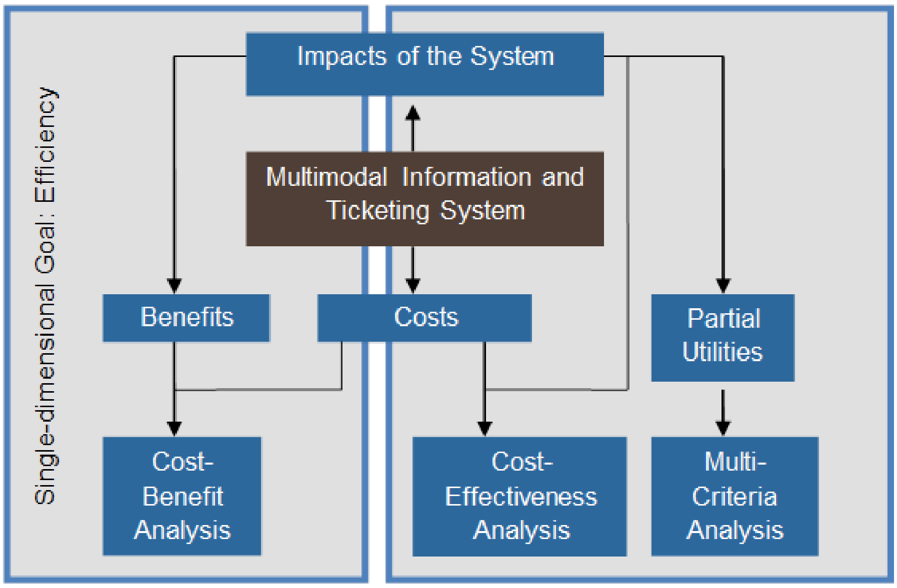

Figure 2: Methodological Approaches for Socio-Economic Impact Assessment
Source: Own figure.

Therefore, as our first step we have to analyse the economic and socio-economic dimensions of benefits. As mentioned above, the main source of benefits from a multimodal trip planning and ticketing system could be savings in transaction costs. Because the concept of transaction costs is rather vague at first glance, we will have to define what is meant by this concept in detail. We will use different approaches to identify in more detail the nature of transaction costs, e.g. estimations of the costs of time per booking activity for customers, and the calculation of standard costs for professional business travel agents.

The potential costs of running intermodal information and ticketing systems should be calculated on the basis of estimations by our consortium. This means that we have to deliver different calculations with respect to the structure of the intended system (the different POCs).

A further important socio-economic aspect of intermodal information and ticketing systems will be their possible impact on modal shift in Europe as identified by the European Environment Agency in their TERM reports (Towards a resource-efficient transport system). As we do not have a quantitative calculation model of travel demand at our disposal, we will rely mainly on secondary research regarding the modal shift effects of multimodal trip information, and put together the experience gathered from case studies and expert appraisals within and outside the consortium with respect to this aspect.

Prof. Dr. Wolfgang Schulz from the Institute of Economic Research and Consulting will execute the cost-benefit analysis in close cooperation with the core team at Zeppelin University.

2.6 WP 6: Analysis of Potential Barriers and Limitations

The main task of work package 6 is to cover the following points:

- The identification of barriers and limitations which could significantly hinder the market implementation of multimodal information and ticketing systems even in the case that such a system could be run on a commercial basis
- The process for overcoming these barriers by using an economic institutional model approach for market implementation

The following figure provides an overview of the structure of the analytical steps and relationships for identification of the relevant market failures. It is Important to match the market failures to the relevant phase of the process of market implementation. Furthermore, it is necessary to find the relevant actor who is the reason for the market failure, and to identify the actor who might be capable of overcoming the market failure.

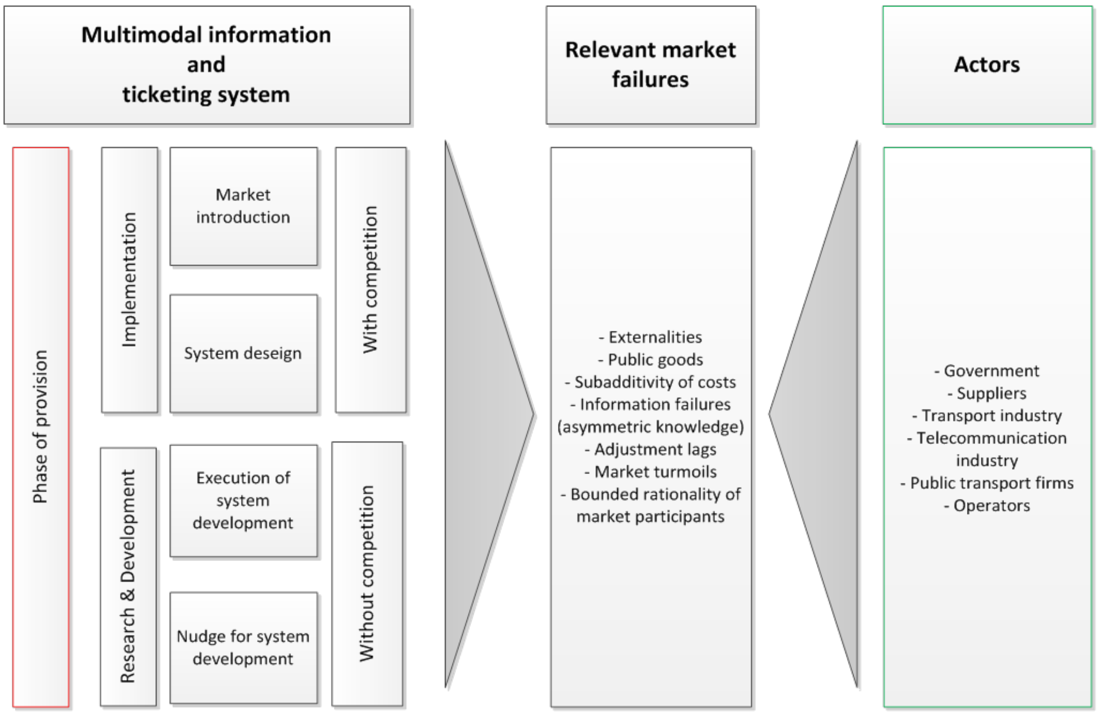

Figure 3: Market Implementation of a Multi Modal Information and Ticketing System: Relevant Market Failures and Actors
Source: Own figure.

Relevant market failures to be examined include the classical concepts of externalities, public goods, subadditivity of costs and information failures. Market failures can also be induced through adjustment lags, market turmoil and bounded rationality of the market participants. One special case of market failure is the possible resistance of the different market incumbents to the introduction of innovative multimodal information and ticketing systems because they fear the omission of their current business model as a result of innovation. An example of this could be the different ticketing philosophies of the national rail operators (Non Reservation Tickets vs. Integrated Reservation Tickets), depending on their domestic networks. Different ticketing philosophies, linked to the business model of the operator, will prove a severe obstacle on the path to a common ticketing standard.

Furthermore, WP 6 provides an introduction to the institutional role model approach. It is a systemic and actor-based approach, where institutions and actors are identified which will later operate or use the multimodal information and ticketing systems. In an initial step, it is clear that a comparison of the previous business approaches used in operator models with the obviously relatively new theoretical approach of economic institutional role models is made. In the second step, the advantages of the institutional role model approach for the implementation of the multimodal information and ticketing system will be pinpointed. Finally, the design steps and relevant elements of the institutional role model of multimodal information and ticketing systems will be explained and illustrated.

Another important part of WP 6 is the treatment of legal problems stemming from the development of multimodal journey planning and booking services. Legal questions are linked to several aspects of such a service. One basic problem is the legal assessment of the cooperation between competitors in the travel market necessarily arising due to the type of services requested. Our analysis must clarify the borderline between permitted cooperative arrangements and collusive agreements that are forbidden by law, and discuss a framework for cooperation.

When a common system for trip planning and booking is established, a regulatory framework has to be defined to ensure non-discriminatory access to the system for market incumbents and new entrants, including the aspect of defining interfaces for the exchange of data. Our legal assessment will develop a general framework for regulation on the basis of the regulation of monopolistic bottlenecks in other sectors.

A further important aspect of the legal analysis will be passenger rights. Our study will discuss the relevant problems of liability and enforcement of passenger rights caused by the introduction of multimodal trip planning, booking and ticketing services, and will provide recommendations for EU intervention in this field where appropriate.

Work package 6 will be performed by the ZU core team in close cooperation with Prof. Dr. Schulz from the Institute of Economic Research and Consulting. The legal aspects of the topic are assigned to Prof. Dr. Jochum from the ZU core team.

2.7 WP 7: Summary of Findings and Political Conclusions

The last work package of the study collects the findings and conclusions of all previous work packages and analyses them from different points of view. We summarise our ideas on how markets for multimodal information and ticket systems may develop, and which barriers and limitations may impede the sustainability of market driven solutions. As the figure beneath indicates, work package 7 will collect together the perspectives of society, technology, economy, business and law to obtain a comprehensive picture of multimodal travel planning and booking.

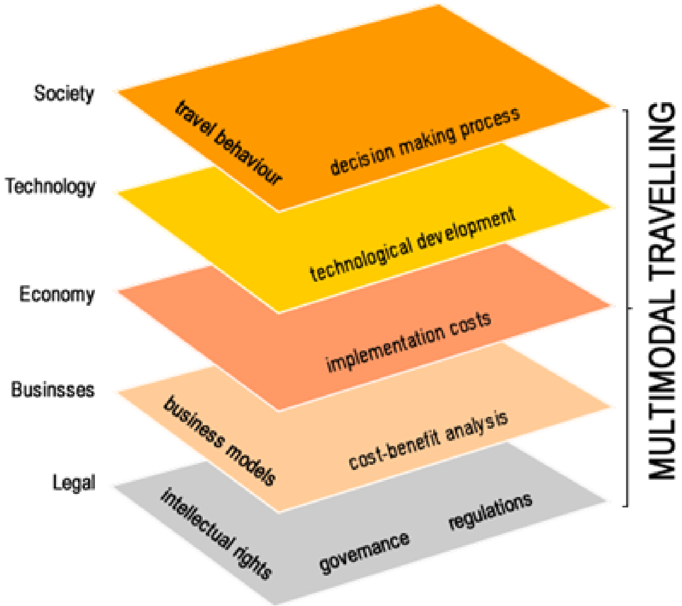

Figure 4: Perspectives of Multimodal Travelling
Source: Own figure.

As requested by DG MOVE, WP 7 also delivers policy recommendations, particularly with respect to actions necessary for overcoming the possible barriers to a development of a multimodal travel planning, booking and ticketing service, and the relevant legal and regulatory affairs. This includes a particular view on the links to other existing and planned EC initiatives.

The Consortium as a whole has developed the recommendations of WP 7. They have been reviewed by our Advisory Board as a check on their significance, and their advice has been taken into consideration.

3 Previous Relevant Work of the European Commission and International Scientific Studies (WP1)

3.1 Studies and EC Projects

In the following chapter, previous studies on the topic of multimodal journey planning are collated regarding their objectives and results as an initial outcome of WP1. The findings from WP1 are used as a background for the further work packages. They are not evaluated in detail, although at the end of this chapter a general evaluation of the findings is given. This chapter will provide a consolidated conclusion from those reports and help to establish the basis of this study.

3.1.1 "Development of an Integrated Ticketing for Air and Rail Transport"

The study dates from 2008, and examines the issues regarding the development of an integrated ticketing solution for rail and air transport in Europe. Therefore, several stakeholders have been polled using a questionnaire containing 9 questions on the possible problems involved and opportunities provided by integrated ticketing.

The objective of the study was to analyse the potential market for integrated ticketing between rail and air. Therefore, the study examines the organisational and technical opportunities related to the sale and promotion of integrated air and rail tickets.

The study comes to the conclusion that the main problems with integrated ticketing in Europe are organisational and financial. In order to set up a sustainable transport system, the study suggests that it is necessary for the European Commission to take the initiative and to motivate stakeholders to collaborate in the development of a pan-European integrated ticketing solution. It is also mentioned that organising a journey by travel modes is a barrier to intermodality, because it is too difficult for the traveller to gain information and order tickets through several platforms.

To set up such a system, total transparency regarding ticket availability and tariffs needs to be provided by the transport operators, particularly by operators within the same transport mode. Travel information has to be easily accessible for every citizen. For integrated ticketing, systems for integrated and interactive information, reservations and sales are necessary to provide the user with the chance to make reservations for the whole journey. Integrated ticketing will have a positive economic impact through better use of public transport, and will simplify open competition in the market. Again, non-exclusively available information is the main factor regarding the outcome of this study.

3.1.2 Study on Public Transport Smartcards -TREN/A4/124-2/2009

This study was conducted by AECOM, The Transport Operations Group of Newcastle University (TORG), PJ associates, Austria Tech and NEA on behalf of the European Commission, and published in 2009.

The report analyses the current situation in the market, provides a forecast on possible trends of the future, and concludes with recommendations for actions that might be taken by the European Commission.

The goal of the study was to identify how a harmonization of existing and future smartcard / smart ticketing services for public transport could be realised, and how the European Commission might enforce this procedure. Therefore, the benefits and barriers that smart ticketing brings to frequent and non-frequent travellers were analysed.

Using smart ticketing might promote the usage of public transport by making it easier to use. This provides several benefits to the user in person as well as to society as a whole.

In the near future, the study suggests, NFC media, for example NFC-enabled smartphones, will be used for smart ticketing.

As a conclusion, the study gives some final recommendations. The European Commission should encourage transport operators to adopt smart ticketing solutions for their booking systems. Referring to the executive summary of the study, these encouragements would be:

- Conducting detailed assessments of schemes, identifying and facilitating the sharing of best practice solutions
- Laying out 'model' scheme designs, business cases and model agreements between partners; engaging with key stakeholders; supporting relevant research into new technologies, seeking/supporting technological convergence
- Providing incentives for the further stimulation of public and private investment and delivery
- Ensuring that the right 'tools' are available (scheme architecture, standards and specifications) and encouraging their use

3.1.3 “Towards a European Multimodal Journey Planner” (2011)

This study examined the barriers and possibilities for a pan-European multimodal journey planer in 2011. “Towards a European Multimodal Journey Planner” was launched by the EC and prepared by the Algoé – Rapp Trans Grouping for DG Mobility and Transport (MOVE). Contributors were Carte Blanche Conseil, Algoé, Jacobs Consultancy, Rapp Trans NL and Rapp Trans UK. The study was launched in January 2011 and the final report was published on September 13, 2011. The results are based on existing studies from previous years, and on stakeholder feedback.

The objective of the study was to “support the EC´s work towards a multi-modal journey planner for Europe, and to prepare the elaboration of functional, technical, organisational and service provision specifications as required by the ITS Directive” (p.3 of the final report). It considered terrestrial collective transport modes as the core object of multimodal travelling.

The authors made clear that multimodal journey planning is not just planning a trip and purchasing a ticket. It is an important factor for providing the traveller with current on-trip information through a mobile device. Therefore, existing multimodal journey planners have been evaluated.

The study explains that a multimodal journey planner may not be a business model itself, because the user is most likely unwilling to pay for this service. For the user, a multimodal journey planner feels like part of the service he receives through buying a ticket or a public good that they have already paid for by paying tax. Whatever the case, the study provides the alternative that an immanent business model could be achieved by using the given information as media content, and selling advertising space for refinancing the system.

Interviewed stakeholders were consensual in their opinion that a multimodal journey planner might promote modal shift, and that data reliability is a prime need. The organisation of reliable real-time data is one of the most challenging issues. Stakeholders are also consensual in their opinion that the European Commission represents the driving force in establishing a legal framework und promoting standardisation. Stakeholders also preferred a distributed solution rather than a centralized one because of existing organisational structures. (pp. 5/6).

As a result, the study recommends a policy of open data access. This originates in the stakeholders' lack of consensus on an appropriate business model as well as their concerns about organisational challenges. Open data is also the best opportunity for keeping up with the existing systems. Using open data relieves companies of the necessity of merging existing systems. Instead, a new system is created that makes use of data deriving from existing platforms.

The vision of the study is a multimodal journey planning solution, which is a free service to citizens, delivered by many actors in a non-exclusive way. Though information is the key point for this solution, open data might be an issue with some transport operators, so it will most likely not become legally accessible throughout Europe. This means, from a technological point of view, data provision is not an issue but most operators will not allow data access.

3.1.4 1st Smart Mobility Challenge for Multimodal Journey Planners

In June 2011, European Commissions Vice President Siim Kallas launched the 1st Smart Mobility Challenge for multimodal journey planners. The challenge was focused on the development of a public transport journey planning solution to deal with issues like increasing congestion and fuel costs. The development of a multimodal journey planner may lead to a modal shift and therefore help to deal with the challenges of climate change by using cleaner transport solutions, and also reduce costs for the traveller. The initial question was '*Why can't I yet plan or book my journey through Europe — switching from air to rail or sea, to urban or road transport — in one single go and online?'* Several participants entered the competition in two categories, and the final winners were announced in Brussels in March 2012.

According to the press release from 12 March 2012, the winner of the category 'operational journey planners' are Idos and Trenitalia. In the category of 'innovative ideas' the winners are Penelope Ventures GmbH and SNCF.

Below you will find a short description of the winner's solutions in the following descriptions deriving from the EC's website.

Operational Journey planner:

"**Idos** is a door-to-door journey planner for the Czech Republic and Slovakia. It also provides other cross-border travel connections around Europe by bus and train. It has 66 million online views per month."

"**Trenitalia's** journey planner – SIPAX – provides train, bus and ferry connections in Italy and a number of its neighbouring countries. It is complemented by the Viaggiatreno tool for real-time traffic monitoring. It has 3 million daily visits."

'innovative ideas' category:

"The journey planner idea **Byebyehello**, presented by Penelope Ventures GmbH, convinced the jury with its many innovative elements and a strong team of stakeholders that could make this vision a reality. The company intends to launch the planner in May 2012, starting in Germany".

“The journey planner idea **Mytripset**, presented by SNCF, appealed to the jury with an innovative use of social networks to provide content and traffic updates. It also relies on a strong team of partners. The launch is planned in autumn 2012, starting in France". All of these trip planners are still online and working, although Byebyehello changed its name to Waymate.

3.1.5 EU-Spirit (5FP)

The EU-Spirit project was aimed at developing a Europe-wide travel information system for door-to-door journeys. It was coordinated by the VBB, the Public Transport Association of Berlin-Brandenburg, Germany. HaCon, one of the leading experts for travel information software, supplied the technology. It was part of the 5th Framework Programme of the European Commission. In 2010, EU-Spirit was honoured with the LINK-Award for its excellent performance in the field of international public transport travel information.

The aim of the project was to develop a system that provides travellers with detailed travel information, including all modes of travel. Possible itineraries were to be calculated between stations or even specific addresses within Europe. Additionally, maps and fare information could be provided to the traveller.

As a result, a Meta Data EU-Spirit Network (meta-search engine) has been developed to gather information deriving from existing travel-data search engines. They are used in regional areas in Denmark, Germany, Luxemburg, Sweden, Poland and France. The service for the region of Berlin-Brandenburg (Germany) can be found online at http://fahrinfo.vbb.de/bin/query.exe/en. A pan-European solution has not been released. As the service itself is working, even with real-time information, the user-interface itself is rudimentary, although a mobile version is available. The system costs are shared by the regional providers and paid as an annual fee.

3.1.6 eMOTION (6FP)

The project eMOTION was carried out by a consortium of several European organisations and authorities from the project value chain as part of the 6th Framework Programme of the European Union. These are, for example, Tele Atlas, OneStepAhead or the Comune di Genoa. The general topic of the project was a multimodal on-trip traffic information system based on the two pillars of technical aspects and legal, organisational and economic issues.

(www.emotion-project.eu)

The objective of the project was to define all specific aspects of a possible multimodal journey planner for Europe and to deliver a basis for its deployment. This is apparently done by integrating information that derives from existing platforms. It is mentioned that pre-trip as well as on-trip information is of high interest to the traveller. The project aimed to provide recommendations regarding the development and deployment of an ICT based infrastructure for a pan-European multimodal travel and traffic information system.

The result was a prototype that went for proofs of concept in Austria and Italy. This prototype was a journey-planning platform that is able to integrate existing information services. Due to this, it is a pragmatic approach for building a multimodal travel-planning tool for Europe. As a result of the proofs of concept, the usefulness of the solution is rated as being high, although the full specifications have not been implemented in the proofs of concept. The study says that a main strength of the system is its ability for use in different situations. It also reflects many standards that are in existence. Requirements for implementing such a system are, as well as highly skilled developers, financial and legal aspects, a high quality of data.

3.1.7 Wisetrip (7FP)

Wise-Trip provides door-2-door travel planning and booking. It is intended to supply the user with real-time information about journey details such as expected or current delays as well as the carbon footprint. This project is realised by the Wise-Trip consortium, supported by the European Union as part of the 7th Framework Programme. The consortium consists of several members from Greece, the UK, the Netherlands, Italy, Russia, Belgium, Spain and Brazil.

By now (May 2013), the “enhanced Wise-Trip” web-service (www.wisetrip.travel) has been limited to interurban journey planning in Greece, Finland, Northeast England, Florence (Italy) and Hangzhou (China). While this is stated on the project´s website, the service itself is currently not available. The project though, is not yet finished, and the web service is officially running in pilot operation to be tested under real conditions.

3.1.8 i-Travel

The vision of i-Travel was to develop a system for the enhancement of defragmentation of the travel market, as the market consists of two general kinds of services. These are pre-trip planning services and booking services, which mostly cannot be connected. Therefore, i-Travel aimed for an end-to-end travel service including pre-trip planning, on-trip assistance and post-trip evaluation services for all available transport modes. The aim of the research project is explicitly not to develop a centralised platform where all information or services are made available. The report explains that this would not be possible because of technical and commercial issues. It would also not be in the interests of stakeholders who run existing services.

This project's main objective is to explore the possibilities of Service Oriented Architecture (SOA) in the travel and transportation sector. Therefore, several specific objectives have been identified. Referring to the project's website, these are:

- To describe a 'snapshot' of existing travel and transport services, technologies and stakeholders
- To identify the main traveller scenarios, and multimodal-use cases of i-Travel service platforms and requirements
- To describe main stakeholder operational and business processes and the required co-operation
- To evaluate standardised technological and architectural options for the i-Travel service platform to enable delivery of context-aware services
- To create organisational models and business tools for the i-Travel supplier community, and to begin acquisition of first community members
- To conduct a feasibility and risk assessment, and to propose a 'roadmap for seamless travel services' which lays out the milestones and development targets along the path towards deployment
- To present a 'virtual demonstration' of i-Travel results, and to identify scenarios and strategies for i-Travel demonstrations in major European cities and cities in developing countries.

The results of the completed study could not be found. (May 7, 2013), even though the project was presented on the ITS World Congress 2009 in Stockholm.
(http://ec.europa.eu/research/transport/projects/items/i_travel_en.htm, May 2013)

3.1.9 ITISS

The aim of ITISS, or 'Intermodal Traveller Information SystemS', is to provide seamless transport and seamless information for travellers. It deals with issues of European travel such as a lack of information on the first and last mile. The study explains that the importance of the topic is based on a certain increase in travel for leisure and business reasons. It also deals with economic and environmental benefits deriving from the use of public transport. Although a seamless journey might be useful for various reasons, consolidating data is very difficult due to different data standards. The project is funded by INTERREG IIIB and was launched in 2003 as part of the European Transport policy for 2010.

The objectives of the project are the simplification of gaining travel information in Europe, as the number of journeys in Europe have increased over the past years. The intention is to promote public transport by making it easier to use. Therefore, the standardisation of data in European countries is necessary. The system not only includes public transport modes, but also includes access to car parking facilities and park&ride solutions. Therefore, the studies take into account the development of dynamic car routing to optimise the allocation of P&R places.

As a result of the project, the ITISS travel portal was launched on the Internet in 2006. As a meta-search engine, it combines several pieces of information from different sources. It is meant to be expanded into other countries and to provide real-time information during the trip.

One example of the success of the ITISS project is the French regional journey planner “Destineo”, which provides travellers with detailed information in the French region of Pays de la Loire. It was awarded with the 2006 Intermodality prize.

3.1.10 IFM – Interoperable Fare Management (7FP)

The IFM project defined a roadmap for the long-term development strategy of interoperable fare management. The final report was published in December 2010. IFM was funded through the 7th EU Framework Program. The initiative included ITSO, VDV-KA, UITP, UNEW, SNCF, RATP and TÜV Rheinland.

The project was aimed towards the development of a European interoperable Fare Management solution in order to facilitate accessibility to Public Transport in Europe. Its main objective “is to provide travellers with shared types of contact-less media throughout Europe". These types of media may be used as a ticket for different transport modes, and encourage travellers to conduct a modal shift by facilitating switching between transport modes. To achieve this goal of smartcards that may be used all over Europe, the IFM project developed a road map towards an EU-wide concept for interoperable fare management as a common model for the EU.

Concluding the work of IFM-project, the initiative explains that a Europe-wide interoperable Fare Management might be possible if a cooperative EU-IFM Alliance were to be set up. This alliance would be the brand owner of EU-IFM, and would manage its implementation. The alliance would also be in charge of following the road map developed by the IFM project. Therefore, the platform would be open and non-proprietary, and would benefit from scale economics.

3.1.11 Integrated Ticketing on Long Distance Passenger Transport Services

The study was funded by the European Parliament and launched by TRT Transporti e Territorio and MKmetric. It was published in 2012. The study deals with the general problems of integrated ticketing. Therefore, the study provides an overview of the current challenges in the market, and analyses several case studies which are supplemented by stakeholder interviews regarding air-rail integration and rail-rail integration as well as a SWOT analysis of future trends.

The study “deals with the issue of integrated ticketing on long distance passenger transport services. By presenting and assessing selected practices in this domain, it highlights the major policy and technical challenges and offers recommendations for further EU action on this issue" (final report, p.5) It also provides the reader with a current overview of existing interoperable ticketing solutions and related issues. Therefore, the study analyses case studies such as Rail&Fly and Thalys-ICE. The study also took stakeholders’ perspectives into account.

As a result, the consortium provides several recommendations for the EU, either to set up regulations or to create incentives for the players.

One general suggestion is to improve the quality and quantity of (real-time) information for passenger transport in Europe. Additionally, it is recommended to support integrated rail-air tickets with regard to the modal shift, although this is dependent on infrastructure issues like the availability of high-speed train stations at airports.

Regarding rail-rail integration, further deregulation and opening up of the market may increase players’ motivation to develop integrated ticketing and fares. During this process, it is important to bear in mind that passenger rights must be secured to a high level through the whole distance of the journey.

Regarding harmonisation in the rail sector, the study recommends further support with the implementation of TAP-TSI. This might also be seen as an advantage for the implementation of ticket integration. It is essential to promote intermodal mobility and to increase traveller awareness about intermodal travel options, even on long distance trips. This could be achieved by improving the branding of travel modes or the according service, or by carrying the information issue to EU level.

3.1.12 TAP-TSI

TAP-TSI is a project “on the technical specification for interoperability relating to the subsystem 'telematics applications for passenger services' of the trans-European rail system”. It was launched by DG Move of the European Commission and eventually formally adopted in 5 May 2011. It has been in force as the Commission Regulation (EU) 454/2011 since 13 May 2011.

According to the Commission Regulation, the TAP-TSI objectives are widely spread across the topic of passenger information systems. Article 2 explains that detailed IT specifications have to be established in order to develop and deploy a data exchange system for trans-European rail travelling. This system should include a wide range of functionalities such as pre-trip and on-trip information, reservation and payment, luggage management, ticketing and management of intermodal connections.

Part of the regulation is the obligation for railway operators to make their timetable data publicly available, also for third parties such as other rail operators. As part of this obligation, railway operators have to make sure that timetable data is always accurate, up to date and available at least for twelve months after data expiration.

Regarding ticketing, the objectives of TAP-TSI includes the fact that every kind of ticket, whether reservation or non-reservation tickets, open tickets or special fare tickets must be available through every European rail operator.

As the objective of TAP-TSI in general was the definition of standards for providing information and issuing of tickets in the European Railway industry, its results became an official Commission Regulation. The project’s approach was based on the use of widely available technology. According to the Master Plan from 28 April 2013, phase 1 of the project’s implementation is currently running. The following figure shows the project plan.

TAP TSI obligations only cover international train journeys in Europe.

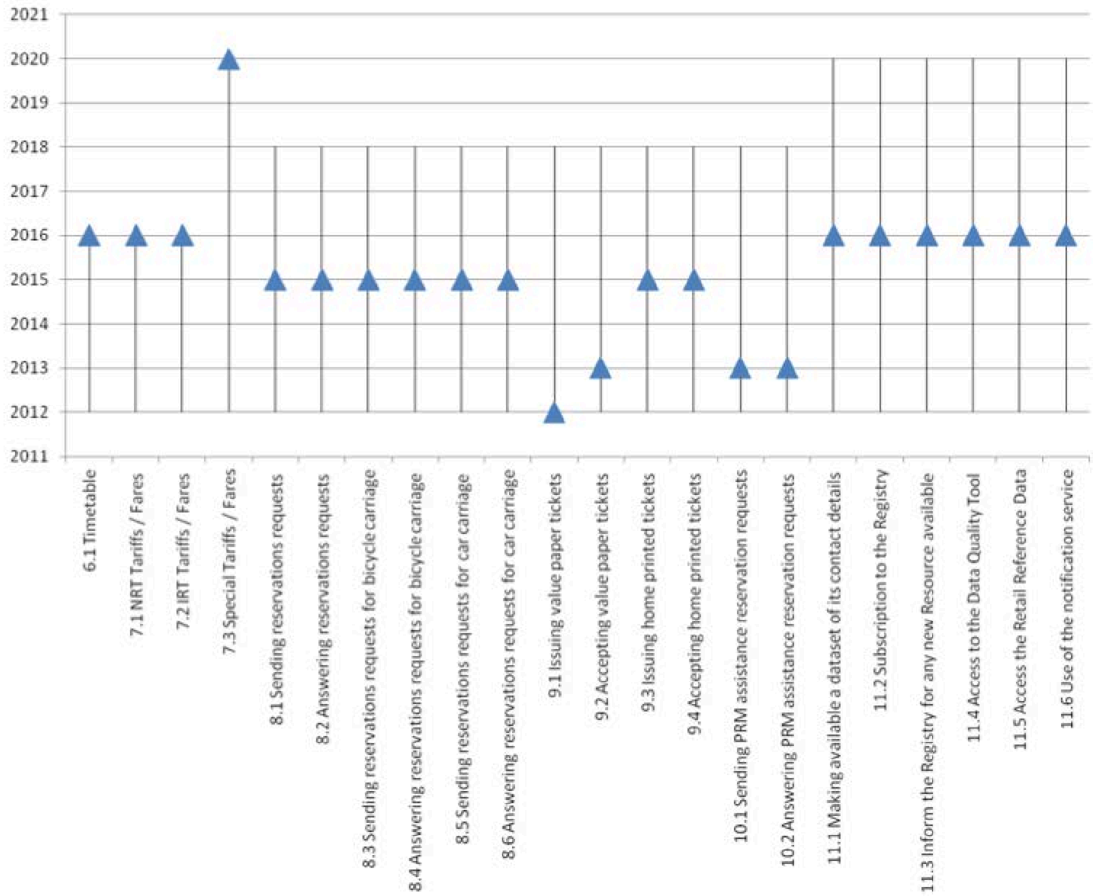

Figure 5: TAP-TSI Implementation Plan
Source: Own figure.

3.1.13 EUROPTIMA (Tickego)

The project is run by a consortium of Calypso, Transdev, Mercur, Stao72, Otlis, Card4B and MTA and funded by the Seventh Framework Programme of the European Commission. It was launched in 2010 and will probably be finished in 2013. During the project, a Smart ticketing solution was developed and deployed in three demonstration sites in Europe. These are the Lisbon Aero-Bus and Lisbon Parking and Pedestrian Zones in Portugal as well as Le Mans Bus in France.

The objective of the project is to develop a system for a pan-European smart ticketing solution with low implementation costs that is easy to use for both the traveller and the operator. Therefore they choose hardware that is already available, like NFC-enabled smartphones and tablet computers.

Other objectives are operational sustainability through reusable software and hardware, as well as improved service through lower access barriers.

Although the project is not yet completely finished, the EUROPTIMA Consortium has developed a system that runs on standard Smartphones and tablet computers. It works using paper tickets, magnetic tickets and NFC-enabled smartphones, and can therefore provide easy access to public transport tickets. By using widely available hardware, the implementation costs and time expenditure are very low. According to the video presentation of the project, it takes the operator only 2 hours to install the new system in a public transport vehicle.

As this project is completely focused on ticketing, it does not deal with the information issue, but provides valuable input on Smart Ticketing. The solution developed by the consortium may also be used for access to car-sharing services and car parking.

3.1.14 Optitrans (FP7)

Optitrans is a project for an "Optimised Transport System for Mobile Location Based Services". It was coordinated by the Institute of Informatics & Telecommunications NCSR Demokritos, Greece, in cooperation with the project partners Telefonica, Spain, Avego, Ireland and the Empresa Municipal de Transportes de Madrid, Spain. Test cases have been deployed in London and Athens. The project was part of the 7th Framework Programme of the European Union.

The aim of the project is to supply a solution for the optimization of personal transport, not aimed just at travellers, but also at commuters. Therefore, it is not purely orientated towards publicly available transport modes, but also towards drivers of privately owned cars, and integrates car-pooling into its travel proposition. The system is intended to be based on location based services. This means that it supplies the best route options based on the current location of the traveller without the necessity of typing in the start address.

The result of this project is a multimodal journey planner for Athens, Greece. Unfortunately, the London planner is out of order. However, the journey planner for Athens provides the user with trip information using several transport modes such as metro, taxi/car, tram etc. A Smartphone app is also available.

3.1.15 Co-Cities

Co-Cities is a traffic management project for urban areas, coordinated by AustriaTech Ltd. and run as a collaboration between several partners from throughout Europe. The project started on 1 January 2011 and will probably be finished at the end of 2013. Pilot projects are running in the European cities of Bilbao, Munich, Florence, Prague, Reading and Vienna.

The project is focused on the development of a mobile reference platform for urban areas in order to establish cooperative mobility services. Therefore, mobile users and travellers provide the system with information about their location and travel. In this way, a "dynamic feedback loop" is generated which provides a regular supply of real-time traffic data, and helps to set up a cooperative traffic information system based on an In-Time Commonly Agreed Interface.

The results of the project have not yet been published, as the project is still running.

3.1.16 EDITS

EDITS stands for European Digital Traffic Infrastructure Network, and is an EU project led by AustriaTech, a Vienna based technology company. It is running since 2012 and will be finished in 2014. The project analysed existing solutions and database systems as a background for the development possible specifications in order to harmonise the structures of existing systems.

The project aims at “enabling interoperable and multimodal traveller information services based on harmonized traffic data and information gathered on a transnational level.” To achieve this, existing traveller information systems are to be improved to provide users with information before and during their travel.

In the case of the journey planning environment, the conclusions in the report tell us that real-time integration adds a certain value to the system. Final results are not yet available, as the project is still running

3.2 General Evaluation of Previous Studies and Projects

Studies and projects launched and/or supported by the EC so far paint a picture of what kind of recommendations can be given on the subject of a pan-European multimodal journey planner. Nevertheless, not all recommendations may become reality due to various factors. Therefore we will try to provide a brief evaluation of the different findings in previous projects and studies.

3.2.1 Information / Data Access

The studies mentioned in 3.1 indicate that access to information is generally the key to a multimodal journey planner. Technically, using data translators to merge different data formats is not an issue - but it might prove an issue with some transport operators. Access to information, or information in general, might be assessed as an asset that needs to be exclusive by its owner. For a multimodal journey planner, open data access to transport operators’ schedules and real-time data is a key factor for obtaining success. If data access cannot be ensured throughout all European Transport Operators, the development of a multimodal journey planner might not be possible.

3.2.2 (Smart) Ticketing

Smart Ticketing using RFID and NFC technology via Smartcards and Smartphones seems to be the most common solution used in public transport so far. Several projects have worked along these lines. In particular the system developed by Tickego seems to be the most useful solution, as implementation costs are quite reasonable. However, a non-competitive alliance, like the Smart-Ticketing Alliance, for management of the implementation of interoperable fare management and a smart card system for Europe, might prove difficult in terms of the self-determination of European Transport Operators.

3.2.3 Payment

Regarding the fact that most Smartcard solutions in Europe are local solutions, and interoperability is not provided, another approach might be useful. In London, contactless credit cards may be used as a replacement for travel smart cards. As credit cards do have an international standard this might prove a viable option for a European solution. For medium and long distance travel, which can be purchased online, several different payment methods like credit card or PayPal would be possible.

4 Customer Needs / Demand Side (WP 2)

A pan-European Multi Modal Information and Ticketing System is to serve customer needs and facilitate travelling across Europe. Therefore, the following chapter provides an analysis of the demand and customer needs. The analysis follows the definition of multimodality as described above, where it is defined as a door-to-door trip covering different modes within one single journey.

The analysis is based on findings from transport Economics literature, from previous studies on this topic, and an online survey. The work package derives the need for a Multi Modal Information and Ticketing System from the perspective of travellers and its quantitative relevance. Therefore work package 2 is structured according to the following research plan:

The first subchapter analyses statistics for European travel activities. The analysis allows the segmentation of trips according to several characteristics as movement patterns (trip distance, internationality), frequented routes, trip complexity (i.e. the usage of multimodality, and trip purpose). Moreover, outlooks are given on the growth of travel demand in order to evaluate the prospects for a Multi Modal Information and Ticketing System. In addition, travel habits of Europeans are investigated, including pre-trip and on-trip behaviour. This analysis gives insights into the relevance of a Multi Modal Information and Ticketing System.

In order to successfully discuss the influence of a MMITS on customer travel demand, the following chapter starts with an analysis of the determinants of modal choice. These criteria will help to understand travellers' obstacles and expectations of multimodal trips. In addition, this discussion helps to explain the European attitude towards a MMITS.

The last chapter of WP 2 discusses possible implications of a MMITS with regard to changes in travel demand. It is discussed whether a MMITS can have effects on the modal split by making travellers change from the car to another – perhaps more environmentally friendly – mode of travel. In turn, the question is addressed as to whether the MMITS can cause a quantitative increase in demand by facilitating travelling in Europe.

INFO-BOX: ONLINE SURVEY

The analysis is based on findings from transport Economics literature and from previous studies on this topic, and an online field. For reasons of time and financial framework conditions a study among all European countries (EU28) was not feasible. Therefore, a selection of European countries had to be conducted. The study was conducted in six European countries with 695 respondents: Czech Republic (n=115), France (n=113), Germany (n=120), Italy (n=119), Poland (n=110), and United Kingdom (n=118). The average age of the respondents is 45.5 years. 52.6% of the respondents are male, 47.4% female. 98.1%.

The countries were selected according to the following criteria to include different cultural regions and geographical locations. The Czech Republic and Poland represent Eastern European countries. Those two countries were chosen to also reflect of smaller and larger Eastern European countries. Additionally, the Czech Republic already has some experience with systems that are similar to a MMITS covering all available modes. In consequence, respondents from the Czech Republic might be able to add different perspectives than those without any experience. France represents a centralised transport infrastructure network. It is a country located in Western Europe with access to the sea. Germany was chosen to represent countries in Central Europe. It can be assumed that countries with a centralised geographical location have different needs than outermost regions or islands. Italy was chosen as a representative for Southern European cultures and attitudes to transport solutions. The United Kingdom represents the island position in Europe. The questionnaire was published in the national languages in order to avoid problems of understanding.

To make sure that the respondents have a certain level of experience with travelling and are able to answer the questions reliably, the respondents had to have travelled at least once during the past twelve months (excluding commuting). The complete questionnaire can be found in the appendix.

Limitations of the Study

However, the study has several limitations that have to be taken into account before analysing the data and interpreting the results:

The sample consists of only 695 responds compared to a basic population of around 500 million Europeans. In consequence, the study cannot be representative for all Europeans and their socio-demographic segmentation. However, statistical theory assumes that a sample of 100 respondents or more provides statistically reliable results. This means that a follow-up survey is likely to produce similar results if the conditions are consistent. Therefore, with a sample of 695 respondents and more than 100 respondents per investigated country, statistical reliability can be assumed.

Additionally, it has to be considered that not all 28 EU-countries were included but six representatives were chose. These representatives are clearly not able to fully reflect the different European cultural, geographical, infrastructural or demographical framework conditions. Nevertheless, they provide useful insights and tendencies that help to evaluate potential customers' attitude towards a Multi Modal Information and Ticketing System.

4.1 Travelling in Europe

The travel market in Europe shows a strong demand for mobility. Therefore, the following chapter provides an overview of the quantitative developments in the European travel market. The modal split gives an impression of the most frequently used modes. In the next step, the trips are analysed according to several characteristics such as internationality and the combination of modes. The analysis of movement patterns helps us to understand where the most important hubs can be found in Europe. The investigation of who travels when, where and why provides an impression of possible traveller segments. Finally, customers' trip behaviour is analysed.

When analysing travel data, it has to be taken into account that the data are highly diverse, and suffers from a lack of comparability and availability. This lack of data makes deeper analysis impossible in some cases. Further studies to gain new detailed information would be necessary, but lie outside the scope of this project. This study therefore only focuses on the available data.

4.1.1 Traffic Volume

An analysis of the development of traffic volume has clearly shown that Europe is marked by an increasing demand for personal mobility. Traditionally, the traffic volume is presented in passenger kilometres[1]. The following figure provides an overview of the development of traffic volume in Europe.

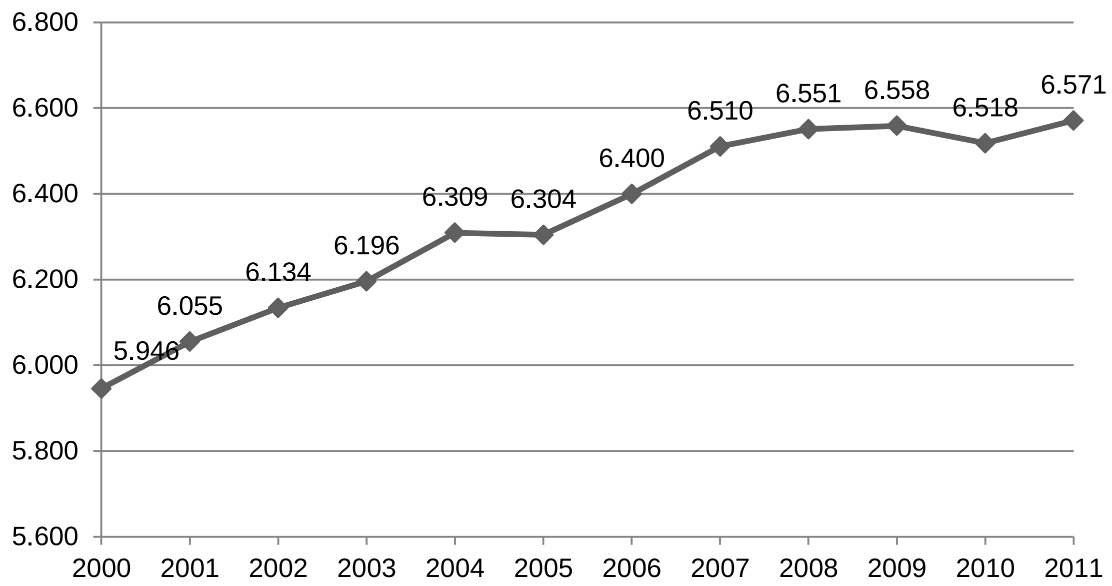

Figure 6: Traffic Volume in Billion pkm for EU27
Source: Own illustration based on the European Commission Statistical Pocketbook (2013).

[1] Passenger kilometres = number of passengers * kilometres covered.

The passenger kilometres have increased steadily over the years. From 2000 to 2011, an increase of 9.5% from around 5,946 billion passenger kilometres to 6,571 billion passenger kilometres can be observed. The traffic volume shows a slight decrease in 2010. The decline can be seen as a consequence of the economic crisis in Europe. However, the passenger transport sector seems not to have suffered from the long-term consequences, as a traffic volume of 6,571 billion passenger kilometres is estimated for 2011.

In addition, it can be seen that the distance travelled per year and person generally remains fairly constant, with only small outliers. If an upwards trend for the traffic volume is assumed, a rising number of trips are also implied.

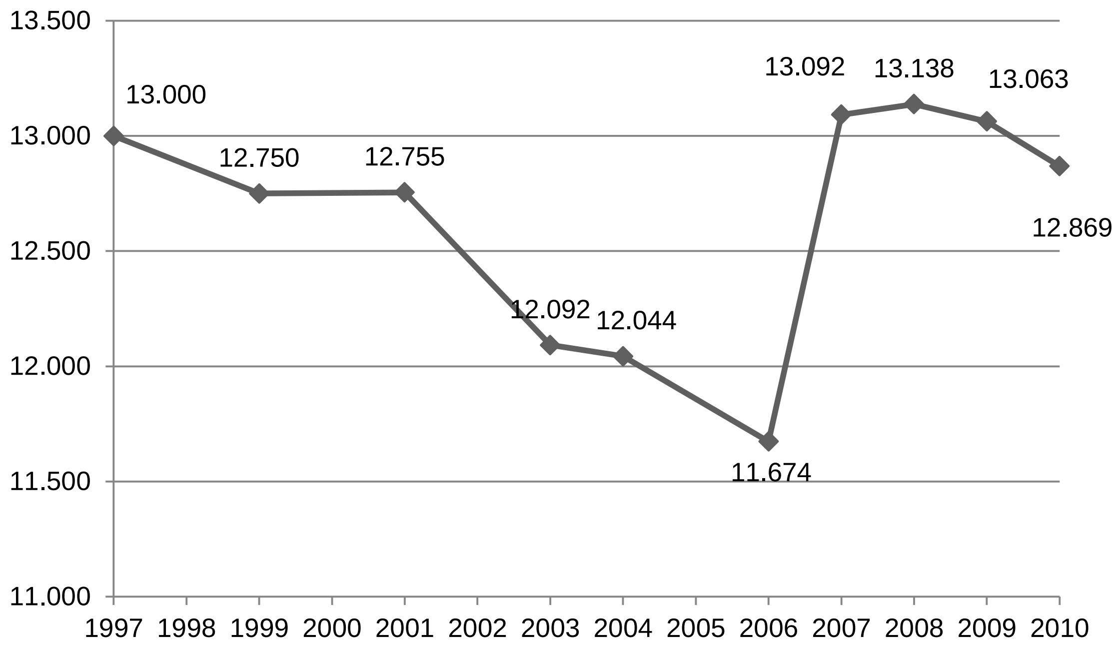

Figure 7: Development of Travel Distance in km per Person and Year in Europe
Source: Own illustration based on EU Transport in Figures 2000 to 2012.

The development of the traffic volume shows that the travel market is subject to slight cyclical fluctuations. In general, the travel market is increasing. A Multi Modal Information and Ticketing System might benefit from this development, as a growth in travel demand also increases the number of potential users of a MMITS.

4.1.2 Modal Split

The modal split provides information about the distribution of traffic volume on the respective modes of transport. The following figure shows the percentage of passenger kilometres carried out with a certain transport mode. The individual traffic (car and two-wheelers) constitutes the main part of the intra-EU traffic volume, which totalled 75.6% in 2010. Air traffic lies well below this figure in second position with a share of 8.2%. About 524.2 billion passenger kilometres were travelled by aircraft in 2010. Therefore, the traffic volume for aircraft is slightly higher than the rail traffic volume, which totals about 6.3% of the modal split in the European Union. Buses and coaches, in contrast, account for 7.9% of the total traffic volume. Local traffic (tram and metro) only constitutes 1.4%. However, this can be explained by the short distances that are covered using local public transport.

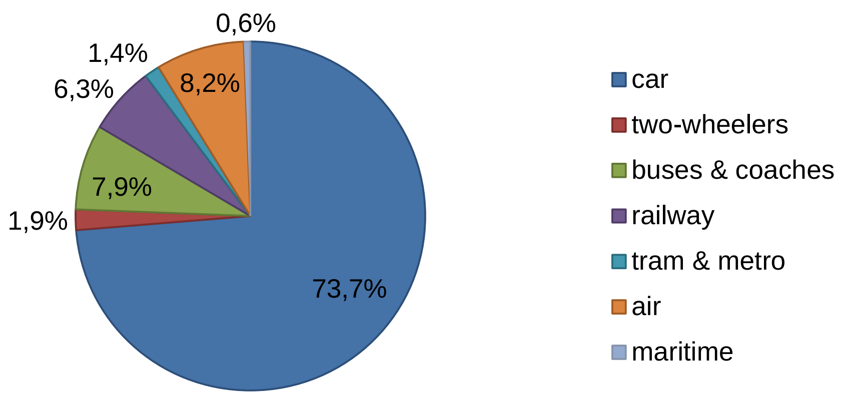

Figure 8: Modal Split in EU27 in 2010 Based on pkm
Source: European Commission (2012).

In general, it can be stated that the modal split does not vary strongly between European countries. In all EU27 countries, the car represents the major proportion of traffic volume today.

Looking at the past development of the modal split in passenger kilometres as indicated in the following figure, one can notice a slight but constant increase in the proportion of passenger kilometres travelled by car. A similar development can be found for air traffic.

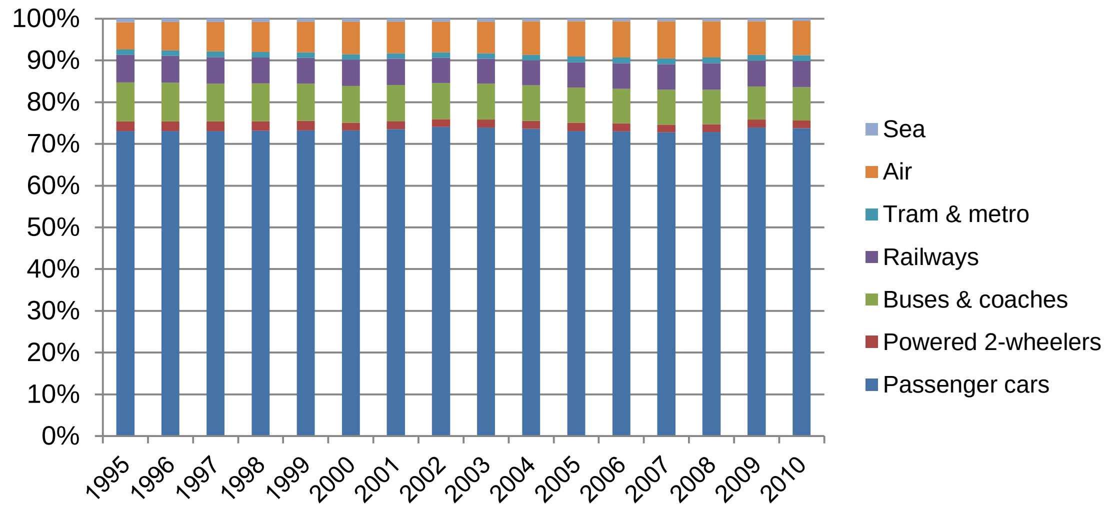

Figure 9: Historic Development of the Modal Split in EU27 Based on pkm
Source: European Commission (2012).

The distribution of passenger kilometres provides us with important insights into transportation performance. However, it has to be taken into account that the traffic volume expressed in passenger kilometres does not indicate the frequency of mode usage. As passenger kilometres are the product of passengers and the kilometres covered per traveller, it can then be assumed that passenger kilometres strongly underestimate the frequency with which, for example, local transport is used, because it is construed for short distances. The usage frequency of aircrafts, in contrast, is overestimated as they travel long distances. However, reliable data on the number of passengers carried is often incomplete, and not available for all modes. Data can be found for rail and air traffic. The number of passengers carried by these two modes in 2010 is shown in the figure below. The Czech Republic, France and Malta had to be excluded because of missing rail data.

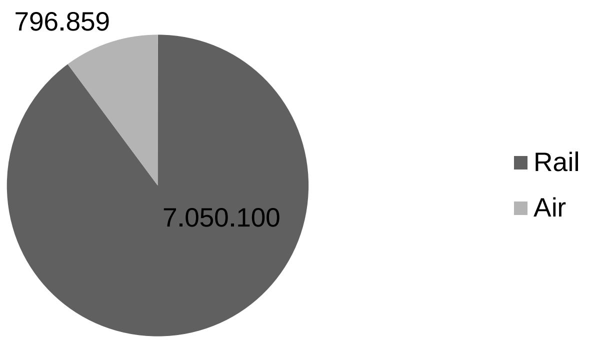

Figure 10: Ratio of Rail-Air Traffic in EU27 (Except CZ, FR, MT) Based on Passengers Carried
Source: EUROSTAT (2012) and the European Commission (2012).

It is worthy of note that – when returning to the modal split in passenger kilometres – air traffic has been dominant compared to rail. This perception changes in the figure that represents the rail-air traffic ratio, which shows that the number of passengers carried by rail is about nine times higher than by air. This ratio reveals the importance of rail on the demand side of the traffic sector.

A more detailed analysis of the relation between the modes and travel segments is conducted in the following chapters.

4.1.3 Movement Patterns

Movement patterns provide information of how and where Europeans move. The Interconnect Study of 2011 already pointed out that the database for these kinds of analyses is quite incomplete, and often out-of-date, making comparisons almost impossible. However, they at least allow the interpretation of tendencies.

4.1.3.1 Short and Long Distance Trips

First of all, a definition of short and long distance trips is necessary. Definitions can vary depending on countries and studies. However, the most common definition is that long distance trips cover 100 km or more. In consequence, short-distance trips have to be shorter than 100 km. Furthermore, we can distinguish between short distance trips with urban or regional transit. (Amadeus, 2012; INVERMO, 2002)

Data on this issue is incomplete, and strongly depends on the survey method used. The following figure shows the number of long distance trips per person and year. Depending on the survey method, different results are observed. Final and definite conclusions on the proportions of long and short distances cannot be made. However, general patterns in the investigated countries become clear. It can be seen that distances of between 100 and 200 km are the most common in all countries. When comparing Switzerland and Great Britain, significant differences become evident for distances above 600 km. Whereas in Switzerland a significant number of trips still covers more than 600 km, the same range of distances makes up only a small proportion in Great Britain – irrespective of the method used to investigate travel behaviour.

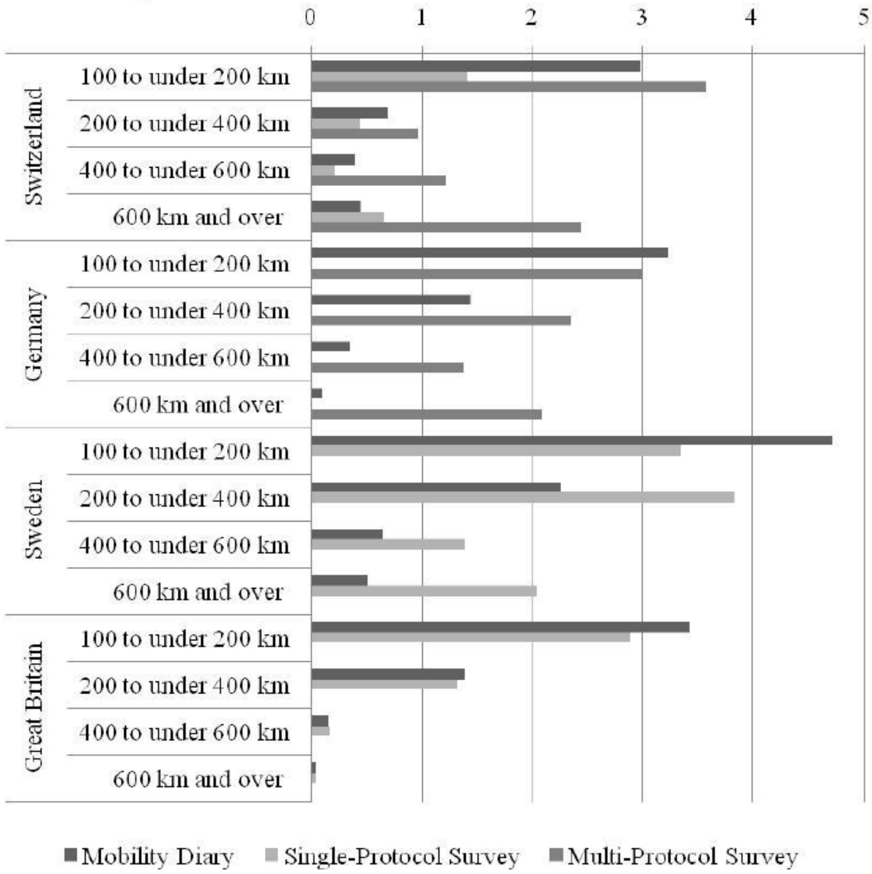

Figure 11: Long Distance Travel Demand by Distance Band as Measured with Instruments in Different European Countries (Journeys per Person per Year)
Source: Kuhnimhof/Last (2009).

Short distance trips often refer to daily trips such as the route to work, shopping trips, etc. Statistics show that people make around three trips per day (Eurostat, 2007). In consequence, the number of short distance trips is significantly higher than the number of long distance trips. The following figure supports this assumption.

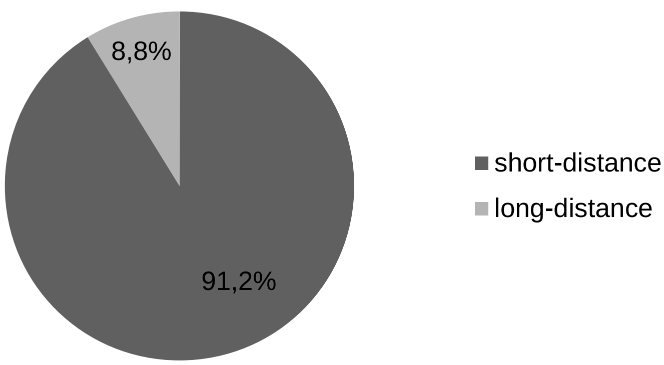

Figure 12: Proportion of Short and Long Distance Trips in NUTS3
Source: Interconnect (2011).

Going more into detail with long distance trips, the following figure shows a modal split for long distance trips measured in passenger kilometres.[2] It becomes clear that aircraft account for the largest proportion with 56%. Private cars still account for 38%, whereas rail with 4% and inland navigation with 2% constitute a minor proportion of the total modal split.

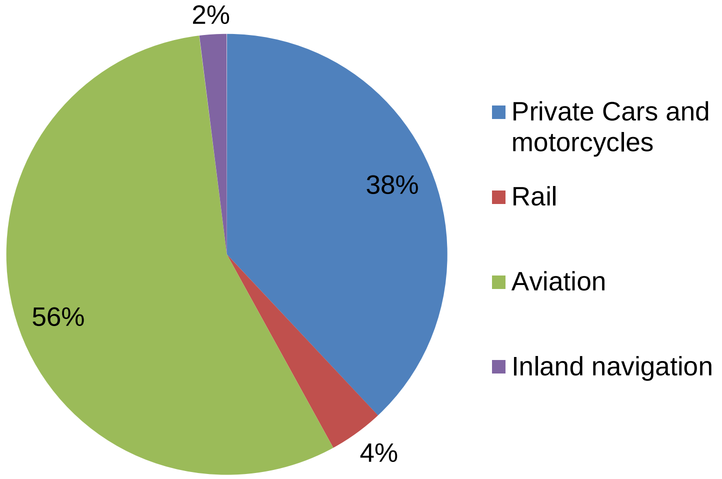

Figure 13: Modal Split in Long Distance Trips Based on pkm
Source: European Parliament (2005).

Critically, it can be argued that this presentation includes trips of 150 km as well as of 600 km or even longer. The KITE project (2008) conducted a more detailed segmentation of distances. It shows that distances of between 100 and 400 km are mostly covered by car, and second-most by rail. Air traffic accounts for a smaller proportion at these distances. For distances above 400 km, aircraft as well as trains gain in importance, whereas the car is used less.

It has to be taken into account that aircraft are the intuitive mode of transport for long distance trips. Rail, in contrast, can be used for all distances. Therefore, the following figure shows that in almost all European countries the rail traffic volume (in terms of passengers carried) is mainly created through short distances (around 90%).

The use of taxi or car sharing schemes have not been considered in this study. Further studies should include the role of this transport mode in the multimodal reality of the future.

[2] Long distance trips in this project were defined as trips covering at least 150 km.

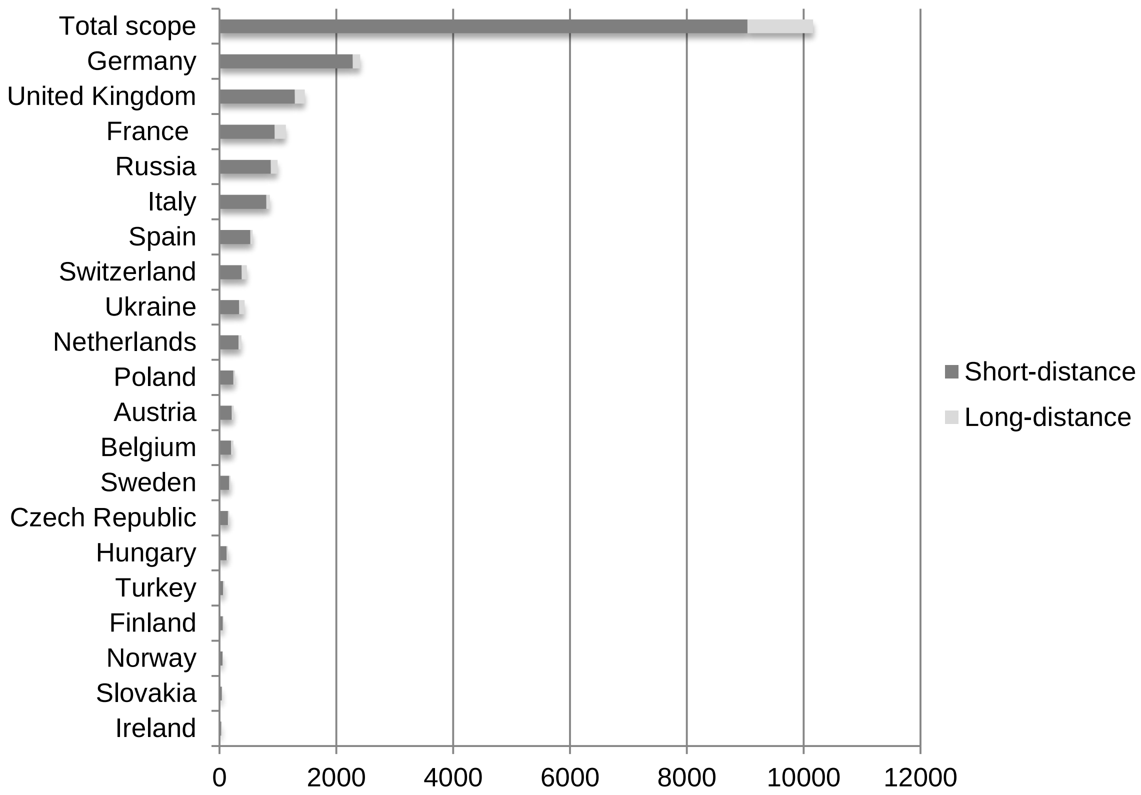

Figure 14: Short vs. Long Distance Rail Market by Country in 2011 (Passenger Volume in Millions)
Source: Amadeus (2012).

A segmentation of long distance trips above 400 km with regard to the trip purpose shows that holidays are the most frequently named purpose among Europeans, whereas business and other private trips play a minor role. It was shown that two out of three long distance trips above 400 km are undertaken for holiday reasons. (KITE, 2008)

4.1.3.2 National and International Trips

As the next step, a distinction between national and international trips has proven helpful. A generally valid conclusion on the distribution of national and international trips across all modes cannot be made, as they are used quite differently. The following figure provides an overview of the distribution of national and international flights. It can be seen that national trips measured in passengers carried account for around 21% of the total number. Intra-EU27 routes, in contrast, make up the largest share with 42%. International flights outside of the EU at least provide 38% of the total number of passengers carried.

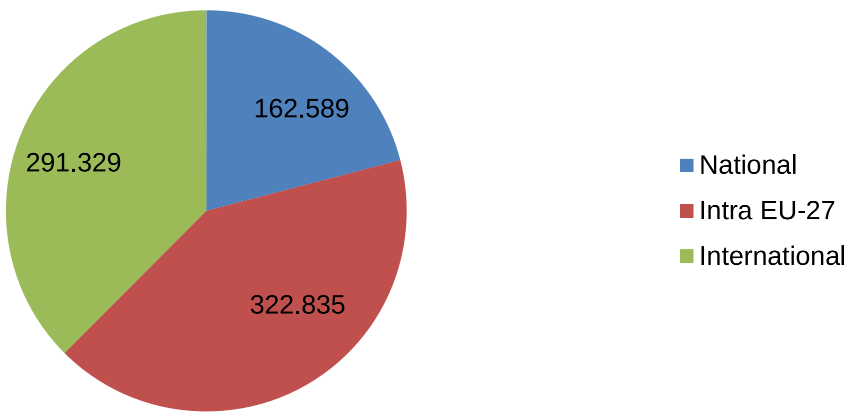

Figure 15: Passengers Carried Nationally and Internationally by Air in Thousands in 2010
Source: Eurostat (2012a).

As indicated in the following figure, a different picture is revealed when taking a look at the distribution of national and international rail trips. International trips make up only 1.3% when measured in passengers carried.

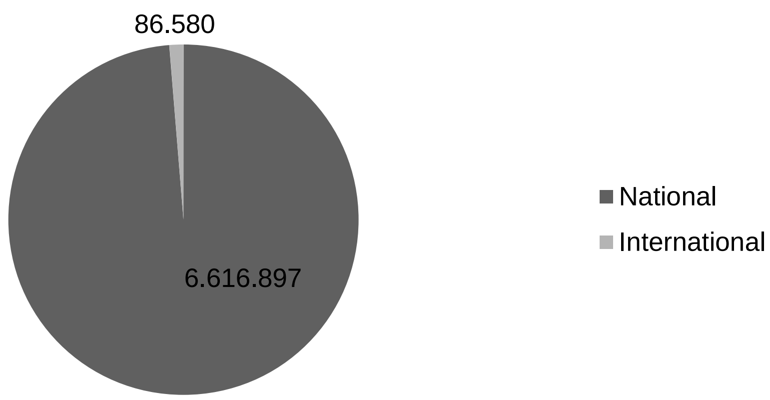

Figure 16: Passengers Carried Nationally and Internationally by Rail in Thousands in 2010
Source: Eurostat (2012).

A more detailed look at long distance trips by rail provides a similar picture; therefore it is suggested that trains currently do not mainly compete with aircraft on international routes. Railways, however, can be a substitute for air traffic on domestic trips (up to 500km). This is illustrated by the following figure.

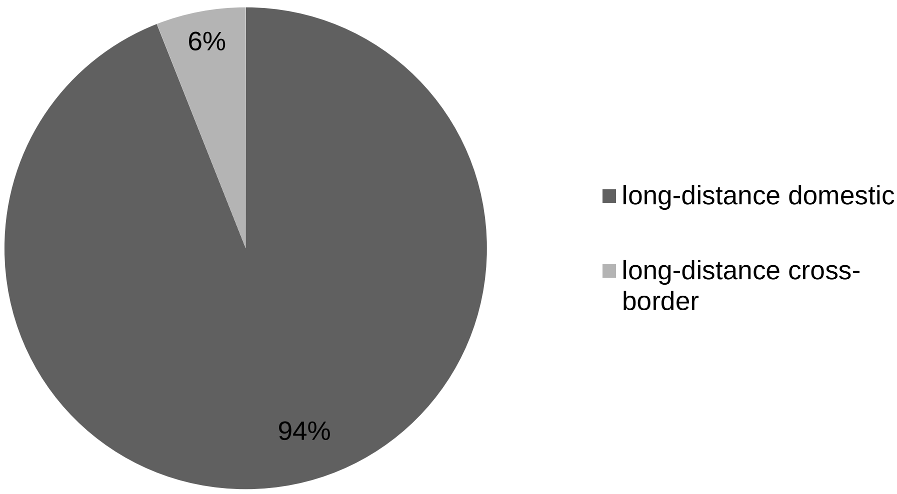

Figure 17: Rail Traffic Volume in Passengers Carried on Long Distance Trips in 2011
Source: Amadeus (2012).

In conclusion, this means that rail trips are mainly domestic trips. Here, more than six billion passengers are carried (see figure 16). When comparing this figure to the number of passengers carried by air on domestic trips (162 million passengers, see figure 15), it becomes clear that rail is the dominant mode for domestic trips. On international trips, the ratio changes: 323 million passengers (figure 15) were carried cross-border by plane compared to 87 million passengers (figure 16) by train.

4.1.4 Frequented Routes

After having analysed the general patterns, the next step is to find out where Europeans travel to and what the most frequented routes are. This provides us with a more differentiated picture, and reveals further important travel patterns. Given the assumption that the introduction of a MMITS is a step-by-step process, these concrete patterns help to identify the most important geographical areas where a MMITS can be utilised most in its initial phase.

Taking a look at the passengers travelling by aircraft, the data shows that in 2010 around 924 million travellers used aircraft. More than half of the air traffic volume in the EU27 is generated at departure airports in four countries: Spain, the United Kingdom, Germany and

Italy. Altogether, they generated around 525 million passengers in 2010. When including France, 65% of all aircraft passengers within the EU27 depart from only five countries.

Reporting country	Number of passengers departed in 1000
ES	201,810.20
UK	128,429.80
DE	107,134.70
IT	87,847.70
FR	77,302.80
CY	46,870.10
SI	42,258.80
NL	27,815.40
EL	27,211.50
SE	21,707.00
PT	20,790.20
IE	20,323.70
DK	17,839.50
AT	16,280.30
BE	15,381.40
PL	14,274.10
FI	11,142.10
CZ	8,614.00
RO	7,664.50
HU	6,266.90
BG	4,813.50
LV	3,395.50
MT	2,969.30
LT	1,933.80
SK	1,545.70
LU	1,267.30
EE	1,111.30
Total	**924,001.10**

Table 1: Air Traffic Volume in EU27 in 2010
Source: Own calculations based on the European Commission (2012).

From these five countries we can derive the most frequented routes in the EU. The following table gives an overview of the most frequented destination countries (by aircraft) for the five previously identified countries, comparing them with the number of passengers carried on domestic routes. It is worthy of note that in Germany, France and Italy, national routes are the most frequented ones. In Spain and the United Kingdom, national routes are the second most frequented routes. The most frequented route overall is from Spain to France.

Reporting Country	Number of Passengers in 1000 on the Most Frequented Route (International Destination EU)	Number of Passengers in 1000 on the Second Most Frequented Route (International Destination EU)	Number of Passengers for National Flights in 1000
DE	20,892.70 **(ES)**	11,067.10 **(UK)**	24,164.50
ES	77,777.90 **(FR)**	28,845.80 **(UK)**	38,227.20
FR	10,029.10 **(UK)**	8,511.60 **(ES)**	25,892.90
IT	10,613.00 **(ES)**	10,326.10 **(DE)**	29,939,90
UK	28,705.40 **(ES)**	10,064.70 **(FR)**	20,977.50

Table 2: Overview of the Most Frequented Air Traffic Routes in the EU27
Source: European Commission (2012).

The following figure highlights the most important country connections.

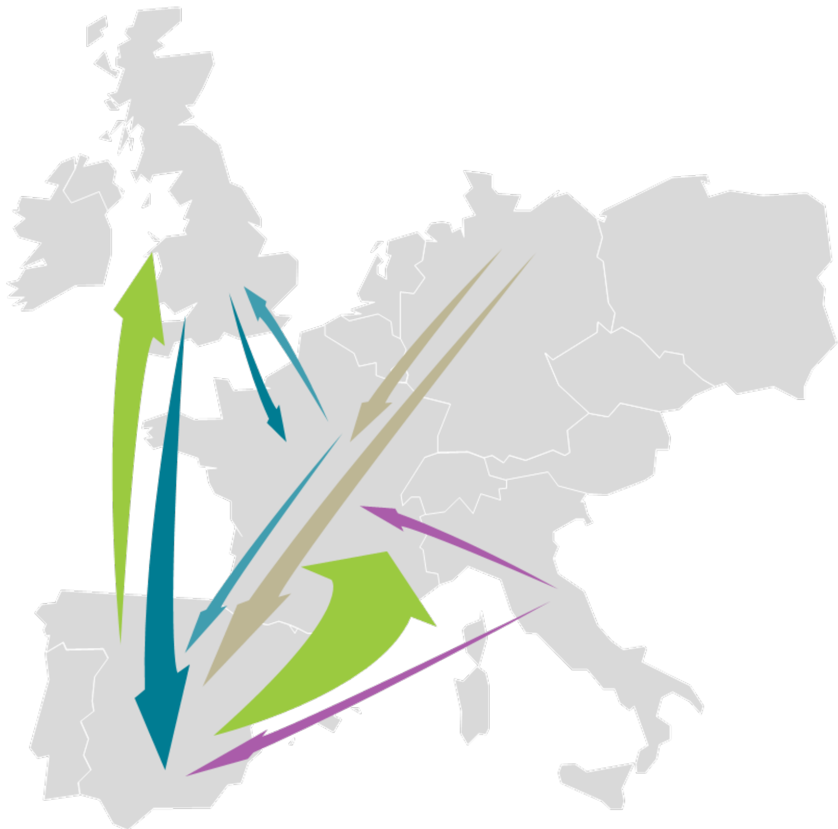

Figure 18: Illustration of the Most Frequented Country Connections of 2010
Source: Own illustration.

Taking a look at other European countries, we find a different picture. In particular in smaller countries like Belgium, Cyprus or Malta, we find almost no domestic air traffic or even none at all, as the distances are too short and can easily be covered by train. Only Denmark, Greece, Poland, Portugal, Romania, Finland and Sweden still show a relatively high national air traffic volume.

Furthermore, the importance of national flights is confirmed by the analysis of the most important airports for intra-EU flights. The following table shows that in 2010, the first twelve positions were occupied by national flight routes. The most important route in the EU was Barcelona-Madrid. This route was used by more than 3 million passengers in 2010. The most frequented routes in Germany were Hamburg-Munich and Frankfurt-Berlin with about 1.7 million, respectively 1.6 million passengers, in 2010. In France, Toulouse-Paris and Nice-Paris were most frequented. In Italy, most passengers were carried between Milan and Rome.

In total, more than 54 million passengers were carried on the following forty most frequented routes. The fifteen routes ranked first already account for almost half of the passengers (that is 26 million passengers).

Ranking	**Airport Pairs**	**2009**	**2010**	**Change 09/10**
1	Barcelona – Madrid / Barajas	2,942	3,084	4.8%
2	Toulouse / Blagnac – Paris / Orly	2,305	2,194	-4.8%
3	Nice / Côte d'Azur – Paris / Orly	2,139	2,105	-1.6%
4	Catania / Fontanarossa – Rome / Fiumicino	1,636	1,718	5.0%
5	Madrid / Barajas – Palma de Mallorca	1,764	1,699	-3.7%
6	Hamburg – Munich	1,628	1,653	1.5%
7	Frankfurt (Main) – Berlin / Tegel	1,552	1,610	3.7%
8	Munich – Berlin / Tegel	1,519	1,580	4.0%
9	Las Palmas / Gran Canaria – Madrid / Barajas	1,549	1,554	0.4%
10	Düsseldorf – Munich	1,481	1,534	3.6%
11	Barcelona – Palma de Mallorca	1,514	1,533	1.3%
12	Milano/ Linate – Rome / Fiumicino	1,721	1,523	-11.5%
13	London / Heathrow – Dublin	1,620	1,493	-7.8%
14	Frankfurt (Main) – Hamburg	1,203	1,481	23.1%
15	Palermo / Punta Raisi – Rome / Fiumicino	1,372	1,407	2.5%
16	London / Heathrow – Amsterdam / Schiphol	1,510	1,333	-11.7%

17	Tenerife Norte – Madrid / Barajas	1,343	1,320	-1.7%
18	London / Heathrow – Paris / Charles de Gaulle	1,339	1,300	-2.9%
19	Madrid / Barajas – Rome / Fiumicino	1,139	1,269	11.4%
20	Frankfurt (Main) – London Heathrow	1,195	1,260	5.5%
21	London / Heathrow – Edinburgh	1,306	1,245	-4.7%
22	Paris / Charles de Gaulle – Rome / Fiumicino	1,322	1,191	-9.9%
23	Athinai / Eleftherios Venizelos – Thessaloniki	1,201	1,172	-2.4%
24	Madrid / Barajas – Lisboa	1,067	1,167	9.4%
25	Copenhagen / Kastrup - Stockholm / Arlanda	1,076	1,166	8.4%
26	Cologne-Bonn – Munich	1,162	1,133	-2.5%
27	Madrid / Barajas – Paris / Orly	1,137	1,106	-2.7%
28	London / Heathrow – Madrid / Barajas	1,127	1,093	-3.0%
29	Amsterdam / Schiphol – Madrid / Barajas	943	1,076	14.1%
30	Amsterdam / Schiphol – Barcelona	1,085	1,067	-1.7%
31	Copenhagen / Kastrup - Aalborg	909	1,061	16.7%
32	Paris / Orly – Pointe-à-Pitre (Guadeloupe) / Pôle Caraïbes	991	1,036	4.6%
33	London / Heathrow – Rome / Fumicino	945	1,033	9.3%
34	Cologne-Bonn – Berlin / Tegel	1,114	1,027	-7.8%
35	Madrid / Barajas –Paris / Charles de Gaulle	974	1,020	4.7%
36	Madrid / Barajas – Valencia	1,026	1,020	-0.6%
37	London / Heathrow – Glasgow	1,080	1,003	-7.1%
38	Amsterdam / Schiphol – Paris / Charles de Gaulle	1,055	990	-6.1%
39	Munich - London Heathrow	902	970	7.5%
40	Frankfurt (Main) – Munich	978	958	-2.0%

Table 3: Main-Intra EU Airports in Passengers Carried in Thousands
Source: European Commission (2012).

Furthermore, it is worthy of note that, among the 40 most important routes within the EU27, we find 23 national routes (marked in yellow) and only eleven member states[3]. The analysis shows that even in air traffic, national routes play an important role for the intra-EU traffic.

For railways, no similar movement patterns are available. This can be explained by the fact that reporting for railways is not as easy as for air traffic. For aircraft, travellers have to book

[3] Denmark, France, Germany, Greece, Italy, the Netherlands, Portugal, Republic of Ireland, Spain, Sweden and the United Kingdom.

a ticket from A to B in all cases. This allows compiling a report about departures and arrivals. In the case of railways, ticket booking is not that specific. This can be explained by the fact that in rail traffic, the usage of non-reservation tickets prevails. In addition, there are a variety of seasonal tickets or commuter tickets that permit travelling without the customer having to state their exact destination.

A further limitation is that table 3 does not show whether the airport pairs were connecting flights or not, i.e. we cannot see from these patterns in how many cases Madrid, for example, was in fact the final destination. Therefore, the next chapter goes more into detail on the usage of multimodality.

4.1.5 The Usage of Multimodality

For this project, multimodality is defined as seamless travelling with different modes regarding a door-to-door journey. When analysing the proportion of multimodality in comparison to unimodality, it has to be taken into account that different sources base their analyses on different definitions. Therefore, the comparability of these studies is limited, and figures have to be analysed critically. In addition, all figures can only be estimated. For this reason, uncertainty in the data has to be assumed in all cases.

The USEmobility study[4] defined multimodality as the *"multimodal use of transport means in combination".* According to this definition, about 35% of all trips already take place multimodally in the questioned countries.

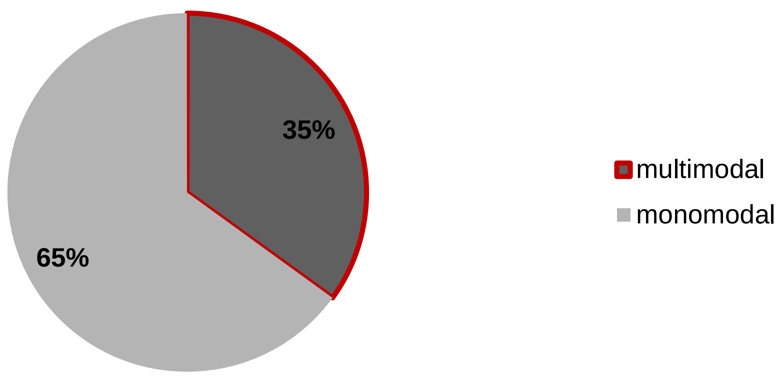

Figure 19: Share of Multimodality According to the USEmobility Study Involving 6000 Respondents
Source: USEmobility (2012).

A detailed analysis of several countries shows that the proportion of multimodality varies strongly between the selected countries. This is also indicated in the following figure.

[4] The EU project analysed seven European countries: Austria, Belgium, Croatia, Germany and Hungary with 6,000 respondents.

Germany (with 42%) and Austria (with 39%) have the largest proportion of multimodal trips, whereas the Netherlands indicates only 25%. This suggests that much variety can be found across Europe.

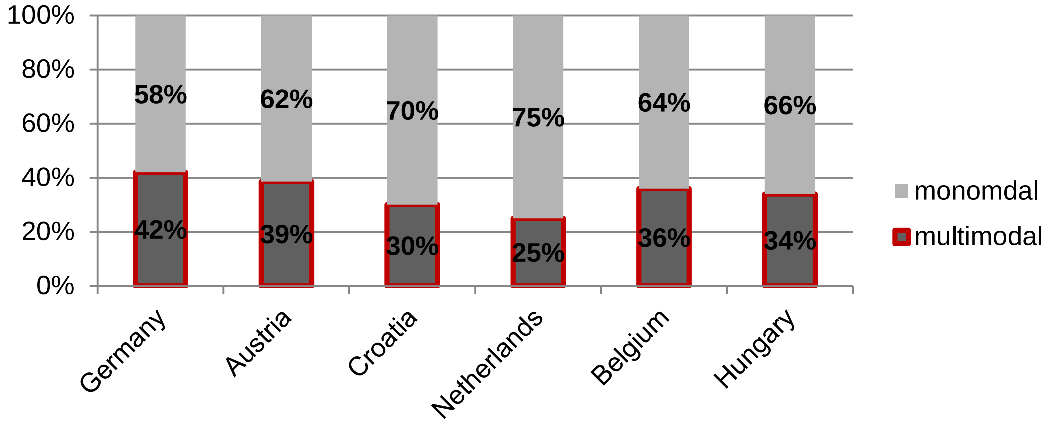

Figure 20: Proportion of Multimodality for Selected Countries among 6000 Respondents
Source: USEmobility (2012).

The Interconnect Study, in contrast, defines multimodal trips as those trips where at least one additional mode of transport is used for more than 15% of the total trip length. The application of this definition is difficult for the AWT project because door-to-door trips are analysed, including feeder modes (e.g. taxi or bus). Furthermore, only long distance trips are included (which can explain the difference to the proportion calculated in the USEmobility project). However, it can provide some interesting insights into the usage of multimodality. The two charts below show the proportion of multimodality measured in travellers (on the left) and passenger kilometres (on the right).

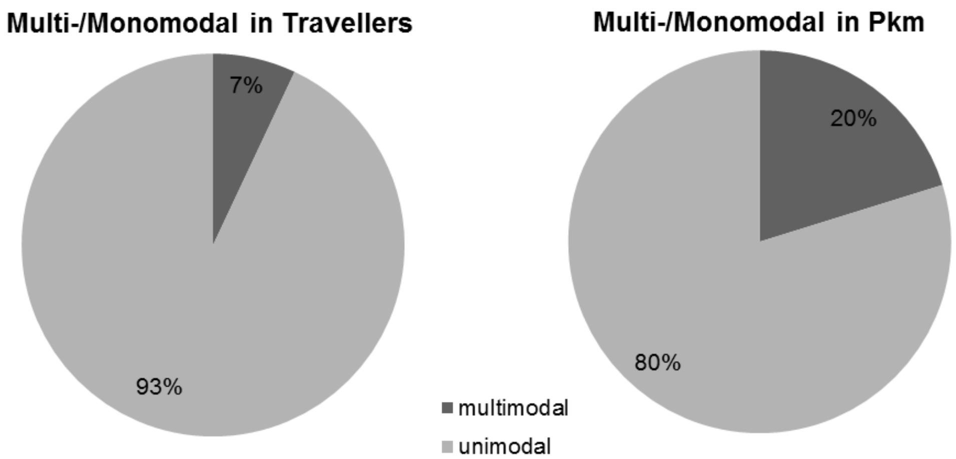

Figure 21: Proportion of Monomodal/Multimodal Traffic on Long Distances Within the NUTS3
Source: Interconnect (2011).

Concluding that Interconnect study estimated the proportion of multimodality at about 7%, - in number of travellers, whereas USEmobility calculated it at around 35%, it can be seen that estimations of multimodality diverge strongly. However, measuring multimodality in passenger kilometres already leads to a considerable proportion of multimodality totalling 20%. This suggests that multimodality tends to occur over longer distances.

The KITE project underlines this assumption by showing the following distribution in the number of modes for France and the United Kingdom. Please note that figures for other countries are not available:

Length/Country	1 mode	2 modes	3 modes and more
Short trips			
France	91%	8%	1%
United Kingdom	89%	10%	1%
Long trips			
France	58%	27%	15%
United Kingdom	17%	41%	42%

Table 4: Repartition of Trips by Length and Number of Modes Used
Source: KITE (2008).

The table indicates that the number of modes rises with the distance covered. It is also worthy of note that, in the UK, travellers rely much more on multimodality for long distance trips than in France.

Now that we are aware of several general aspects of multimodality in Europe, an analysis of the mode combinations is necessary in the next step. The following figure illustrates the most common combinations of modes – always suggesting one dominant transport chain. A transport chain is indicated as unimodal when no other mode is used for more than 15% of the total trip length. If a transport chain is chosen based on the car, only a few additional modes are needed. The car accounts for around 95% of the total of passenger kilometres and is completed through city connectors (probably to avoid the typical inner city traffic jams). The aircraft as main mode is usually complemented by car or city connectors. This is because an aircraft cannot provide full door-to-door transport.

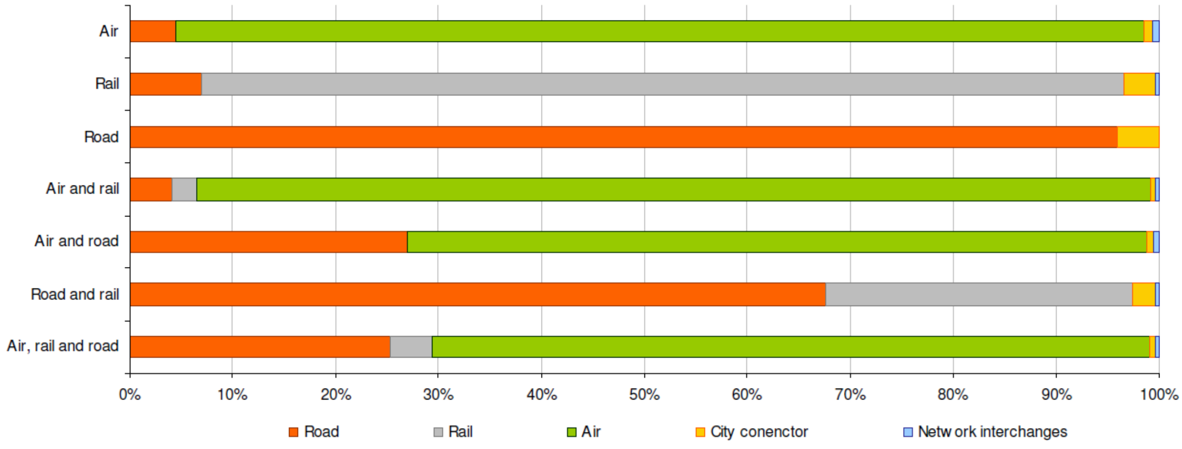

Figure 22: Average Length of Mode for Different Transport Chains
Source: Interconnect (2011).

In conclusion, it becomes evident that the car is present in all transport chains. This can be explained by the fact that it enables motorised transport even on the last mile.

4.1.6 Trip Purposes

After having analysed how travellers move from place to place using different combinations of modes, the next step focuses on travel reasons and purposes. The trip purpose strongly influences travellers' expectations and demands on their trip and mode. These expectations are examined later. This paragraph focuses on the quantitative distribution of trip purposes.

The following figure illustrates that holiday trips make up almost half of the total number of trips.[5] Aggregating holiday trips (holiday trips are for the purpose of recreation, and are mostly long distance trips) and private trips (private trips are for personal reasons (not for recreation) and can be short and long distance trips) under the category of leisure, it becomes obvious that leisure accounts by far for the largest proportion. However, business trips (business trips take place within a corporate framework. They can be short and long distance trips) still account for around one third of the total number of trips.

[5] The DATELINE analysis is based on 11,876 trips.

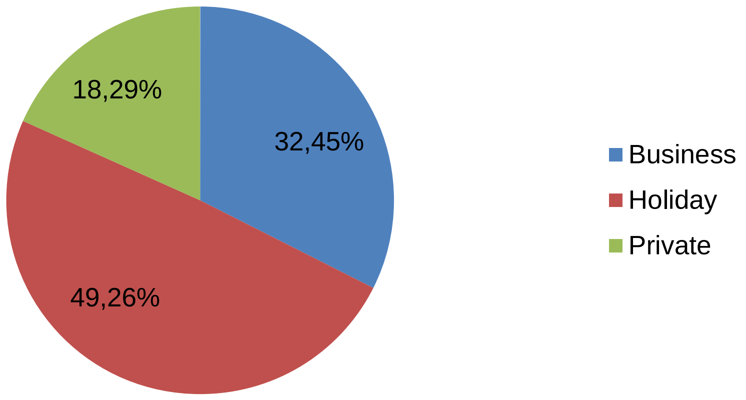

Figure 23: Distribution of Trips by Purpose
Source: Own illustration based on data by Peeters et al. (2012).

In addition, it is revealed that the car is the most dominant mode for all trip purposes. However, it is also shown that aircraft are important for holiday trips as well as business trips. Private trips rely less frequently on aircraft. (Peeters et al., 2012)

Furthermore, it is documented that the total number of leisure trips has constantly increased over the years. While the number of long leisure trips has decreased, the number of short leisure trips has increased. This means that leisure trips are increasingly not based on one large holiday per year, but rather on four or five short breaks per year. (World Travel Tourism Council, 2011)

The analysis of the gross bookings confirms the importance of leisure trips for the travel market. Between 2006 and 2011, leisure trips made up around 84% of the total gross bookings in Europe (measured in Euros). (PhoCusWright, 2010)

When analysing trip time, it can be seen that Europeans are willing to invest the largest proportion of their time for leisure trips. This aspect will be addressed later on in detail when analysing modal choice criteria in the context of trip purposes. Moreover, differences in trip length, clustered according the trip purpose, can be found. Leisure trips are marked by longer distances, whereas business trips are intended to be kept as short as possible. However, in Germany and Sweden the distances for business trips are above average compared to the investigated reference countries[6]. (Eurostat, 2007)

[6] The Netherlands, the United Kingdom, Switzerland, and Norway.

4.1.7 Traveller Segmentation

The previous sections provided a rough segmentation according several criteria. A more detailed analysis that investigates correlations for example with demographic aspects requires data that not are not available for now on a European level and cannot be generated within such a study.

Traveller segmentation aims to subdivide European travellers into groups that are relatively homogenous regarding a set of attributes. Traditionally, segmentation relies on a combination of demographic and behavioural variables. The execution of a segmentation of the European traveller not only requires an analysis of travellers' demographics (age, gender, family status, etc.), but also an analysis of their destinations, on-trip behaviour and psychological influencing factors (such as attitudes and values). There is no explicit data available at a European level, meaning that data mining would be necessary to conduct the segmentation at a European level.

A common classification, which is often cited in literature, was laid down by Anable (2005). In his study, six traveller segments were identified, mainly based on psychological factors. The travellers were divided into: malcontented motorists, complacent car addicts, hard drivers, aspiring environmentalists, car-less crusaders and reluctant riders. Each segment is characterised by several habits, attitudes and values. Socio-demographic factors play a minor role in this segmentation. The following table summarises the important features.

Traveller Segment	**Characteristics**
Malcontented motorist	- Pro-environmental behaviour - Willingness to reduce car use - Attributes other modes with environmental issues as well
Complacent car addict	- Car use not attributed negatively - Motivated by cost aspects but not environmental aspects
Hard drivers	- Lowest desire to reduce car use - Strong psychological dependency on the car
Aspiring environmentalist	- Practical approach to modal choice and car use - Already reduced car use, would reduce further if a chance was given
Car-less crusader	- High ecological awareness - Perceives less problems with other modes - Tendency to favour alternative modes to the car
Reluctant rider	- Does not own a car but not because of conviction but because of a lack of access (often older, low income) - Would use the car more often if there was a chance

Table 5: Traveller Segmentation according to Anable (2005)
Source: Anable (2005).

First of all, it must be noted that this segmentation is car-focused. Assuming that the car is the most frequented mode, Anable has identified the attitude towards the car and the motivation behind this method of travel. For the UK, he calculated the proportions into which these segments are distributed. This distribution is shown in the following figure. The largest proportion is provided by two groups: first, those using the car but at the same time showing some kind of environmental consciousness and, in consequence, feeling stressed by using the car (malcontented motorists: 30%). Secondly, those who are confident car users and whose main criteria are costs (complacent car addicts: 26%). The third-largest group is the hard drivers, who see the car as being the one and only method of travel (19%), whereas aspiring environmentalists (18%) use the car when it is the most practical solution but would rather choose alternative modes. Car-less crusaders (4%) and reluctant riders (3%) only account for a small proportion.

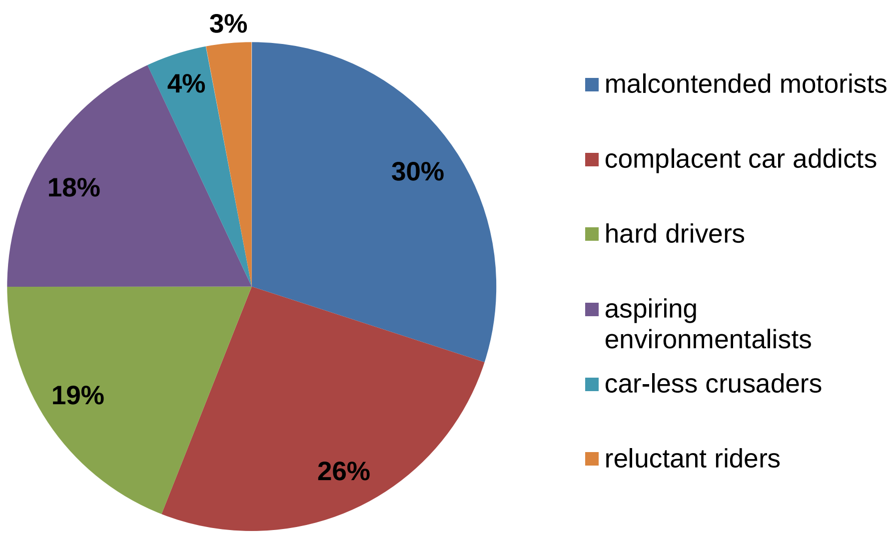

Figure 24: Possible Traveller Segmentation among British Travellers
Source: Own illustration based on Anable (2005).

There are a variety of further possibilities for traveller segmentation. The BTN Group conducted segmentation for American business travellers according to their behaviour and values on the trip. The UK Department of Transport segmented British travellers according to demographic factors and their correlation with travellers' movement patterns.

4.1.8 Outlook on Future Travel Trends

In order to draw a complete picture of the developments on the travel market, forecasts and trend analyses represent an important component. To fully understand the demand side, it is necessary to take a look into the future. At this point it must be made clear that future prognoses are always based on assumptions. Quantitative forecasts, for example on the development of traffic volume, usually underlie certain assumptions that determine the development in one or another direction. These assumptions can be, for instance, a business-as-usual development.

The following figure illustrates the projected development of traffic volume in passenger kilometres for the EU27. The forecast was calculated by the European Environment Agency (EEA). It can be seen that constant growth is expected for the following years until 2030. Taking 2005 as a baseline, a growth of around 35% is projected until 2025, and of 41% until 2030. Likewise, the growth development for all modes is marked by an increase. However, significantly different increases can be shown for the different modes. Air traffic shows the strongest growth with around 113% by 2030. The smallest growth is projected for inland navigation (10%) and public road transport (17%). The use of private cars is estimated with an increase of 37%, and rail with an increase of 49%.

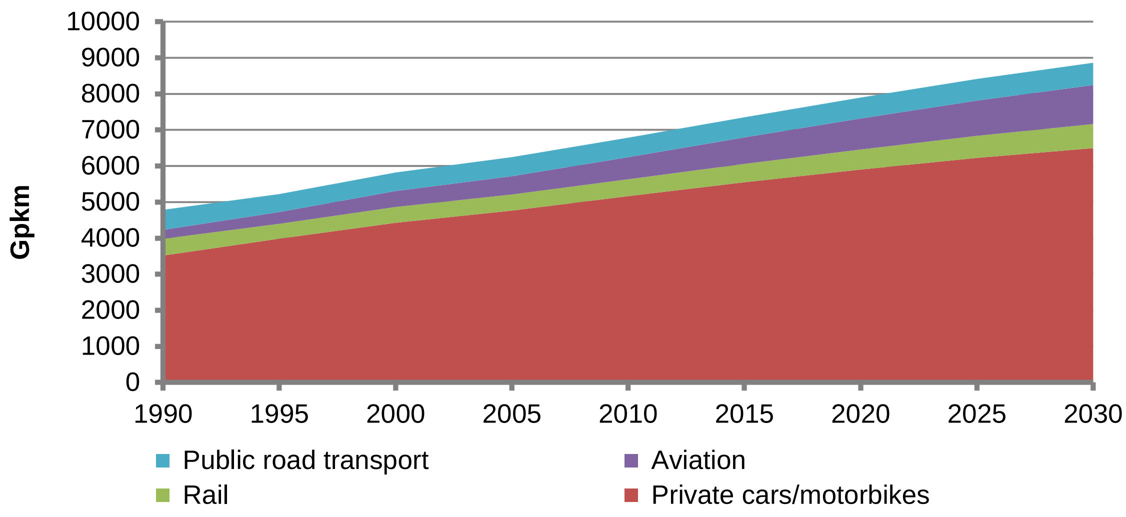

Figure 25: Projected Passenger Transport Activity in EU27 between 1990 and 2030 in Gpkm
Source: EEA (2009).

A growth forecast for long distance trips in the EU27 shows similar developments in comparison to the total traffic volume in the EU27. The total long distance traffic volume is predicted to double from 2005 to 2050. It becomes evident that air traffic volume is expected to nearly triple from 2005 to 2050 on long distance trips. Rail shows the lowest anticipated increase. Similar growth rates are predicted for inland navigation.

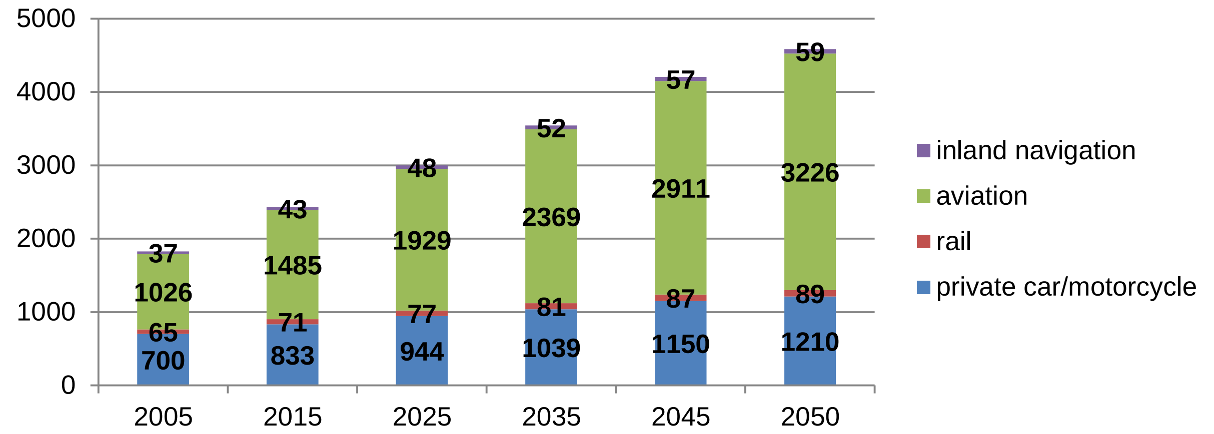

Figure 26: Projected Passenger Transport Activity on Long Distance Trips in EU27 Between 2005 and 2050 in Gpkm
Source: European Parliament (2005).

These estimations, however, can change if taking into account the development of the high-speed rail network until 2020. The high-speed network is to be expanded by around 5000 km until 2020 as illustrated in the following figure and is to have tripled in length by 2030.

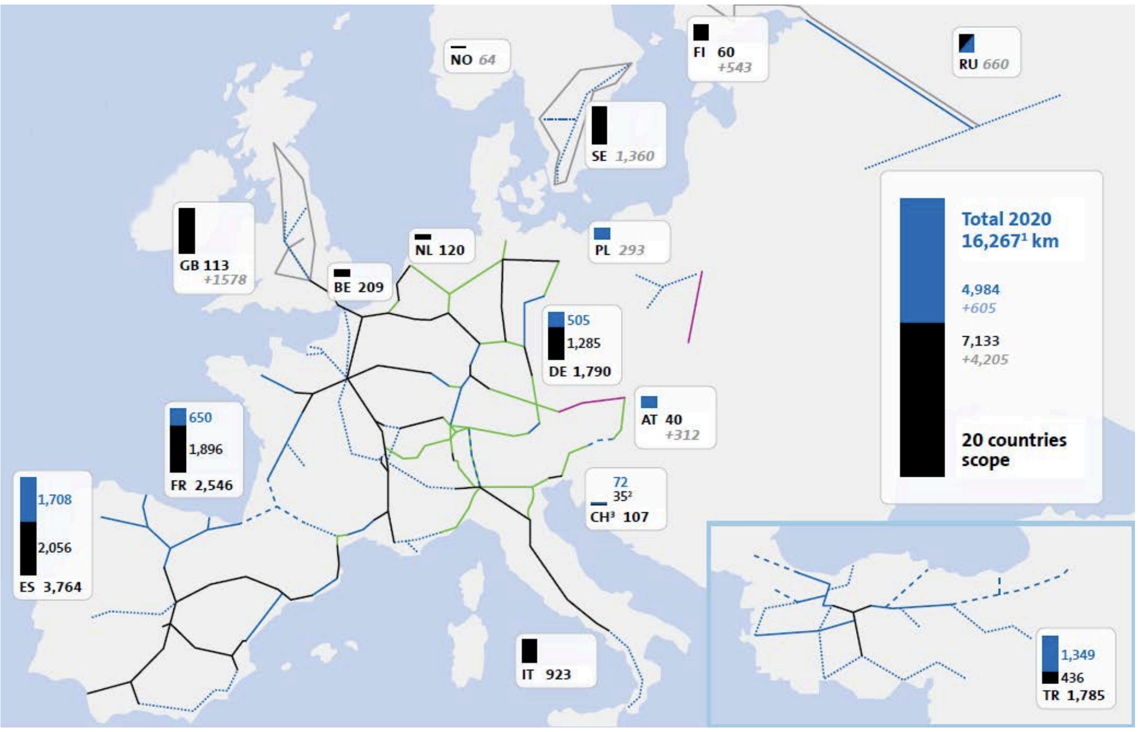

Figure 27: European High-Speed Network 2013-2020
Source: Amadeus (2012).

It is assumed that these expansions will have significant effects on the demand for rail traffic and could therefore lead to a stronger increase in rail demand than has been projected in the abovementioned scenario. It has been assumed by the industry itself that an extension of the network will lead to an increase in rail demand of around 40% (International Union of Railways, 2003).

The increase in long distance trips correlates with an increase in international passenger flows. The following figure shows the global development of passenger flows in air traffic by contrasting 2010 and 2030. It can be observed that intra-continental routes are expected to be increasingly frequented.

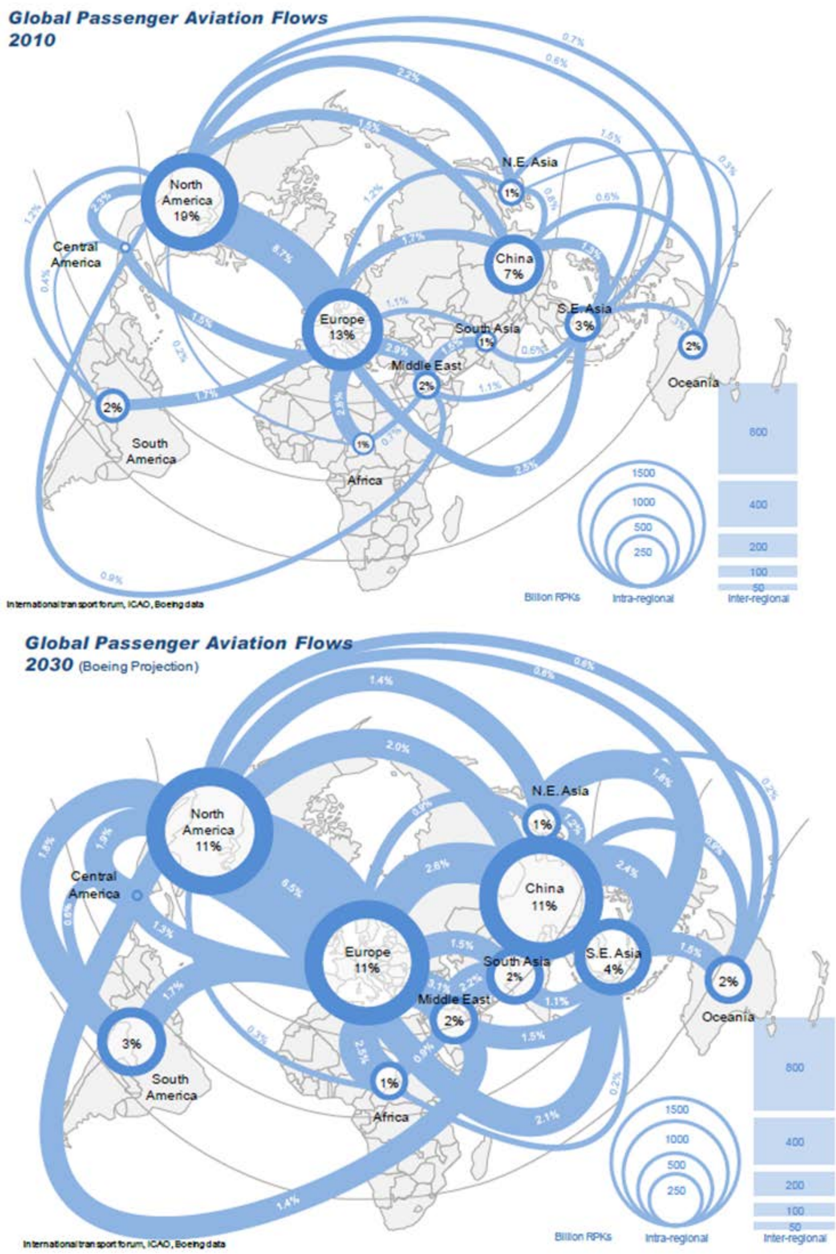

Figure 28: Global Passenger Aviation Flows
Source: International Transport Forum (2012).

4.2 Customer Travel Behaviour and Needs

After having analysed the market on a quantitative basis, this chapter is dedicated to customer behaviour during the travel process. The travel process is divided into the following categories: Information, booking and payment and the trip itself.

4.2.1 Shopping Process

The first step refers to the information process once a need for mobility has been generated. The information process starts after the mobility need has been noted, and after the decision to travel has been made.

The following figure illustrates the decision timeline for planning and booking the trip based on the examples of the United Kingdom and Germany (similar data is not available for other European countries). We see that, in the UK, around 116 days pass between the first destination search and the departure, whereas in Germany only 108 days are needed. From the 116 days between the trip decision and the departure, 16 days are spent on destination selection in the UK. In Germany 14 days out of 108 are spent on destination selection.

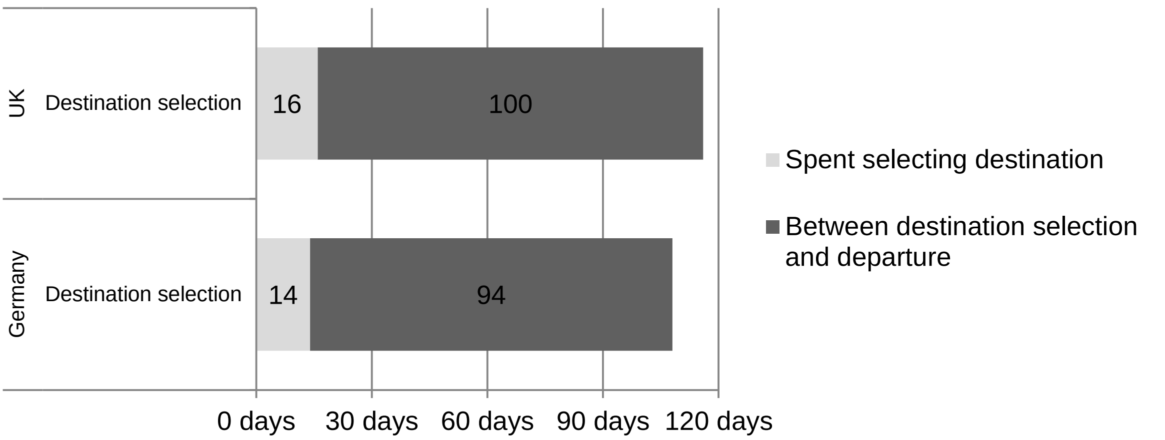

Figure 29: Decision Timelines before the Trip (Average Number of Days)
Source: PhoCusWright (2012).

Furthermore, it should be pointed out that European countries (and developed countries in general) spend a relatively long time on the decision process compared to other countries like India (destination selection: 50 days) or Russia (destination selection: 83 days).

The question arises as to which channels customers use to search for information during their trip planning. The following figure provides an overview of the importance of several information channels (data based on an online study fielded in the context of this project). It is shown that the websites of transportation companies, as well as general search engines, provide the most important sources for trip planning information. These two channels are important in all countries, with only slight differences.

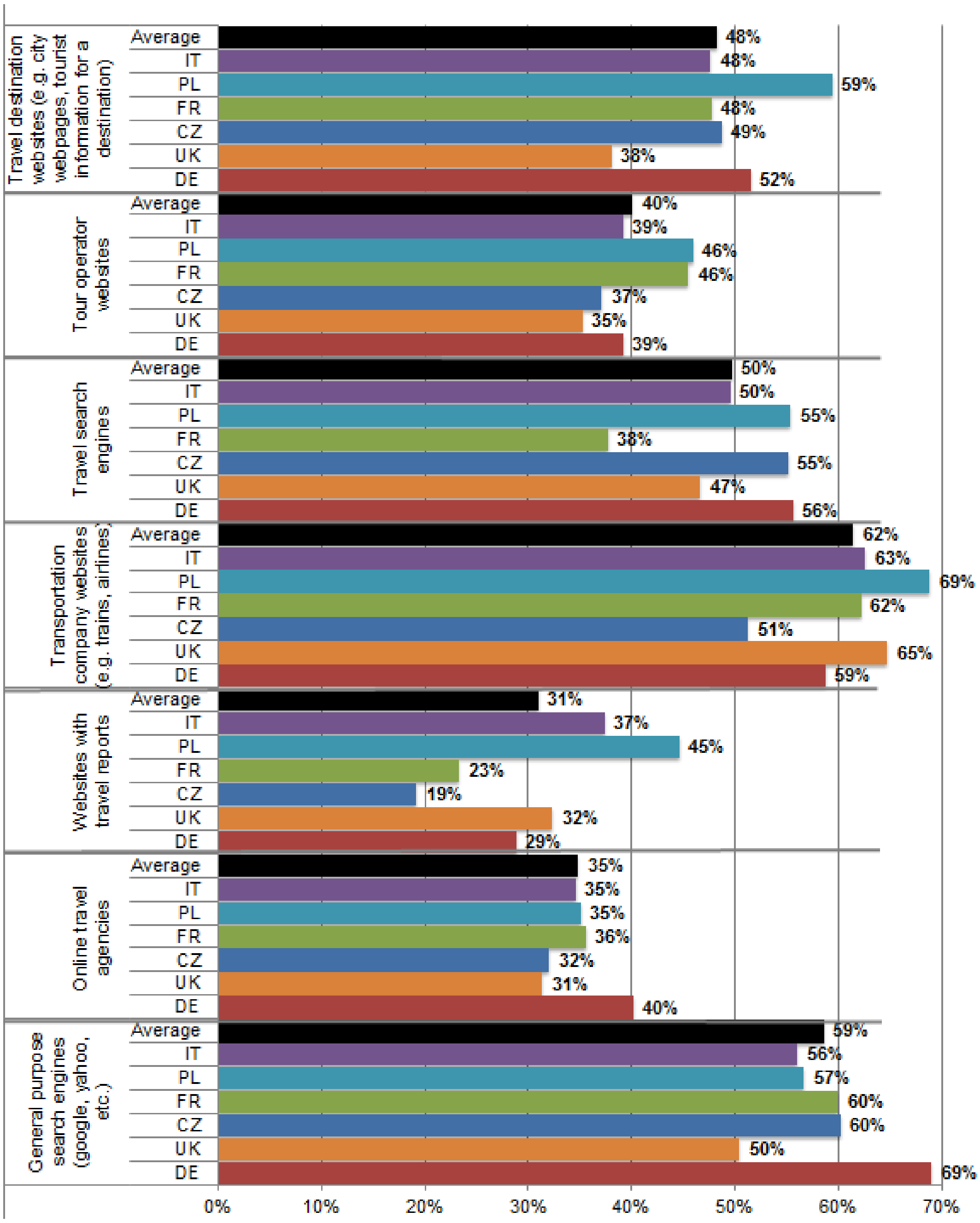

Figure 30: Information Channels during the Trip Planning Process ("What sources of information do you use in particular when planning journeys?")
Source: Own data.[7]

General search engines have the advantage that they collect information independently from mode or destination. General searches are possible, as well as specific queries under determined conditions. This seems to provide an advantage, although it only offers a selection of websites where further information can be found. However, compared to other websites, general search engines require the least previous knowledge. Therefore, this may imply that search engines are preferred that collate information in one overview. It can be

[7] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

assumed that leisure and business travellers weight the importance of several channels differently. The importance of transportation company websites suggests that both business and leisure travellers often already have a preference, and, in consequence, enter the company websites directly.

A Google study among US travellers of 2012 has highlighted that leisure travellers mainly rely on general search engines, whereas hotel and airline websites are most important for business travellers. It can be assumed that business travellers search more precisely, as they have more exact ideas on the destination and arrival times. Furthermore, they are probably more experienced searchers and therefore already know where to look for the information in question, and know which platforms they prefer.

However, customer confusion plays an important role during the information process, appearing to be especially distinctive in online searches. A PhoCusWright study of 2012 showed that at least one third of the searchers questioned suffered from information overload. Before travellers book a trip, they want to be sure they have found the optimum choice (regarding their preferences). However, among those travellers that experienced difficulties during the planning process, the issue of finding the cheapest option was the most relevant (Accenture, 2012). Consequently, a reliable comparison could possibly help to reduce customer confusion and therefore to increase traveller convenience.

The increasing demand for individualisation, however, significantly influences the information process. Travellers increasingly search for uniqueness. The one-size-fits-all-product is not working any more. Travellers search for tailored trips that fit to their individual demands. This individualised demand is strengthened by the increased of options and the fact that the traveller has become smarter and better informed in all areas. This allows the traveller to be creative and more demanding in their wishes. (Amadeus, 2012b, Greaves, 2008)

These findings highlight the potential for a Multi Modal Information and Ticketing System during the pre-trip information process. By providing all necessary trip and mode information at a glance, the pre-trip information effort can be significantly reduced. As a MMITS would provide information across all modes, it can on the one hand be used as a substitute for general search engines, but would on the other hand allow the presentation of more selective information. Whereas the general search engine provides the user with a variety of information not necessarily related to the trip itself, the MMITS allows a search for mode options. At the same time, a MMITS reduces the information on the mode options including all information (e.g. about price or travel time). This could lead to a reduction in customer confusion, as the customer might not then have to deal with redundant information.

Once the traveller has decided which trip they want to take, the booking process starts.

4.2.2 The Booking Process

The booking process is the last step of the planning process. It can occur after a short or even week-long search process, depending on the traveller's time frame. It is the realization of the decision on what to book. However, after the decision has been made, there often remains the question of where to book. There are several options: Face-to-face booking at a ticket counter, booking via telephone or letter (which is rather old-fashioned) or the modern ways of booking, via Internet (PC, tablet or smartphone). The booking decision can be made implicitly or explicitly. If the information provider directly offers a booking option, the booker will probably just follow the offered method. If the booking option requires a change of local setting (from an OTA to a supplier site, for example) then the decision where to book will take place explicitly.

The most frequented booking location nowadays (in developed countries) is the Internet. Booking tickets in person at ticket counters or via telephone is decreasing in importance, above all among frequent travellers. Our study has shown that, in all investigated countries, the respondents mainly use the Internet for making bookings. Mobile devices are not yet very common. Travellers mainly make use of the PC. The following diagram provides an overview of the frequented booking channels.

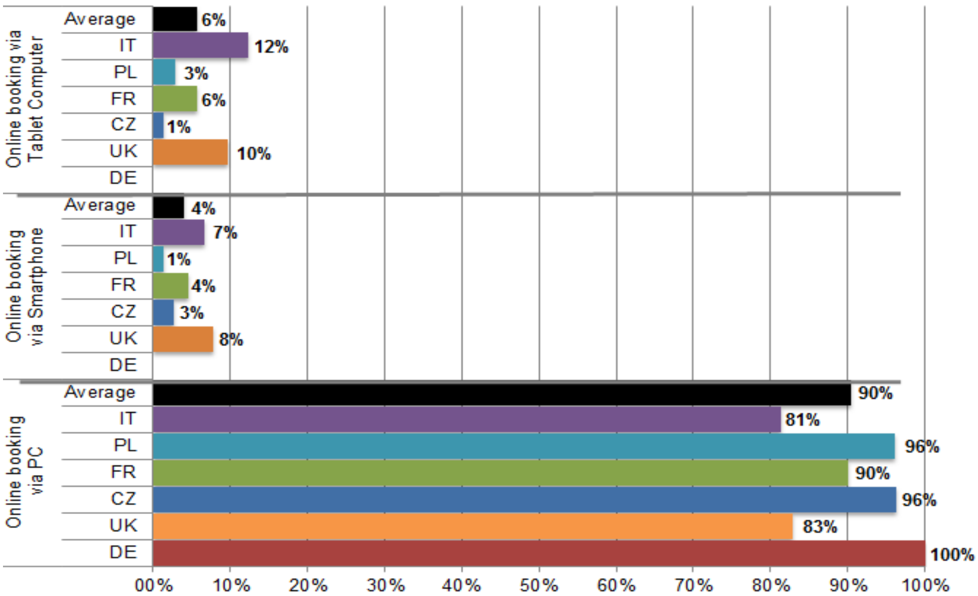

Figure 31: Most Frequently Used Booking Channel ("Which of the following booking methods do you use most frequently?")
Source: Own data.[8]

These results have been confirmed by previous studies (Amadeus, 2012a; Google, 2012). We found only a few national differences. In particular in Italy, the use of mobile devices such

[8] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

as the tablet and the smartphone is already on the rise. The reasons for not using mobile devices in the booking process are manifold - the main issue being inconvenient website handling. Either the websites are hard to see and use, as they are not optimised for mobile devices or have to be handled on a much smaller screen, or they are often still too slow and make the booking process inconvenient. (Google, 2012)

The following figure shows that travellers in general have a positive attitude towards all three online channels (PC, smartphone and tablet). The dominance of the PC as a booking channel can be explained by the fact that the other channels are not so common as yet.

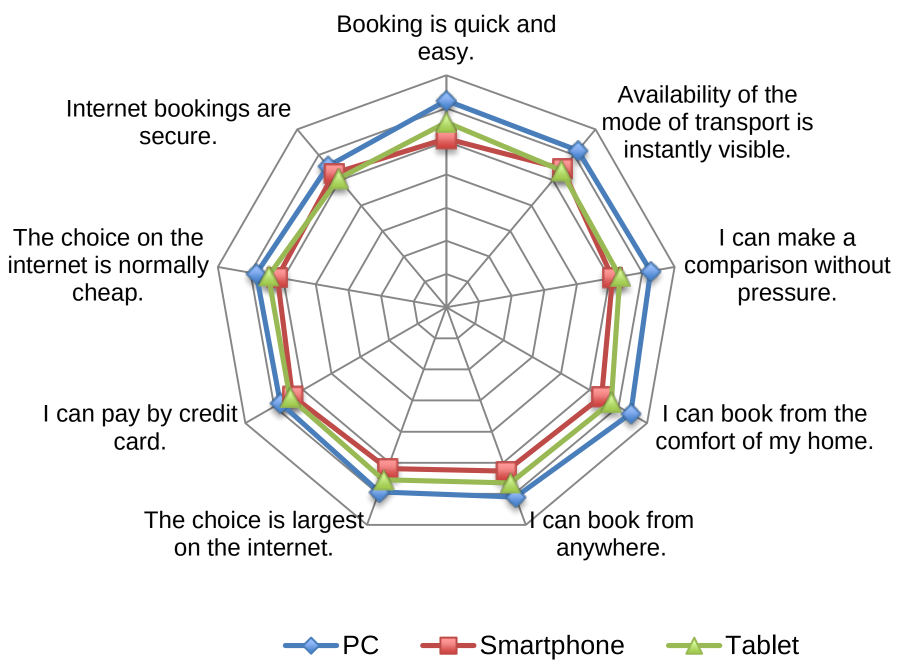

Figure 32: Reasons for Booking via PC, Smartphone and Tablet ("Why do you use…?")
Source: Own data.[9]

Loyalty programs can influence the booking process. There is no data available on how many travellers are enrolled in loyalty programs (e.g. Miles and More by Lufthansa), especially in Europe. However, Google (2012a) showed that many travellers were enrolled in loyalty programs. Here there are significantly more business travellers enrolled than leisure travellers, especially in flight and hotel programs. These programs can lead to an explicit decision about the booking channel, because the collection of loyalty points is ranked as important.

These findings suggest that travellers may change their booking platform even if the information platform offers a booking option as well, just in order to earn the loyalty points.

[9] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

It becomes clear that the booking process is strongly influenced by the Internet, and it is predicted that the relevance of online booking will rise. Studies suggest that travellers expect a seamless booking experience on the Internet as well as on their mobile devices (Accenture, 2012; Amadeus, 2012b). In addition, it is anticipated that the use of the Internet will lead to a change in spending patterns. As the customer can easily compare prices and thus find the optimum solution, it is likely that travellers will rely increasingly on the cheapest option. This is rendered by price transparency and is also demanded by the traveller of the future. At the same time, it is expected that willingness to pay for extra services that will make the trip more comfortable or which will provide a certain kind of luxury will increase (perhaps as a result of the fact that travellers will spend less on the trip itself). (Accenture, 2012; Amadeus, 2012b; Greaves, 2008)

It has to be taken into account that the booking and payment process differs in the case of urban transport. A more detailed analysis of this issue is provided in work package 3 (see Local Public Distribution Value Chain).

The dominance of the Internet in the whole booking process opens up an opportunity for a potential MMITS, as it satisfies the customers' need for mobile and flexible online booking options.

4.2.3 The Trip

Trip behaviour has changed over the years. This is strongly related to the emergence of new media and mobile devices. It has already been shown that the use of mobile devices is on the rise in the pre-trip process. They gain additional importance during the trip. Mobile devices can improve the travelling process.

An Amadeus study (2012a) has revealed a willingness to utilise several features related to mobile devices. An overview is provided in the following figure.

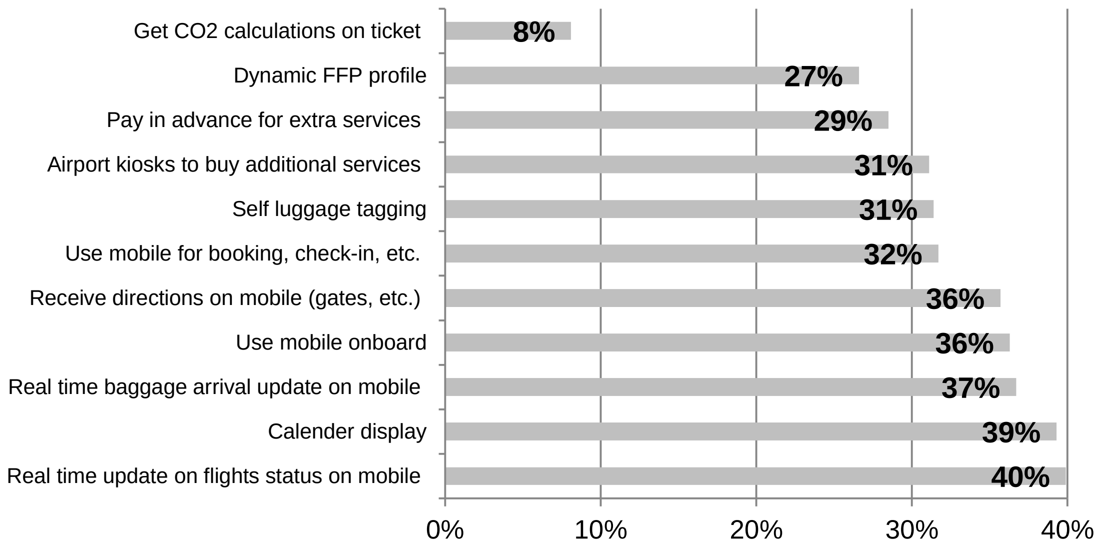

Figure 33: Willingness to Use Innovative Features/Services on a Mobile Device
Source: Amadeus (2012a).

It becomes apparent that real-time on-trip information is highly valued by 39% of the respondents. This information can include status alerts and the latest schedules. These features are especially important for business travellers, who are often confronted with changes in travel plans. A further on-trip issue is disruptions occurring during the trip, for example because of delays. Disruptions generally cause stress and frustration, especially when connecting modes cannot be reached. Therefore, travellers are asking for a disruption management that provides them with information about delays and whether or not connecting modes can be reached. Moreover, the option to reaccomodate during the trip is perceived as important. In general, the results show that travellers rely on mobile devices as it can be a factor for increasing convenience (Amadeus, 2012a).

PhoCusWright (2012)[10] also identified the possibility of looking up itineraries and local information as important features. Around 30% of travellers in Germany and 40% of travellers in the UK request these possibilities while they are underway. The possibility of using the mobile phone as a ticket or boarding pass is also important.

Travel processes are now strongly influenced by the development of mobile Internet and provide possibilities to improve the travel experience for the traveller. However, it has to be mentioned critically that the PhoCusWright study only included Germany and the UK as representatives of European countries. These countries, however, show a disproportionate aversion to the usage of mobile devices during the trip. Around 30% of travellers in both countries have no interest whatsoever in using their phone for online travel-related activities. Compared to the other investigated countries (with an aversion proportion of 11 to 18%) this

[10] The study was undertaken for Brazil, Germany, India, Russia, the UK, and the US.

is a high percentage. Therefore it must be made clear that these two countries do not necessarily represent the whole of the EU. Our study has confirmed that there is some reservation towards mobile devices in the United Kingdom and Germany. By contrast, a higher level of acceptance can be found in Italy and France.

A general study on rail customers proved that travellers are willing to pay extra to increase their travel comfort. The most important factors to increase travel comfort were a connection for their mobile devices and access to on-trip information. (Accenture, 2012)

Along with the inclusion of the Internet in the travel process comes the traveller who can always remain connected. The traveller is always connected with service providers (information, etc.) via social media, but also with friends and other consumers. (Amadeus, 2012b)

This section has shown that the Internet is becoming more and more integrated within the travel process because it generates comfort and convenience for the traveller by making the change between the modes easier. Therefore it can be suggested that seamlessness is gaining in importance.

A MMITS could provide useful leverage in this trip process, especially regarding reliable disruption management if it includes real-time information. Today, travellers have to download the respective app from each carrier that provides them with on-trip information, for example about delays. It has to be taken into account that on a multimodal trip this information is currently not synchronized, i.e. does not provide information as to whether a connecting flight can be reached if the train is delayed. A MMITS, in contrast, can provide synchronized information and even the possibility of re-accommodation, thus increasing the perceived reliability of multimodal trips.

4.2.4 Special Needs of Elderly and Disabled Travellers

Disabled or elderly travellers account for around 80 million people in Europe as stated in the ITB World Travel Trends Report (2012). In the EU project TELSCAN, several categories of disability were identified: lower limb, upper limb, upper torso, coordination/dexterity, physical strength, sight, hearing, language, speech and cognitive functions (Naniopoulos, 1999). Elderly travellers often face similar obstacles to disabled travellers. However, the variety of possible disabilities already shows that obstacles and limitations, i.e. the person’s disability, can strongly differ from person to person. Nevertheless, they all have in common that travelling constitutes a special challenge for them. In consequence, they have special demands when deciding on their form of mobility.

Max Stich, the ADAC Vice President of tourism, stated: “Nearly half of all handicapped people would travel more frequently if there were more barrier-free offers. And about 40 percent have already renounced travel because adequate offers were missing.” This shows that disabled travellers have special needs that are obviously not yet fulfilled. Accessible tourism, therefore, is an important need.

Elderly or disabled people usually have special requirements when making a trip. Therefore the information process is much more detailed and extensive. They search for different information according to their special needs. For this group of travellers, it is not only important to know if, for instance, the modes are barrier-free (e.g. if there is level access to trains) but also if the hubs are appropriate for the provision of a barrier-free trip. Barrier-free can refer to mobility impairments, but also to hearing impairments and blindness . Not knowing in advance if the trip can be processed barrier-free can generate immense uncertainty that could even prevent the traveller from starting a trip. Therefore, necessary trip information for disabled travellers is categorized according to: 1. Physical access (for people with mobility impairments, for instance a wheelchair). This category includes information about the accessibility of modes as well as hubs via e.g. elevators or escalators. This information is necessary for travellers who want to know in advance if there are barriers that can physically prevent them from proceeding with their journey. 2. Sensory access (for people with hearing or visual impairment). This category covers information about tactile markings or the need for hearing augmentation. Finally, 3. Communication access (for people suffering difficulties with words, language or speech) which includes information about the necessity to communicate. It is important for disabled travellers to find the necessary information at one glance in a comprehensive way. With this detailed information process, the traveller is provided with the certainty that no unexpected barriers will occur that could disturb them or even make the trip impossible.

In addition, on-trip information might be requested in case of disturbances that help the traveller to proceed the trip without barriers. Furthermore, this group of travellers needs on-trip information that allows them to move around independently at the hubs. On-trip information is needed that navigates the traveller through the whole trip, always taking into account their restrictions according to their disability.

For elderly people, travelling is often linked to a feeling of uncertainty and nervousness due to confusion. A MMITS can reduce this confusion by providing clear instructions on the journey (e.g. digital maps showing geographical nature of hub/stations)For business traveller. It provides travellers with exact information on when they have to take which mode, at which time, from which location.

This means that elderly and disabled travellers request, more than others, the possibility of planning the trip from door to door. The travellers must know when and where they have to change modes of transport, and how they can get from one mode to another. Furthermore, they need to know more than other traveller groups about the possibility of booking all tickets in advance, because this decreases uncertainty when arriving at an unknown station. By booking all tickets for the door-to-door trip, travellers are not confronted with technology and do not have to make efforts that are not adapted to their disability or impairments.

In addition, it must be pointed out that elderly or disabled travellers often face physical barriers. These barriers can be, for example, a lack of level access to the respective mode, small entrances that are not appropriate for wheelchairs, or a lack of elevators at the hubs. They can, furthermore, be a lack of navigation support at the hubs as unknown locations, where this group of people finds it especially difficult to orient themselves.

A MMITS cannot overcome physical barriers. It could, however, help to plan a trip carefully and decrease the level of dependency and uncertainty throughout the whole trip if it also allows requests for individualised information according to the disability. This means in consequence that the perception of the quality of the trip is directly correlated to the quality of information adapted to the needs of disabled people. Finally, it has to be clear that the listed advantages of a MMITS in this chapter do not only meet the needs of the group of elderly and disabled travellers. In fact, they increase the trip quality for all travellers. The advantage of increasing confidence, however, plays a special role for elderly and disabled travellers. Economic feasibility for a MMITS could be improved by the assumption that the total number of travellers might increase as the number of elderly and disabled travellers increases.

4.3 Modal Choice

In order to satisfy existing mobility needs, customers usually choose between a selection of travel modes. The optimum choice is determined by several factors. These determinants can address economic-rational and / or psychological considerations. However, considerations are of different relative importance, as discussed below. This analysis provides the basis for the following discussion of the obstacles for multimodality. From this, the implications for multimodality and a Multi Modal Information and Ticketing System can be derived in later chapters.

4.3.1 Determinants of Modal Choice

The following chapters discuss several criteria of modal choice.

Availability and Accessibility

Availability and accessibility are basic criteria that are included in the mode decision. It is obvious that availability is the crucial determinant for being able to choose a certain mode at all. However, availability itself is only a helpful criterion if the mobility user is aware of the available modes. This means that availability and its awareness provide the basis for multimodality. Studies show that the car is perceived as being much more available than alternative modes (e.g. Beirão/Sarsfield Cabra, 2007). This can be explained by the fact that cars are not bound to timetables. If the customer owns a car, it is almost always available independently from time and place. If a car cannot be afforded, the traveller is forced to consider alternative modes.

However, accessibility plays an important role that can limit availability. Accessibility can, on the one hand, refer to freedom from barriers. Here customers take into account physical limitations that could make a certain travel mode impossible for use. On the other hand, accessibility can refer to infrastructural aspects. Customers consider whether a travel mode is able to bring them from A to B given the current infrastructure. A car offers door-to-door travelling, which can rarely be provided, for example, by trains. (Schneider, 2013; Beirão/Sarsfield Cabra, 2007)

A further aspect of this criterion is the accessibility of information on the available transport modes and additional information such as schedules and routes. This argument especially affects travel modes which do not involve a private car. The mobility user might be aware of alternative travel modes. However, if information about schedules, routes, etc. is difficult to access or to find, this can lead to an exclusion of the respective travel mode from the choice set. The problem is not necessarily the missing access to information, but rather that it is complicated. Therefore it is important that information can be accessed without much effort in terms of money and time. (Pripfl, et al., 2009)

Travel Time, Budget and Price

Travel time and cost are intuitive economic factors that are included in the modal choice process.

Usually, travellers seek to minimise both factors. Travel time is then defined as the sum of the time spent in and out of the vehicle, for instance while waiting or walking.

Travel time = in-vehicle + out of-vehicle time. (Limtanakool, et al., 2006)

However, when choosing the optimum mode, a traveller can only include the expected travel time. Some extra time usually is included as well to make sure that the destination is arrived at on time. This extra time is called the time margin. Therefore, it can be assumed that travellers leave their starting point earlier.

Travel time budget = expected travel time + travel time margin.

The full price of a journey for each individual is composed as follows:

Price = fuel costs + investment costs + ownership & maintenance costs (O&M)
(Daly, et al. 2012)

A ticket price already includes all components. Extra costs may not be expected by the customer. When taking the car price as a basis, perception is often distorted by limited or incomplete information. When deciding about whether to go by car, fuel costs are mainly included in the calculation. The component investment costs and O&M costs remain unconsidered. This leads, in consequence, to an underestimation of the costs when choosing the car. (Pripfl, et al., 2009)

Reliability

Reliability can refer to different aspects. A journey is always associated with a certain amount of uncertainty. An important criterion, therefore, is punctuality. It has to be taken into account that punctuality cannot be guaranteed for any travel mode. However, customers look for the mode that has the lowest perceived probability of being late. Especially in the context of multimodal trips, punctuality is an important issue. Another decisive variable is the certainty that even the last possible connection can be reached and that the trip will still work on the last mile.

The reliability of a travel mode can be influenced by the weather. Consequently, customers not only consider punctuality in general but also whether a transport mode, in their opinion, will still be reliable under extreme weather conditions. (Pripfl, et al., 2009)

In general, customers want to have an answer to the question as to whether a travel mode is able to bring them from A to B within the calculated travel time margin and without further disturbances. (Pripfl, et al. 2009)

Travelling Comfort

Travelling comfort refers to physical as well as psychological comfort. This can for instance mean such basic requirements as the availability of seats. This is a particular issue for public transport, and not as much for cars or aircraft, where the number of transported passengers is directly linked to the number of available seats. Travelling comfort can also refer to special needs such as comfortable seats or personal space.

When talking about travelling comfort, the option of storage, for example of luggage or bikes, is often identified as another important aspect. This refers to the storage option within the vehicle, but also to the (dis)comfort when having to change the travel mode with luggage.

Another aspect that can make travelling more comfortable is privacy. Studies have shown that customers want to decide on their own when and with whom they have contact. Privacy is seen as a basic condition for feeling comfortable. However, creating privacy while travelling is a difficult issue. Whereas the car provides a certain level of privacy even when there is a lot of traffic, collective travel modes are not able to guarantee the same level. (Pripfl, et al, 2009; Schneider, 2013)

Finally, the possibility for a traveller to work has to be taken into account. This criterion is especially important for time-sensitive business travellers. If the time in the mode of transport can be used for working, then the feeling of wasting time can be overcome.

Flexibility

Another decisive determinant for modal choice is flexibility. Flexibility refers to spatial and temporal autonomy. Mobility users tend to choose vehicles that allow them to travel whenever and wherever they want, independently of fixed timetables and static routes. Temporal flexibility is linked to the frequency with which a means of transport runs. The more often it runs, the more flexibly it can be used. From this point of view, the car provides a maximum of flexibility, as it does not depend on schedules and can be used at any time.

Furthermore, this flexibility has to be achieved with a minimum of effort. In consequence, this means that mobility has to be uncoupled from only "moving with the masses". Being able to choose when and where to go addresses an important emotional factor: the feeling of independency. (Pripfl, et al., 2009)

Ecological Awareness

Finally, ecological considerations are considered to be a determinant of modal choice. The CO2 footprints, or the usage of oil, are certainly aspects that are recognised by the customer. However, it has to be mentioned that ecological awareness does not necessarily influence the modal decision-making process. This gap is explained when taking into account that customers are not willing to accept much extra effort (in time, costs, organisation, stress, etc.) for ecologically-minded behaviour. However, the more acute someone's ecological consciousness is, the higher is the probability that ecological aspects may change behaviour. (Pripfl, et al., 2009)

Situational and Individual Factors

The previously identified determinants, however, are not equally important in all situations for all individuals. Therefore, situational and individual factors also have to be taken into account.

Socio-demographic factors have an influence on certain determinants. A low income, as indicated earlier, can limit the availability of certain travel modes: a car might not be affordable or a flight ticket too expensive. In particular the ageing of a population affects travellers' expectations towards modes. They are expected to place special emphasis on price and comfort. The elderly population has also special informational needs. (Greaves, 2008)

However, current studies have shown that the influence of demographic factors, such as gender, family structure or household size, is decreasing in importance. Other factors such as individual norms, in contrast, gain importance. These norms can form the basis for mobility types: some might rate the importance of a car as being very high simply because they like to drive; others prefer to be brought from A to B without having to drive. Depending on the type, ecological considerations, cost aspects, availability, etc. are weighted differently.

When taking a look at situational factors, the basic distinction that has to be made is whether a route is a habitual one or a new one. Habitual routes can be the weekly shopping trip or the route to work. In these situations, mobility users make their modal choice once, and later use the business-as-usual vehicle. They do not reconsider the influencing factors every time a habitual mobility need occurs. This is a rather automated process. An explicit modal choice does not take place in these cases. Only under special circumstances is the chosen mode is reconsidered. These circumstances can be temporary, such as extreme weather conditions that force the traveller to make a new decision, but only for one occasion. However, these circumstances can also cover long term changes, such as changes in personal circumstances (job, birth of children, etc.) In these situations, the traveller makes a new decision that then turns into an automated process again. (USEmobility, 2012)

Mobility needs can also refer to new or unfamiliar routes, where the customer consciously or subconsciously takes into account determinants of modal choice.

Another situational factor is the trip purpose. The transportation criterion might be of more importance on a holiday trip than on the way to work.

Time pressure refers on the one hand to time pressure during the trip, but is already included within the travel time budget. Here it can be assumed that customers decide on the mode that is assumed to bring them to the destination most reliably within the given time budget. Time pressure during the decision-making process is another issue. In this case, those modes that can be used quickly and spontaneously maintain an advantage. (Racca/Ratledge, 2003; Pripfl, et al., 2009)

The figure below summarises the decision-making process for modal choice.

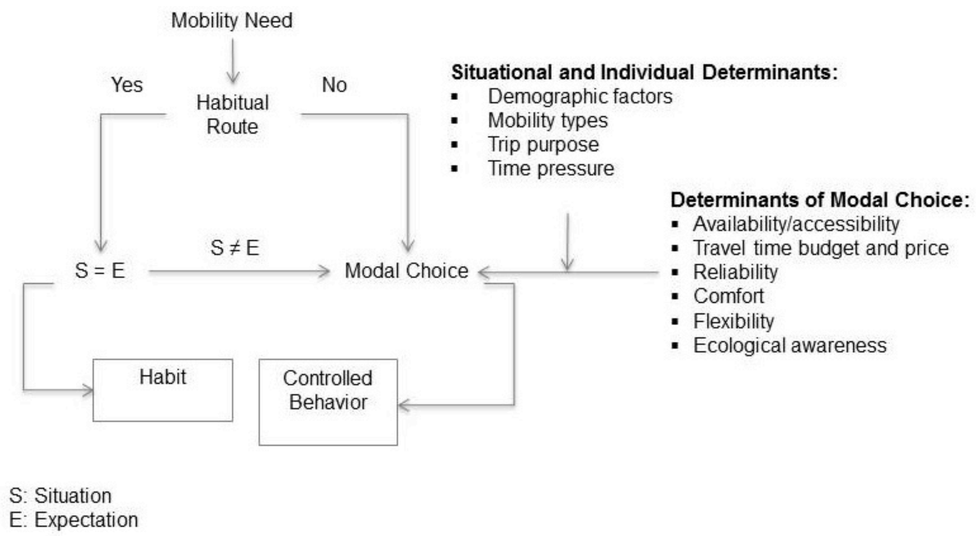

Figure 34: Conceptual Model of the Modal Choice Process
Source: Slightly changed according to Pripfl, et al., 2009.

4.3.2 Weighting the Importance of Modal Choice Criteria

As already mentioned, the importance of each criterion differs between situations and individuals. However, we have found that several criteria are of general importance.

The following figure shows how these criteria are rated among travellers (a study of German travellers). The figure shows that mobility users strongly expect the chosen transport mode to allow them flexibility. Almost 75% of all respondents named flexibility as an important criterion of their modal choice. Interestingly, only 52% see time gains as a determinant. Surprisingly, even fewer respondents (about 43%) indicated that costs would influence their modal choice decisively. This strong importance of flexibility explains the heavy usage of cars although it does often not make sense from an economic point of view. More than three fourth of all trips in Germany are done by car. This is even though the total costs of the car are considerable higher than public transport (new car: 21 Cent/km; public transport: 12 Cent/km, bicycle Cent/km as calculated in a publication by Lell (2013) in the journal *"Internationales Verkehrswesen")*.

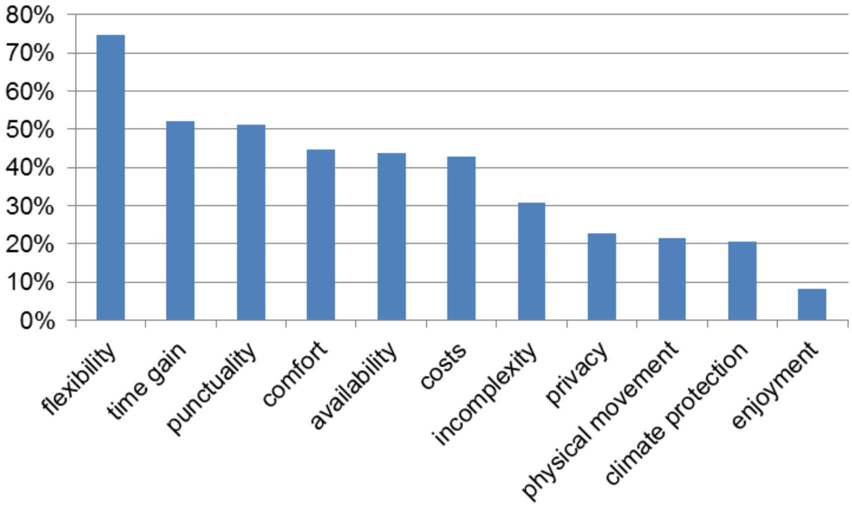

Figure 35: Importance of Determinants of Modal Choice
Source: According to the VDA (2009).

Another figure worthy of note is the importance of climate protection when choosing a mode. It was shown that only 21% evaluate this criterion as being decisive for their modal choice. This confirms our theory that mobility users do not yet include environmental protection aspects in their modal choice.

Our study has shown that similar results are generated when polling people in several European countries. The respondents were asked to rate the relevance of the named criteria on a scale from 1 (not at all important) to 7 (very important). National differences and the deviation from the European mean (within the Czech Republic, Germany, France, Italy, Poland and the United Kingdom) are trivial. The low ranking of having a possibility to work can be explained by the overhang of leisure trips. This mean, however, changes if we take a look only at business travellers. Here the mean rises to 4.51.

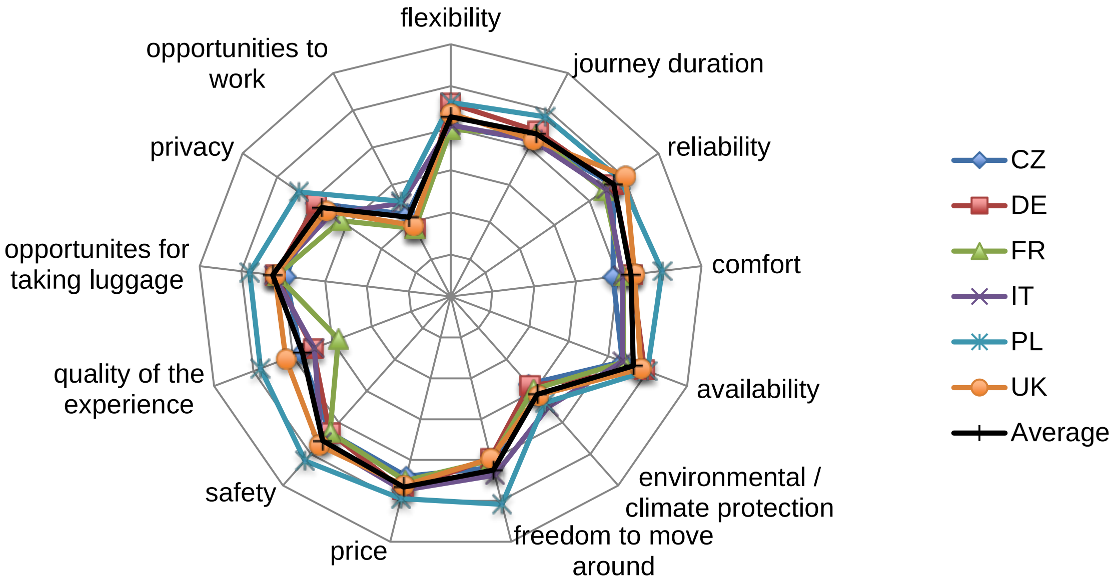

Figure 36: Determinants of Modal Choice in a European Comparison
Source: Own data.[11]

The example of the 'opportunity to work', where the importance strongly varies between leisure and business travellers, shows that the trip purpose has a significant influence on the importance of each criterion. Table 6 provides an overview of the ranking of the determinants of choice from the literature. It shows that the importance of the determinants is ranked differently according the purpose of the trip. First of all, it can be noted that business travellers possess high levels of time sensitivity. Therefore, punctuality and speed are ranked high on their list. For business travellers, it is more beneficial to arrive early at their destination than spending a lot of time on tour, thus losing working time. For private and holiday trips, in contrast, we find a stronger focus on price, whereas the time factor is negligible. Moreover, flexibility can be rated as less important for holiday travellers. This can be explained through the assumption that holidays start and end at a fixed date and are already planned carefully before the trip. Travel changes are not usually expected. (Last/Manz, 2003; Eurocontrol, 2004)

[11] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

Trip purpose Ranking of determinant of choice	Business trip	Private	Holiday
1.	punctual	safe	safe
2.	fast	inexpensive	uncomplicated
3.	safe	flexible	inexpensive
4.	flexible		
5.	uncomplicated		

Table 6: The Influence of Trip Purposes on the Importance of the Determinants of Choice
Source: According to Last/Manz (2003).

Once people have decided on their priorities, the next step is to find out which mode best fulfils the prioritised criteria. The following figure gives an overview of the public opinion on transport modes. However, it must be taken into account that this can only provide an aggregated picture of those opinions. Individual perceptions can differ. The figure shows that the car is perceived as by far the most flexible transport mode. The same applies for uncomplicatedness. This may be related to the fact that a car neither requires changes between vehicles nor the inclusion of schedules. The car is also perceived as being quite strong in almost all criteria except environmental friendliness and restorative effects. However, as argued in the previous paragraph, environmental effects are not taken into account very strongly in today's world. The aircraft represents the closest competitor to the car.

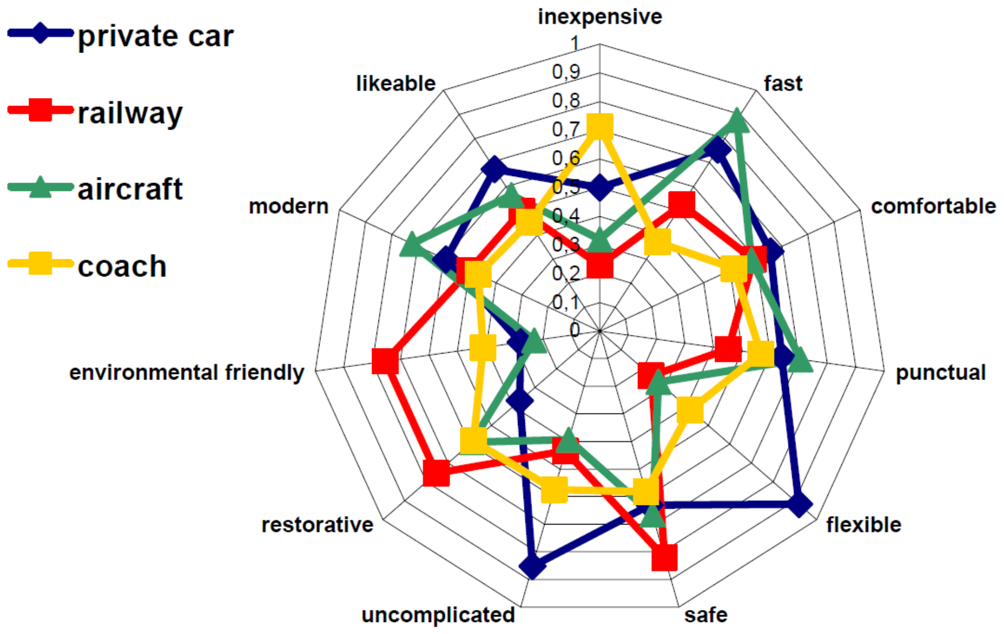

Figure 37: Characteristics of Different Means of Transport in Public Opinion
Source: Last/Manz, 2003.

The following table summarises the relationship between situational/individual factors and the determinants of choice as discussed previously.

Determinant of Modal Choice	Moderating Situational and Individual Factors
Availability/accessibility	Demographic factors
Travel time budget	Trip purpose: strong sensitivity of business travellers, negatively correlated with the sensitivity for price
Price	Trip purpose: strong sensitivity on leisure trips, high elasticity of business travellers
Reliability	Individual variance
Comfort	Individual variance
Flexibility	Trip purpose: connected with frequency, which in turn is important on business trips
Ecological awareness	Individual variance

Table 7: The Influence of Situational and Individual Factors on Determinants of Modal Choice
Source: Own presentation.

4.3.3 Customer Obstacles to Multimodality

The expectations on the chosen mode as discussed in previous chapters also reflect the attitude towards the journey itself. This means that the trip is subjected to the same requirements as the mode itself. The elaborations concerning the characteristics attributed to the particular transport modes have already proved that car and aircraft are generally perceived as being superior. Thinking back to the development of the modal split, it becomes obvious that most of the kilometres covered take place by car. Nonetheless, a significant increase in air travel can be found as well. In the previous chapter, it has already been explained that it is difficult to provide exact information on the proportion of multimodality. Still, it has become clear that travellers tend to keep the number of modes as low as possible.

The first reason is a perception problem. The modal split has shown a large proportion of cars, but also the rising importance of aircraft. Both are attributed with positive associations as being fast, likeable, punctual and comfortable, as has been shown in a previous chapter. Rail, in contrast, has been proven to be perceived as not particularly fast, inflexible and complicated. Rail or public transport is attributed with lower quality. If multimodality is to provide a significant part of the total traffic volume, this perception will present an important barrier for a shift to multimodality. (Eurocontrol, 2004)

Beyond this perception problem, central elements can be identified that have an influence on the usage of multimodality from the traveller's perspective:

In general, it is shown that users, when considering the whole travelling process starting with the search and ending with the arrival at their destination, expect the same level of comfort when using multimodality as when using just one mode for the whole trip. Comfort, however, can rapidly decrease, and complexity may increase when multimodality is provided by several operators. First of all, users depend on the coordination and cooperation of these operators. If the train, for instance, is late because of technical or weather problems, the connecting flight might be missed. Multimodality is thus perceived as being less reliable.

However, another aspect has to be considered in this case. Trip complexity strongly increases when the schedules of different modes have to be compared to find the ideal connection. Also, it is possible that flexibility decreases when longer connecting times, for example, between trains and aircrafts have to be taken into account.

Moreover, the ticket-buying process is more complex in the case of multimodality, because users do not just buy one ticket but several, and consequently have to conduct several payment processes. This creates interesting leverage for a Multi Modal Information and Ticketing System.

When taking into account the importance of flexibility and comfort or simplicity, the customer's obstacles to multimodality are obvious. The more seamless the trip appears, the lower are the barriers to switching from unimodal to multimodal transport chains. Based on these arguments, important implications for the implementation of a Multi Modal Information and Ticketing System can be found.

4.4 Customer Expectations towards Multimodality and the Influence of a Multi Modal Information and Ticketing System

If a lack of seamlessness is the central barrier for using multimodality, the question remains what kind of improvements in multimodal trips are able to change travellers' opinions, and which role a Multi Modal Information and Ticketing System can play. Simply transporting people from A to B does not meet the consumer expectations of their travel experience.

Taking into account that a lack of seamlessness favours unimodality, customer expectations towards multimodality can be derived for different parts of the trip (shopping process, booking process and the trip itself). Travellers expect a multimodal journey to fulfil the same requirements as a unimodal trip. This means the multimodal trip is expected to be at least as comfortable, cheap and time-intensive in order to be able to compete with the unimodal one. This leads to user-friendliness gaining a high level of importance.

The willingness to accept multimodality strongly depends on several factors that can be categorised as follows: Network/interchanges, passenger information, tariffs and ticketing, and baggage handling (ILS NRW, 2004).

The interchange between two modes is often linked with additional effort. Travellers, however, expect that a multimodal trip combines the modes in such a way that the standards of comfort, duration and flexibility during the whole trip are comparable to the car. Therefore, the interchange as a physical action is expected to be as comfortable as possible. This includes short walking distances between the modes. These systems, on the one hand, make the physical movement itself more comfortable and, on the other hand, can reduce transfer time. It also has to be considered that multimodality may require strong physical mobility (being able to walk quickly, carrying luggage, etc.). Therefore, support by technical systems such as elevators, escalators or shuttle services represents an important demand at the interchanges and takes on a special role for physically disabled travellers. (ILS NRW, 2004; KITE, 2008) Moreover, the physical effort can be reduced by the provision of customer friendly guidance through the interchanges.

In addition, short waiting times are expected, as they can significantly increase the total trip duration. The time needed to switch modes or change within one mode is regarded as the greater hassle than the travel-duration as such. Waiting times can refer to the period between two modes. They have to be as short as possible in order to keep the total travel time short. Furthermore, waiting time is expected to be minimised at the transfer points: check-in at the airport, security checks or ticket counters (KITE, 2008). An IATA study (2003) showed that about 40% of the respondents would value easier connections.

Another leverage element regarding the interchanges refers to the cooperation between operators (interline agreements). Multimodality, as already mentioned, can suffer from a lack of reliability because connections might be missed if one mode is delayed. The customer, therefore, asks for cooperation between operators (across companies and modes) to make sure that the connection either can be reached (because the connecting modes wait) or that alternative connections are provided. In consequence, the demand for a reliable trip across all modes can be served.

A further traveller requirement is the need for information. Information is an essential part of the transport chain, and plays an important role in the perception of the quality of service. Information makes the trip easier (unimodal as well as multimodal trips). However, on multimodal trips it is necessary to provide the traveller with integrated and multimodal passenger information. This information can be pre-trip or on-trip. Travellers not only request door-to-door mobility but also door-to-door trip information. In consequence, information has to cover all modes. It has to be multimodal and integrated. Information is expected to cover timetables, fares and conditions of carriage, in case they differ between the countries, as well as potential information about the carbon footprint. Data on the CO2 emissions of certain modes per passenger are available today, and can be integrated in a MMITS. This information might help the traveller to take the final modal choice decision. On-trip information regarding delay and rebooking options can increase customers' willingness to accept multimodality. Transparent, comprehensive and easily comprehensible information throughout the whole process can help to decrease the level of uncertainty which often accompanies multimodality (ILS NRW, 2004; Lyons, 2001). With the on-trip information comes another customer need: the need for re-accommodation. If the traveller is provided with the information that a chosen mode is delayed and the connecting mode, for example, cannot be reached, the traveller must be able to ask for the option of re-accommodating a trip in order to be able to continue the journey without extra trouble. Disruption management therefore plays a central role. In order to further facilitate the multimodal, pan-European travel experience, users would need to access all the relevant information in the language of their choice, in an easily understandable format and at a single point of access.

Another central aspect concerns ticketing. In order to keep the planning effort as low as possible, travellers wish to reduce the number of transactions during the trip planning process. This means, in turn, that the number of booking and buying actions has to be minimised. It can be interpreted that behind this wish lies the demand for one ticket for all chosen modes, i.e. integrated and multimodal ticketing (Eurocontrol, 2004; ILS NRW, 2004). This means that consumers want to be able to book a single ticket for the whole trip, regardless of the different modes, transport operators, tariff systems or regulatory requirements of the specific country. . If a trip, for example, includes a train ride from Düsseldorf to Frankfurt, a flight from Frankfurt to Barcelona and the metro from Barcelona Airport to the City Centre, the consumer should be able to pay for everything in advance, without the need to register with every provider or operator (especially when integrating flexible offers such as car-sharing currently a single registration process for every operator is required). This is particularly important for consumers who do not use these services on a regular basis in order to lower usage barriers for them. Different ticket-vending machines, price categories and fares currently are frustrating even for experienced travellers.

One last traveller concern is the issue of luggage handling during multimodal trips. This aspect has been proven to be a decisive factor, especially for travellers with heavy and/or bulky luggage or limited mobility. Besides the storage problem that is often associated with trains and public transport, there is the issue of transporting luggage during the interchange. Once the luggage has been checked in for air travel, it is no longer necessary to worry about one's luggage. If, however, the trip includes another mode, the traveller usually has to carry their luggage and find a new storage space. Studies have shown that especially the aspect of luggage handling represents a decisive criterion when choosing multimodal trips. (Eurocontrol, 2004; ILS NRW, 2004)

Therefore, the next step is to find out which leverage a Multi Modal Information and Ticketing System can use to meet these demands, and how the acceptance towards a Multi Modal Information and Ticketing System could be developed.

In our study, the respondents were presented with a description of a possible application of a Multi Modal Information and Ticketing System before and during their trip. Afterwards, they were asked to evaluate the perceived utility. The following figure shows the evaluation of the system in different countries.

First of all, it becomes evident that, seen overall, the evaluation of a Multi Modal Information and Ticketing System is positive[12]. A significant agreement (mean=5.08, SD[13]=1.511) among all Europeans is that the MMITS represents a helpful tool for planning and booking. In addition, the usability of such a system is evaluated highly (mean=4.96, SD=1.54). Concerns about data safety, however, should not be underestimated (mean=3.97, SD=1.748). We find that people feel rather uncertain about their data. The issue of data safety could provide an obstacle to travellers' willingness to accept such a system. However, when asking travellers whether they would use the system if they could obtain access to it, the conclusion is positive among Europeans (mean=4.92, SD=1.656).

[12] Evaluated on a scale from 1 (I disagree completely) to 7 (I agree completely).
[13] SD: The standard deviation shows how much the responses diverge from the mean.

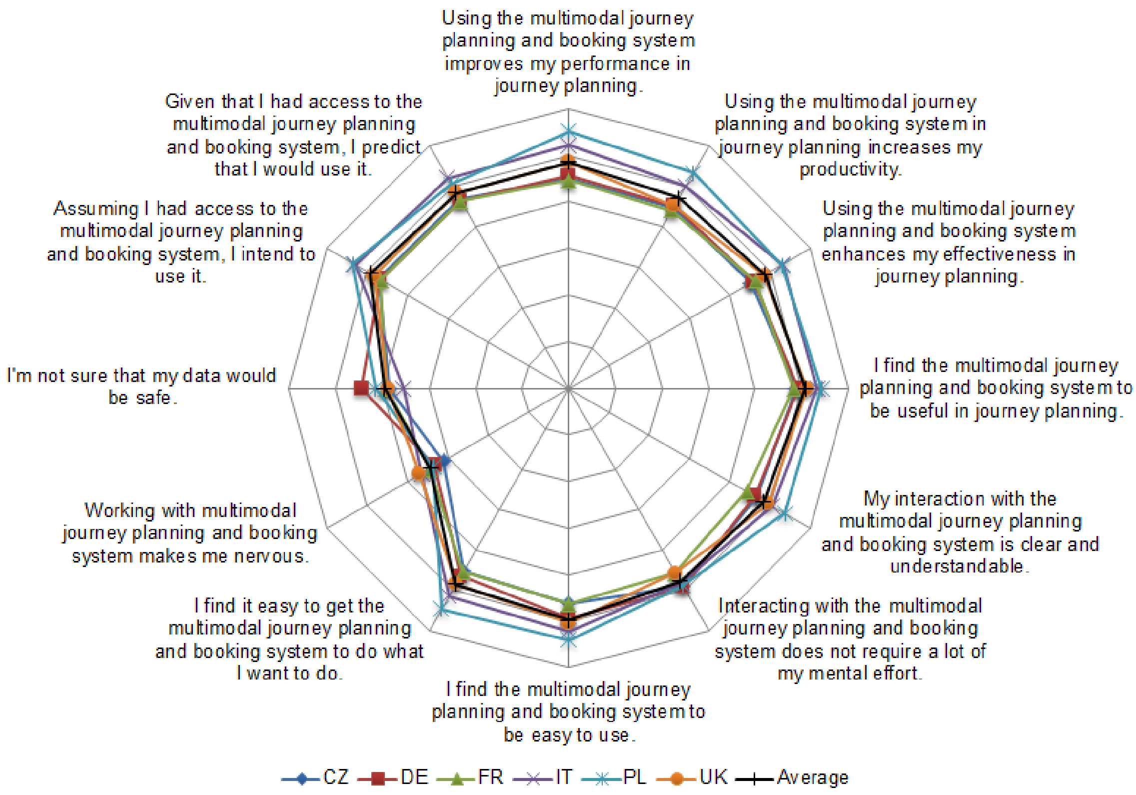

Figure 38: Travellers' Evaluation of a Multi Modal Information and Ticketing System
Source: Own data.[14]

Although the general pattern is quite homogenous among the investigated countries, small differences still occur. In all countries, the perceived utility is evaluated highly positively (with means>4.41). However, a certain range within the evaluation is obvious. The most travellers proving most optimistic about a Multi Modal Information and Ticketing System are to be found in Italy and Poland. The highest level of scepticism against the utility of such a system can be observed in France, and, in part, in the Czech Republic. Evaluations of German and English travellers are mostly ranged close to the calculated average among the investigated countries. Personal data safety is a critical issue especially with respect to personal data.. Here we find the strongest national differences: whereas a stronger concern can be found in Germany (mean=4.44, SD= 1.786) and Poland (mean=4.15, SD=1.728), the concern is not as severe in other countries. Interestingly, the lowest level of concern prevails in Italy (mean=3.55, SD=1.74). When asking in the different countries about the willingness to use such a system, the positive attitude of Europeans is confirmed. However, it can be observed again that Italian and Polish travellers show the highest degree of intention to use it. Taking into account that those two countries already evaluated the system most positively, this result is consistent. Similarly, the lowest intention of using a MMITS can be found in France and

[14] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

Germany. This can be explained by the fact that the previous system evaluation has already been rather cautious compared to other countries.

Despite national differences, a generally positive attitude towards a Multi Modal Information and Ticketing System was revealed. In all countries, it is perceived as a tool that would facilitate a travel process over multiple steps.

Furthermore, a willingness to pay for a Multi Modal Information and Ticketing System can be observed. Respondents were asked for their willingness to pay for the extra service of a Multi Modal Information and Ticketing System in two ways. First they were asked how much they were prepared to pay for a Multi Modal Information and Ticketing System compared to the average booking costs, expressed in percent. In a second question, they were asked about the amount of money they were prepared to pay in the form of an annual fee, expressed in Euros. A summary of the results can be found in the following table.

	Willingness to Pay Expressed as Annual Fee in €			**Willingness to Pay Expressed as Share of the Ticket Price**		
	All respondents	**Respondents willing to pay**	**Adjusted**	**All respondents**	**Respondents with willing to pay**	**Adjusted**[15]
Valid N	687	401	388	685	284	332
Range (minimum-maximum)	0 - 5000	1 - 5000	1 - 600	0 - 100	1 - 100	1 - 37
Mean[16]	55.86 €	95.71 €	51.49 €	9.25%	16.50%	9.58%
Median[17]	10.00 €	25.00 €	20.00 €	2.00%	10.00%	10.00%

Table 8: Willingness to Pay for a MMITS
Source: Own data.[18]

The table shows a wide range in willingness to pay for both payment options. In order to test the robustness of the results, the data set was analysed in three steps. First, all respondents were included. Second, only those with a willingness to pay higher than zero were included. Thirdly, the respondents with a willingness to pay higher than zero were adjusted for the values at twice the standard deviation. In this way, the results are adjusted for possible outliers. Furthermore, to give less importance to possible outliers, not only the mean is calculated but also the median, which is less susceptible to outliers. It has to be noticed that

[15] This sample is adjusted for values with twice the standard deviation.
[16] Mean refers to the average.
[17] Median is the value in the middle of the value series sorted by size.
[18] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

the results are not statistically representative for all European, but can be used to serve as an indicator for willingness to pay.

In general, the data shows that 43% of all respondents are not willing to pay at all, although they have a positive attitude towards a potential MMITS.

Among those respondents that have stated a willingness to pay an annual fee, the average fee would be 95.71 €. When outliers are excluded from the analysis, the willingness to pay accounts for 51.49 €. This shows that some outliers strongly influence the final results. However, in all cases a willingness to pay an annual fee can be found. In addition, the median confirms this conclusion, which accounts for 25 € among all respondents with a willingness to pay higher than zero and for 20 € if adjusted for outliers.

The analysis of the willingness to pay in proportions of the ticket price has to be interpreted with caution because this an even abstracter amount than the annual fee. 9.58% as calculated with the adjusted data set results in a low extra amount for a ticket of 10 € but is very high for a ticket of e.g. 600 €. It is questionable that a respondents always take into account this divergence.

However, based on stated preference it has to be considered that respondents have a general tendency to overestimate their actual willingness to pay. Therefore, it is critical to reduce the mentioned willingness to pay by a certain amount. Nevertheless, it is difficult to make a general statement about the percentage of reduction. According to Hausman (2012) the degree of deviation varies with the survey method (supported or unsupported questioning), the respondents and the commodity. It can be assumed that the imagination of such an abstract service as a MMITS comes along with a stronger overestimation than more known products. This overestimation is called hypothetical bias. From experience it can be said that a reduction between 20 and 70% can be necessary to finally have the actual willingness to pay.

4.5 Implications of a Multi Modal Information and Ticketing System

Assuming that the travellers will use a MMITS, the question arises as to whether a Multi Modal Information and Ticketing System could actually influence people's travelling behaviour. The system would provide comparable information and would allow flexibility throughout the whole travelling process. Assuming that travellers then have a maximum of well-structured information throughout the whole trip process, and thus can make well-informed decisions, the question arises as to whether this would lead to a shift to alternative modes.

It can be argued that alternative mode information is often hard to access or to find, and is therefore rarely consulted by travellers. In consequence, they are often unaware of alternatives. The suggestion is that the perception of alternatives to the car would change.

In our study we investigated the reasons why travellers would not choose one of the presented alternative modes (car sharing, aircraft, train, and bus). The determinants of modal choice criteria were confirmed: environmental aspects do not play an important role for any mode. Buses are especially associated with a long journey time, a lack of comfort and a lack of privacy. Trains suffer from a lack of flexibility and reliability, but also a high price. Car sharing is associated with a high price and a lack of availability. The reasons against the aircraft are ranked relatively low compared to the other alternatives. The main reason against the aircraft is the high price. In particular the criteria "lack of availability", "lack of reliability" (which can also be a problem of perception as discussed in chapter 2) and "lack of flexibility" can be improved by a Multi Modal Information and Ticketing System. Assuming that these criteria are decisive for trains and buses, the highest potential for improvement through a MMITS lies within those two modes.

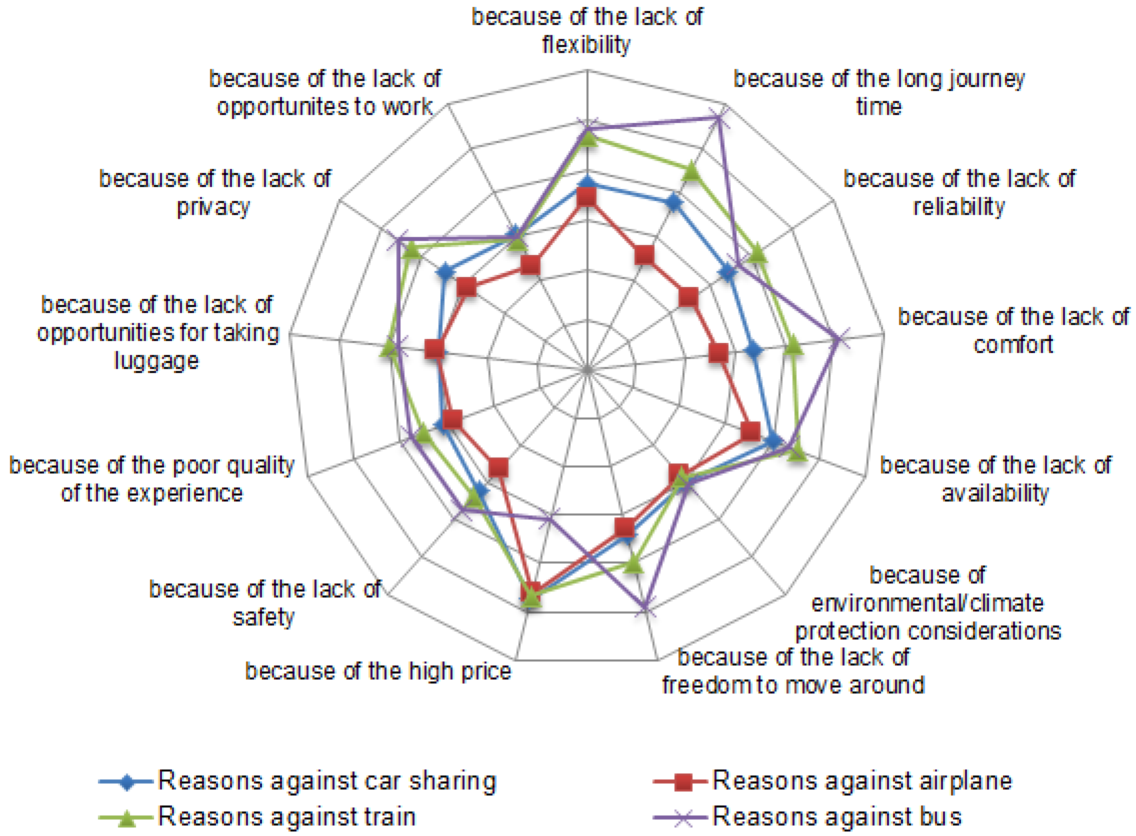

Figure 39: Reasons for Not Choosing a Certain Mode
Source: Own data.[19]

Our study, however, has shown that the overall willingness to switch from one mode to another among all respondents does not significantly change with the introduction of a MMITS. Only a small increase in the use of aircraft is to be expected. An increase of 0.3% in the mean (from 3.37 to 3.38 on a scale from 1 to 5) can be found. Only a little more increase in willingness to change can be found for the train of 1.18% (from a mean of 3.34 to 3.40). Although car sharing (increase of 3.66% from a mean of 2.63 to 2.73) and buses (increase of 4.81% from a mean of 2.77 to 2.91) experience the highest increase in willingness to change, in total it can be concluded that travellers would most probably change to the train.

[19] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

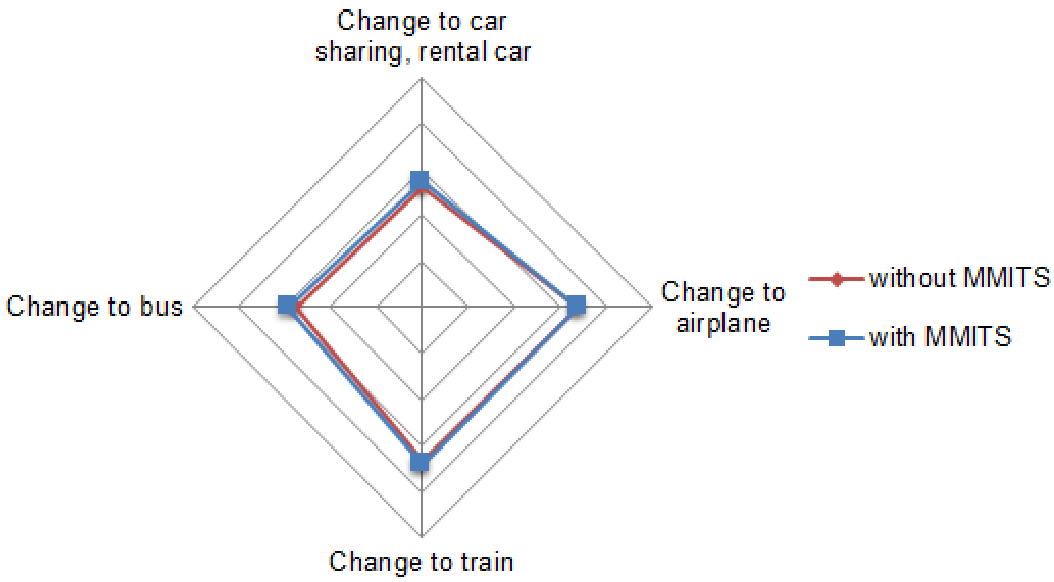

Figure 40: Willingness to Change Without and With a MMITS ("Could you envisage your mode of transport choice changing due to the use of the multimodal travel information and booking system?")
Source: Own data.

A closer look at car drivers, however, reveals a more differentiated picture of the willingness to change. The analysis of heavy car users[20] showed a by far higher increase in the modal shift potential. The willingness to change from the car to car sharing increases by 8.19% (from a mean of 2.23 to 2.43). The willingness to change to an aircraft increases by 7.17% (from a mean of 2.78 to 2.99), whereas the train is marked by an increase of 8.21% (from a mean of 2.74 to 2.98). The strongest relative increase can be found for buses, with around 14.7% (from a mean of 2.1 to 2.46). It can be assumed that the strong increase is generated by travellers that would now rather use public local transport. However, the largest willingness to change in absolute figures can be found for trains (mean with MMITS: 2.98) and aircraft (mean with MMITS: 2.99). The superiority of the aircraft is only small. Therefore it can be assumed that, in the end, the real decision varies when comparing, for example, the price between aircraft and train.

[20] They answered the question "Please order these modes of transport according to their average usage on your planned journeys. Please be sure to focus on your main journey routes in the last 12 months." with 75% or more.

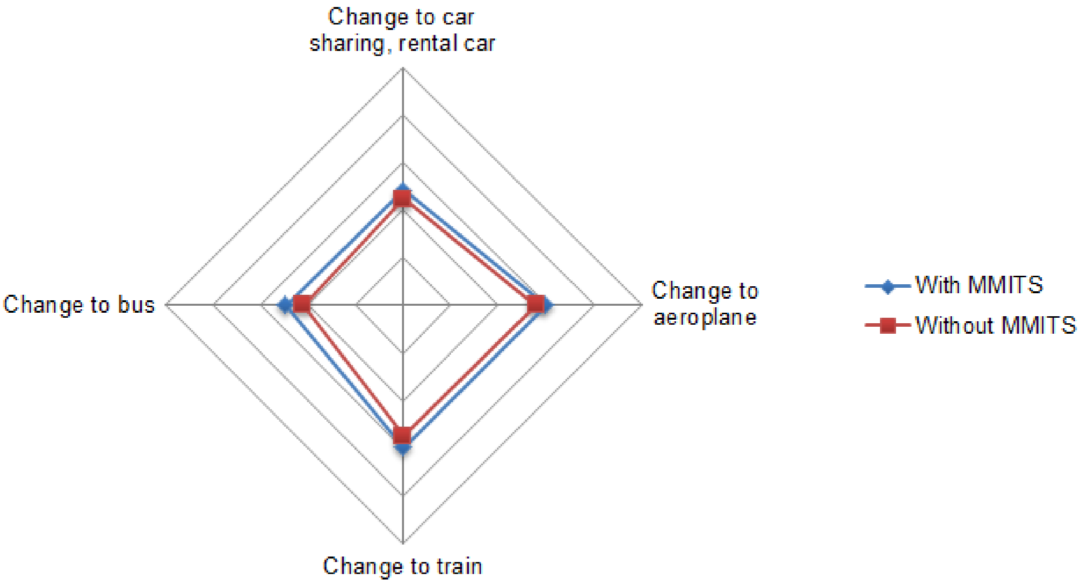

Figure 41: Willingness to Change Without and With a MMITS among Heavy Car Users
Source: Own data.[21]

If travelling now becomes easier for all modes, the question arises as to whether this will lead to an increase in traffic volume, i.e. induced traffic. In theory, induced traffic can be generated for example through the improved facility of routes, rescheduled traffic, destination shifts or additional travelling.

In our study, the participants were asked if they had ever refused a trip because planning was too complicated. It showed that the degree of complicatedness usually did not influence people's travel demand. Almost 73% stated that the complicatedness of the trip planning had not or had not at all prevented them from taking the trip. Around 27%, however, partially to completely agreed that they had not conducted a trip because trip planning was too complicated. For this group of travellers, it can be suggested that trip planning might improve, and additional trips might therefore result.

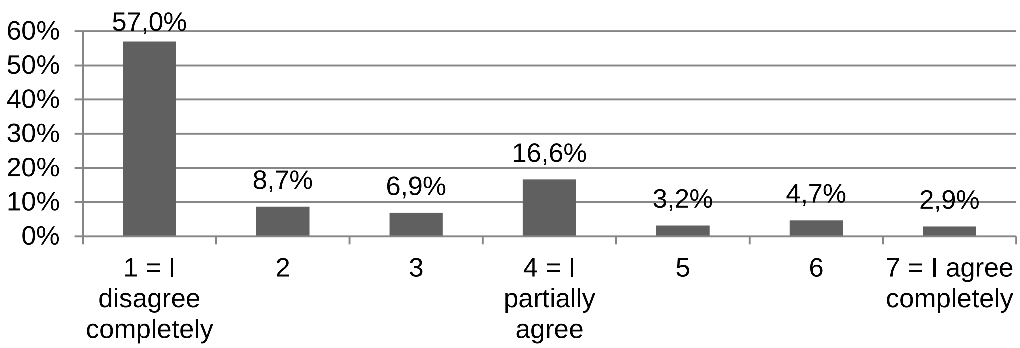

Figure 42: Share of Travellers that Cancelled a Trip due to Complicatedness
Source: Own data.[22]

[21] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

4.6 Key Findings of WP 2

1. Passenger transport volume in Europe has been steadily growing over the past years (except 2010). The modal split in passenger kilometres is dominated by car usage (74%); rail accounts for 6.3%, and air traffic for 8.2 %. The volume of the European travel market will continue to grow over the next decades.
2. Roughly 90% of trips in Europe are short distance trips (<100 km). The modal split of long distance trips is dominated by air traffic and private cars. Around 90% of rail traffic in Europe is short distance traffic. Currently, rail does not play an important role in European cross border traffic, because 94% of long distance rail trips are domestic.
3. The most frequented routes (in air travel) depart from Germany, Spain, France, Italy and the United Kingdom. The most important fifteen Origins and Destinations provide almost half of the number of passengers in Europe. On average, 35% of trips in Europe are multimodal (source: USEMobility). With respect to trip purpose, leisure trips account for the largest proportion of the trip volume; business trips account for around one third of the total trips.
4. An in-depth analysis and segmentation of the multimodal travel market's demand side cannot be performed because of a lack of appropriate data at a European level.
5. Websites of carriers and general search engines are the most important sources for trip planning information (source: own survey). 90% of respondents use their PC for booking. Mobile devices are gaining in importance, offering additional services and comfort during the trip (e.g. disruption management).
6. The results of our survey confirm the criteria for modal choice found in the literature. Environmental/climate protection is ranked rather low regarding the criteria for modal choice (source: own survey).
7. The main barriers for multimodal travelling are a lack of seamlessness and high complexity. Leverage elements might be: Restructuring networks and interchanges, improving information, offering single tickets and making luggage handling easier to facilitate multimodal travelling.
8. A MMITS may meet the demands of passengers and thereby facilitate multimodal travelling. In our survey, the evaluation of the MMITS is positive, but the willingness to pay for a MMITS is very limited.

[22] As previously discussed in detail, the results are not representative. However, they are statistically reliable.

9. The MMITS might improve the travellers' opinions of "lack of availability", "lack of reliability" and "lack of flexibility", which are often related to trains and buses. This is a chance to improve the perceived quality of these modes, notably in a multimodal travel chain.
10. Willingness to switch from one mode to another does not significantly change with a MMITS, except in the case of heavy car users.

5 The Market for Information and Ticketing Systems in Europe – Status Quo and Key Drivers of Future Development (WP3)

Work Package 3 is focused on the supply side of the market for multimodal journey planning. It is mostly based on expert interviews and internal documents provided by external experts and consortium members.

At first, and due to the complexity of the topic, we will discuss the three essential elements of a Multi Modal Information and Ticketing System (Information, Booking/Ticketing, Settlement/Payment), preparing a basis for the analysis of the market in general.

The following chapter firstly presents currently running platforms for multimodal information, ticketing and booking. Subsequently, different online channels are analysed to show the importance of digital distribution channels for the industry. In addition to the platforms and channels, we describe today's multimodal approaches on the European market. Analysing the solutions currently available in the market, we distinguish between truly multimodal approaches and co-modal approaches, which sell single-modal products combined or packaged at the distributional or retailing end of the distribution value chain.

After this, the distribution value chains of the main travel modes, air, rail and local public transport are analysed in far more detail. This provides valuable information about typical processes for each travel mode as well as the players involved. The distribution value chains are compared to each other. In addition, data interfaces and different ticket schemes are analysed to complete the picture of today's travel distribution in Europe.

Based on the breakdown of the current market, the next step is the identification of future trends. Therefore, we distinguish between technological trends and market immanent trends. The latter derive from internal developments in the market, while technological trends most likely derive from the ICT (Information and Communication Technologies) industry. It is thereby analysed how the technological background of the market may develop. This also includes current fragmentation of data standards in the travel sectors.

Going deeper into the market for a MMITS, the next chapter addresses the business models of currently available web platforms. The business model patterns of the existing multimodal journey planning solutions are investigated and further evaluated. Based on this investigation, a future outlook is provided regarding the possible strategic positioning of existing platforms. This leads to the analysis of possible business model patterns for the future of MMITS systems.

The last chapter of WP3 deals with socio-economic aspects regarding the market for MMITS systems. It addresses the role of the different key players in the market and their incentives to promote a MMITS: We discuss the role of OTAs and transport operators on different levels, and their incentives for cooperation.

5.1 Three Pillars of Multi Modal Information and Ticketing

A Multi Modal Information and Ticketing System (MMITS) rests on three pillars. As shown in the figure, these pillars are information, booking & ticketing and settlement/payment. In order to ensure that the service is available to the traveller and therefore usable throughout Europe, these pillars are based on the general availability of (mobile) Internet. Due to the fact that a service can only be as good as the quality and comprehensiveness of its data, non-exclusive access to schedules, prices and availability information for all European transport operators is required.

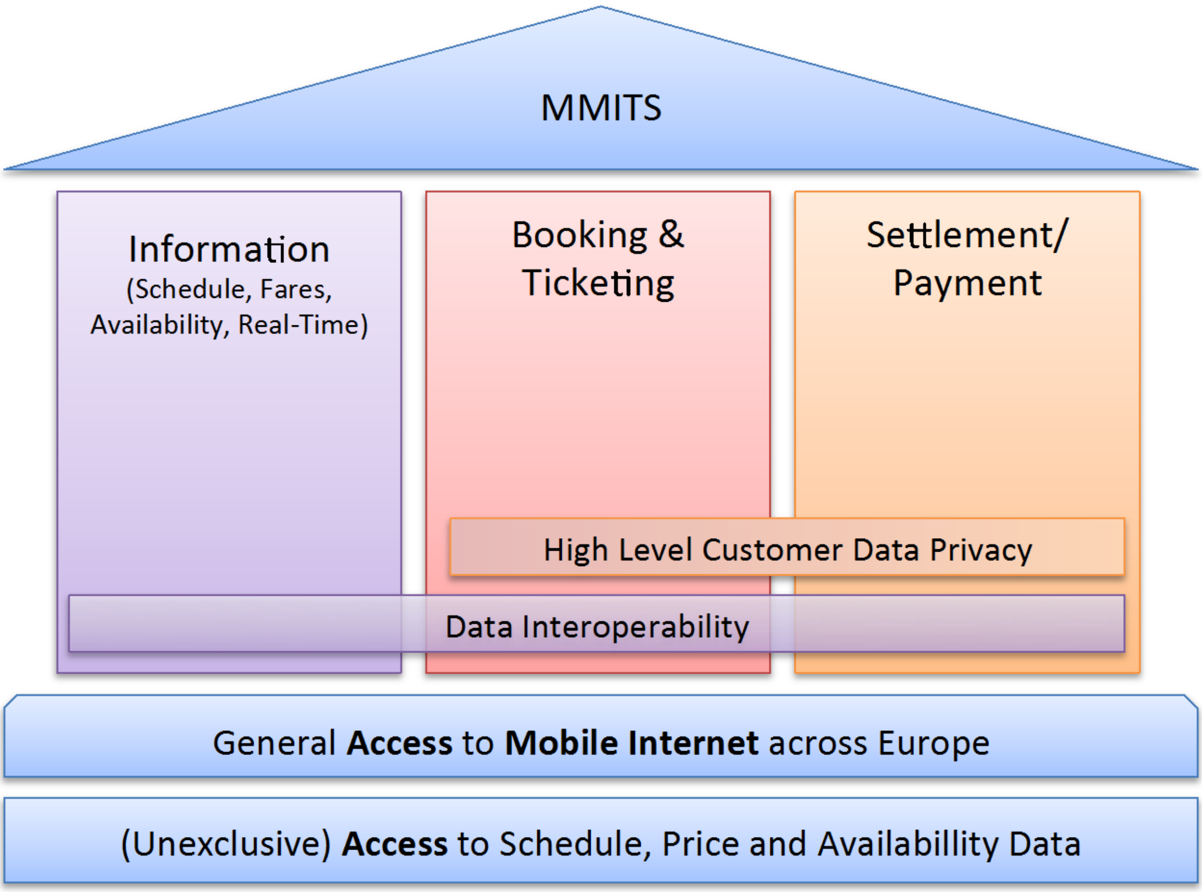

Figure 43: Three Pillars of the Multi Modal Information and Ticketing System
Source: Own illustration.

5.1.1 Information

Information is the key factor for planning a journey, and includes various items such as (vehicle) locations, stations, schedules, fares, etc. The main issue with information today is a lack of publicly available information due to the fact that not all European transport operators are willing to share their information with other players in the market. This could be because they view information as intellectual property, or treat it as a competitive advantage. In addition, market players use different software solutions that use different codes (data formats) for the same station or location. As this will prove an issue when setting up a common system, it may be necessary to merge this data by setting up a central data hub that translates the information of different sources into a common language.

Regarding air travel, common travel information and booking solutions are available through Global Distribution Systems (GDS). A GDS is a computerised system that collects all available data from the participating airlines as an intermediate actor in the booking process. This data includes schedules, availability, fares and related services.

Regarding the rail industry, the situation is different. Every rail operator in Europe uses a mainly national solution for schedule information, booking and settlement. Data formats are mostly not interoperable and therefore can hardly be merged. Although there is a certain amount of cooperation between European rail operators, , the only approach to a common information platform for the rail industry at the moment is MERITS. MERITS (Multiple European Railways Integrated Timetable Storage) is a single database, which contains the schedule data of all participating rail operators. The platform is for B2B purposes only, and does not provide travellers with schedule information. In order to improve international rail travel, the European Commission has developed TAP-TSI to implement pan-European information and booking standards for rail travel. This includes the commitment of making schedule and fare information publicly available to travellers and other rail operators. The contents of this regulation are for example the exchange of data on timetables, tariffs, reservations, fulfilment information to passengers in stations and the vehicle area and train running information. TAP-TSI also aims at a common standard in case of station codes, and is intended to be put into full operation as of 30 January 2016.

Local public transport is mostly organised on a regional or local level. Thus, again, a common information system is not given. Regarding local public transport, this arises from the situation that local authorities arrange public transport and hence only focus on their own region. However, due to the fact many different local solutions are in use, a standardised solution would be useful. This could for example be realised with a common data hub. This data hub will have to translate data from the different planning solutions to provide the user with a single contact point for local public transport information. This solution requires electronic vehicle disposal and GPS-equipped public transport vehicles all over Europe. In particular small mobility providers might struggle with such systems due to the high costs of implementation.

We can divide the information required into pre-purchase data and post-purchase data.

Pre-purchase data is required by the traveller before booking a trip. Pre-purchase data consists of static and dynamic information. Schedule information, which is typically static information, is filed in advance. This type of information only contains the schedule and the static fares. It is required to plan a journey in advance, and may also be defined as "push" data, which is updated and delivered by the transport operator on a regular basis.

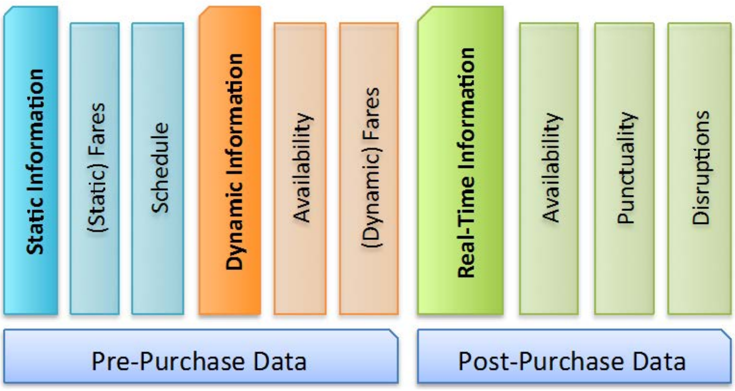

Figure 44: Classification of Travel Information
Source: Own illustration.

Dynamic information contains dynamic fares and availability. This information is generated just in time when the traveller requests for information. Transport operators in Europe have different business models, and therefore use different fare systems. Some rail operators calculate fares based on travelled kilometres. Others have dynamic approaches, and calculate fares according to current demand. Special fares, such as the Deutsche Bahn 'Spar-Preis', are fares that are not based on travel distance, but which may be calculated dynamically according to traveller's request, depending on availability. As this information may not be filed in advance, it has to be "pulled" from the operator's database when requested.

Post-purchase data typically consists of real-time data. Real-time data is used for information during the trip or very shortly in advance. This type of information is also dynamic, and is therefore steadily updated. It is based on real-time location information of public transport vehicles, and must be highly accurate to be of any use. In contrast to static information, real-time information is not filed in advance, and has to be updated permanently from the operators' API (Application Programming Interface) by a travel information system.

Real-time data is usually required during a journey. The only exception to this classification are last-minute travellers and local public transport users who do not book in advance, but make a decision regarding their travel mode on real-time data (See WP 2 for information about modal choice).

5.1.2 Booking & Ticketing

Information is only the first step, directly followed by booking and ticketing. Booking of certain itineraries is a process that is only possible and/or necessary with transport modes that allow or even require previous reservation. The term 'booking' itself describes the reservation of a seat for a certain transport service without receiving the ticket itself. Regarding different travel modes, this process varies. The ticket results from a contract between transport operator and traveller. It is a proof of the contract that allows the traveller to use the operator's transport service. It is independent from payment and settlement.

The figure below describes today's booking and ticketing process in a multimodal journey from the traveller's point of view. It must be mentioned here that the process may fail after every single step due to multiple circumstances.

In step 1, the traveller requests a certain connection via an online travel agency or transport operator's web service. As a response, they obtain static information about each operator's schedule, which is filed by the transport operators. Based on the connections available, the traveller matches possible opportunities themselves, compares the opportunities regarding their own individual criteria, and then makes a decision in step 2. If the traveller decides positively, step 3 is to split up the journey into the single travel modes again, and separately check the availability for each travel mode. Step 3 also includes dynamic data, unless using public transport. The availability of connections and the fares are calculated dynamically on request. Therefore, the offer is also based on dynamic information. Based on certain offers, the traveller may now alter their decision. Steps 4 to 6 eventually complete the process by processing the booking itself, fulfilling the payment and receiving a ticket.

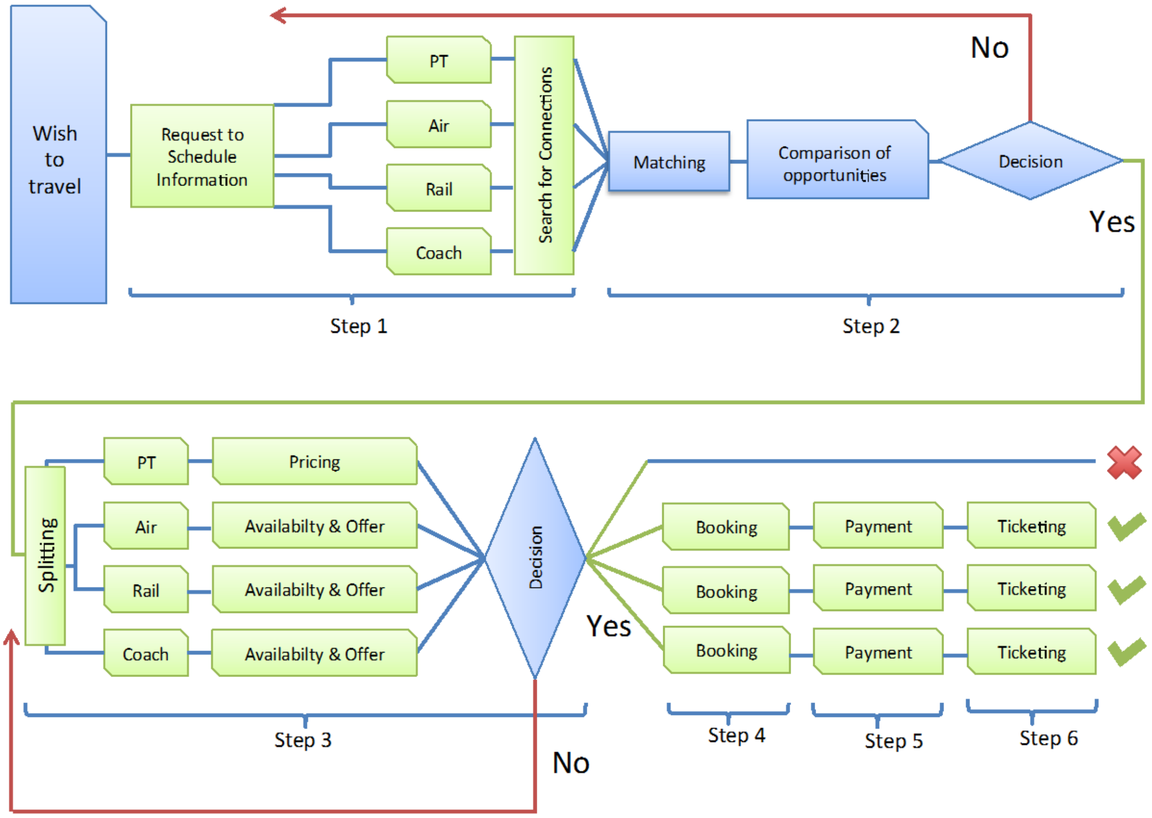

Figure 45: The High Level Process of Multi Modal Booking & Ticketing from a Travellers' Point of View in 2013
Source: Own illustration.

As the figure shows, advanced booking and ticketing is only possible for medium and long distance transport modes. Due to the fact that local public transport only uses non-reservation tickets, and booking is not required, no local booking systems exist at all. Therefore, in step 3 only fares can be provided, but no information on availability. A ticket for a single connection will probably not be purchased in advance, but rather on the day of travel.

5.1.3 Settlement

The third pillar of multimodal journey planning is settlement. Settlement describes the process used for the payment and accounting of ticket sales. Procedures of settlement vary between the transport modes and channels used for purchasing a ticket. In the air industry, for example, various players are involved in the process of settlement. Due to this, the settlement of different transport modes will be specifically discussed in an additional chapter.

Payment is not always the actual process of transacting money in return for a transport proposition. In case of credit card payment, it is only a proof of the solvency of the traveller. The actual process of transacting money is processed afterwards. Payment can be made in advance, just in time or after conducting the transport.

Payment in advance, meaning before the transport is conducted, is usually to be found with transport modes that require booking, like air and (integrated reservation tickets in) rail, where it happens as part of the booking process. For advance payment, several payment modes can generally be used, such as credit card, PayPal and bank transactions.

Regarding local public transport, payment is usually processed just in time as a person travels - i.e. shortly before or shortly after. An exception to this rule are monthly or seasonal tickets issued by local transport authorities, and multi-trip tickets. These are usually bought by frequent travellers such as local commuters. This is also true for pre-paid smartcards, for which money is loaded onto the smartcard. The smartcard is then used to pay for the trip.

5.2 The Market in General

The European travel market as a whole has grown to approximately 219bn euros in 2011 and will probably, after a slight recession in 2009/2010, increase to 252.4bn euros in 2016, as reported by a Barclays Capital study from 2012. According to a forecast by eMarketer from September 2012, the percentage of online travel sales in the European travel market is growing steadily and will probably reach 50% in 2016. In addition, as a traveller study by Google and Ipsos MediaCT reveals, the number of leisure travellers using their mobile devices to obtain travel information has increased by more than 450% since 2009.

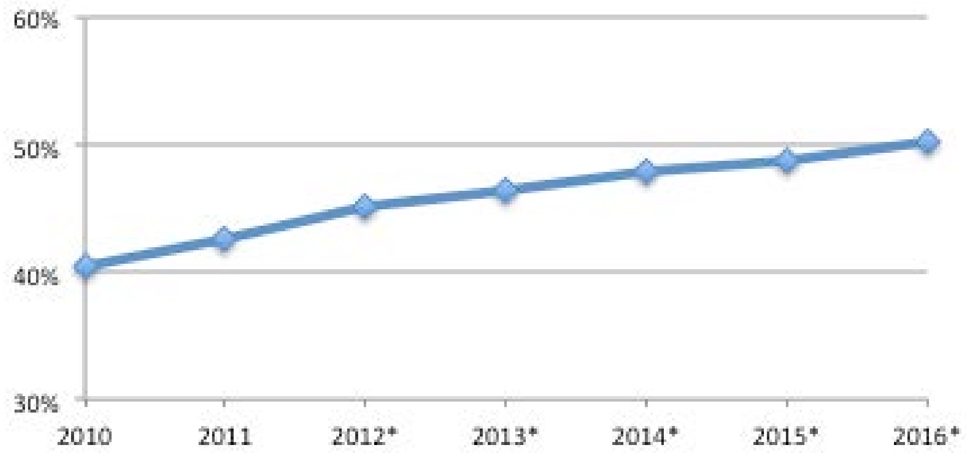

Figure 46: Forecast: Percentage of Online Travel Sales in Europe 2010-2016
Source: Statista; http://www.statista.com/statistics/247349/percentage-of-online-travel-sales-in-europe/

According to a study by comScore Media Metrix from 2012, an average of about 57% of European Internet users aged 15 or older accesses travel websites. The UK is the leading market with a reach of 69.4%, followed by France with a 61% reach of travel websites.

Figure 47: Access of Travel Websites in European Countries in May 2012 by Proportion of Internet Users (in Percent)
Source: http://www.statista.com/statistics/235377/online-reach-of-travel-sites-in-europe/

As these figures show, the Internet will probably become the main channel for travel distribution in the future. In this context, the development of a MMITS as an online service seems generally reasonable.

5.2.1 Information, Ticketing & Booking Platforms

Over the past years, several online services for travel information have been released. Many of these are provided by transport operators as direct distribution channels; others are independent travel search engines that take on the role of (online) travel agencies. In addition, meta search engines are available which crawl online travel agencies and transport operators' web services in order to obtain the widest possible range of accessible information, thus providing their users with the best possible offer. They also have access to GDSs, and therefore to information on current availability and real-time price quotes. Others crawl the information provided by travel agencies on the web, utilising direct access to transport operators' web services. Regarding the different service providers, it would appear that immanent business models are also different.

Currently, there are several multimodal journey planners available on the (European) market such as Waymate, Rome2Rio, Google Transit and JourneyOn, to name but a few. They offer a variety of services, ranging from transport information for local public transport to international flight connections. Some of them, like Rome2Rio, also provide the user with the possibility of comparing transport modes, allowing them to make a decision regarding costs, travel duration and even CO2 emissions. Others, like Waymate, not only act as an information platform, but also sell tickets in the capacity of a travel agent.

While these planners offer valuable services, none of them offers a comprehensive multimodal information and booking solution.

5.2.1.1 Direct Sales and Travel Information

Most transport operators offer online travel information, booking and ticketing as part of their customer service and sales strategy. The user can browse the schedule and fare database, usually of one transport operator at a time, and filter search results by various items via the transport operators' website. Subsequently, they can book the preferred itineraries on the same webpage. The e-ticket can either be downloaded or be delivered by email. E-tickets contain unique QR-codes and bar codes for validation on the train or at the airport.

Usually, local public transport authorities do not offer a booking and ticketing service because no booking in advance for single leg tickets is required. For local public transport, tickets are sold and issued shortly before the beginning of the journey. Only frequent travellers, who use season tickets, pay in advance. However, many local public transport providers run their own journey planning web service. Travellers can typically use it free of charge.

As direct sales do not include third parties, it represents the most profitable sales channel regarding the contribution margin per ticket from a transport operator's point of view.

5.2.1.2 (Online) Travel Agencies

Travel agents offer a variety of services; the most important is allowing the traveller or the travel buyer to compare offers from different transport operators, and issue tickets. Increasingly, and in particular in the B2C space, travellers search for information via an online travel agency (OTA) or a meta-search engine. OTAs act like traditional travel agencies, that predominantly use GDSs to offer the best possible journey proposition to their clients, but sometimes also "web scrape" transport operators' websites to acquire content. Meta-searches, unlike travel agencies, do not provide payment or ticketing, but refer the traveller to a provider's website for completing a transaction. Unlike other search engines, OTAs do not primarily rely on advertisements to monetise their service. Instead, they add service fees to the client, and in some cases, particularly for hotel bookings, receive commission for products sold. Fares offered via travel agencies may differ from transport operators' direct offers. (Online) travel agencies may also sell the allotments of seats and tickets on their own behalf, booked in advance with transport operators.

EU travel agencies are obliged to provide neutral information pursuant to Regulation 80/2009 (the CRS Code of Conduct).

5.2.1.3 Meta Search Engines

Meta Search Engines (MSE), as shown in Fig. 6, in general, connect to transport operators' web services, but also OTAs, and GDSs. Kayak, for instance, is powered by Amadeus. Their main task is the aggregation of publicly available information to simplify the range of offerings and to give recommendations on which itineraries to choose for a certain journey, based on logical algorithms. Meta search engines rely primarily on revenue from advertisements. MSE are not currently subject to the neutrality obligations of travel agencies in the EU.

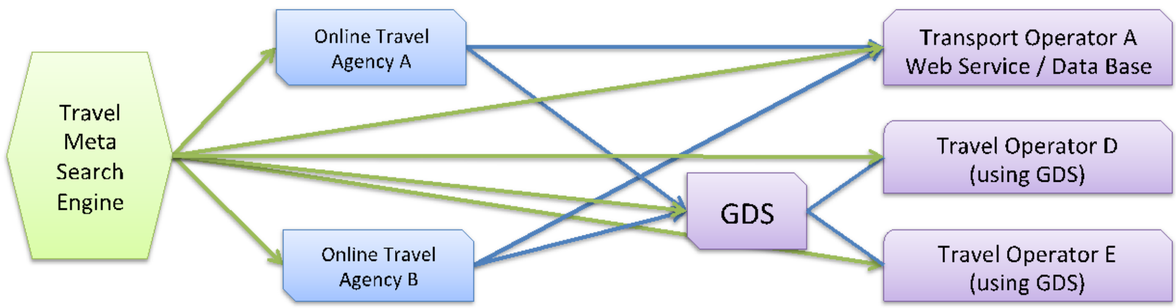

Figure 48: OTA and Meta Search Engine
Source: Own figure

In addition, MSEs also deal with fragmented data standards. Besides the aggregation of information in order to create a convenient user experience and usable information, different 'languages' used for schedule, fare and availability data between different travel sectors need to be translated and brought together.

5.2.2 Online Channels

With reference to multimodal journey planning and ticketing, online is most likely the strongest and most important channel for information and distribution. Online represents a fast-growing channel for travel information and sales. According to a study by Accenture from 2012, 71% of all train travellers use the Internet for booking their journeys frequently or very frequently. In addition, the study tells that mobile devices are to become the preferred information and booking channel of the near future. In European and global e-commerce, travel is also the largest category.

Online travel revenues, as a percentage of total travel revenues in Europe, have increased from approx. 23% in 2006 to about 43% in 2010, and are still rising.

One main characteristic of online channels is a strong increase in market transparency, as the online channel provides a wider choice for the comparison of different offers, and reduces transaction costs for the customer.

In this chapter, the online channel is divided into desktop, mobile and tablet access.

Desktop access holds the strongest stake in national and international journey planning and booking. More than 50% of the European travel market is booked via desktop computers or laptops, either home or office-based.

In recent years, the percentage of desktop use has decreased due to new devices such as smartphones (mobiles) and tablet computers.

Since 2007, the year Apple introduced the iPhone, the market for mobile services has developed extremely intensely. In the context of travel, a study from 2013 by the European Travel Commission states that the number of leisure travellers using a smartphone for searching travel information has increased from under 10% in 2009 to nearly 40% in 2012. As the figure below shows, the growth of travellers who use mobile devices to search for travel information is even larger in business travel.

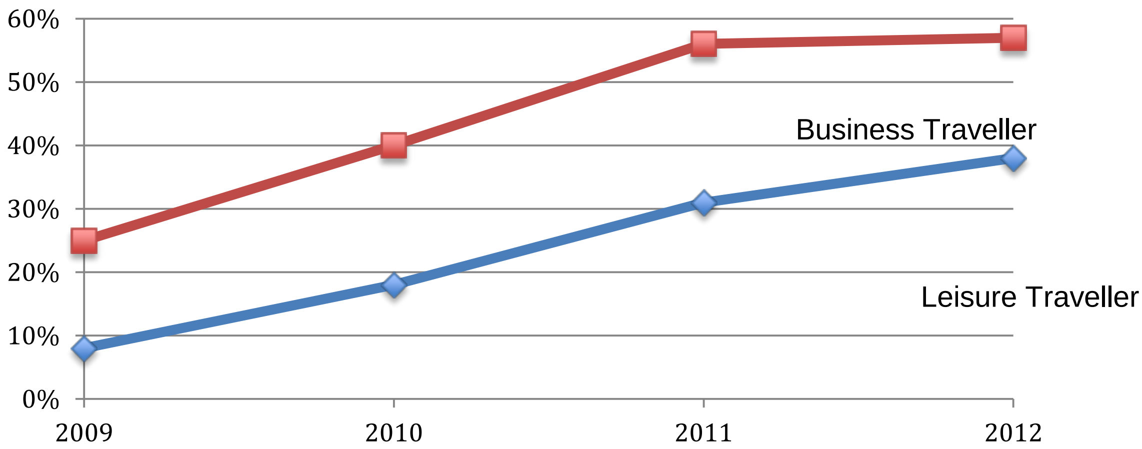

Figure 49: Percentage of Travellers who use a Mobile Device to Search for Travel Information
Source: European Travel Commission, New Media Trend Watch World, 29 June 2013.

Regarding operating systems and according to a study by Kantar Worldpanel ComTech (2013), more than 50% of smartphones in Europe run on Android OS (Spain: 92%, Germany 76 %, France 65%), while iOS (Apple) is right behind them in second place, ranging from a nearly 30% market proportion in the UK to only 4% in Spain. The application market for Android smartphones is rather liberal, whereas Apple's App-Store is a walled garden that is kept under the iron control of Apple Inc. Every application entered into the App-Store is reviewed by Apple, and rejected if it does not accord with the general terms and conditions. Besides applications which are not interoperable between different smartphone operating systems, mobile web services represent another method of entry into the mobile market. A study by Walker Sands, dating from January 2012, tells us that 23.14% of worldwide website traffic in Q4 2012 came from mobile devices. This is a strong increase related to only 6.25% in Q4 of 2010, and shows a substantial upward trend.

Figure 50: Share of Website Traffic Coming from Mobile Devices from the 4th Quarter 2010 to the 4th Quarter 2012 (in Percent)
Source: Walker Sands via http://www.statista.com/statistics/216832/share-of-internet-traffic-coming-from-mobile-devices.

Previously included in mobile statistics, tablet computers are meanwhile widely used as home-based devices to access the Internet. Therefore, they need to be regarded as a new kind of privately-used computer. Since 2009, the number of tablet computers has grown to about 33 million devices in Western Europe. A study by Forrester, polling 13,000 customers in France, Germany, Italy, Netherlands, Spain, Sweden and the UK, estimates that this number might grow to more than 147 million devices in 2017. Regarding this massive number of devices, tablets need to be taken into account as a proper channel for online information. According to a study by eMarketer published in 2013, the revenue gained through tablets in the UK will generate twice the revenue gained through smartphones by 2017.

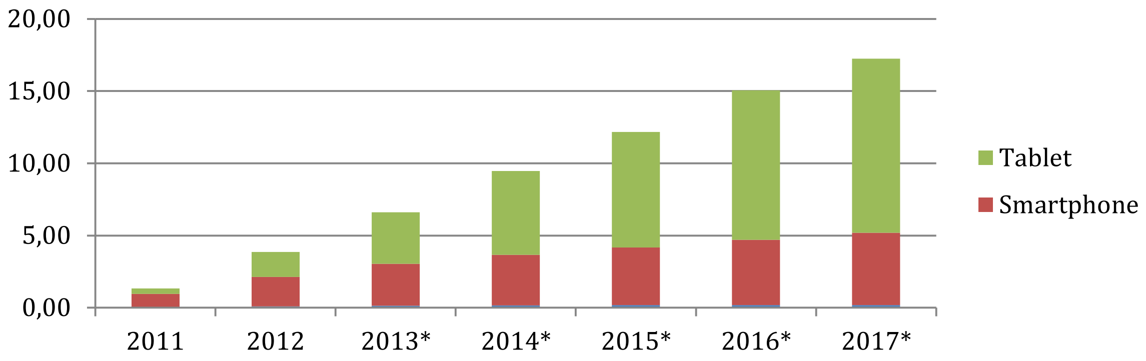

Figure 51: Mobile Retail Commerce Revenue in the United Kingdom from 2011 to 2017, by Device (in Billion British Pounds)
Source: http://www.statista.com/statistics/260970/mobile-retail-commerce-revenue-in-the-united-kingdom-by-device/

5.2.3 Multi Modal Approaches Today

This chapter provides the reader with an overview of the current market situation in the market for multimodal travel planning and booking. By now, May 2013, many things have changed in E-Business and the digital industry since the last study conducted by the EC on multimodal journey planning in 2011.

Some examples of current offerings are provided below. They vary from simple regional journey planners to a global system that includes nearly every publicly available transport mode. The examples show that multimodal journey planning is not an issue in general. Services that provide multimodal journey planning are available, but mostly cover only national, regional or local transport modes, and do not cover all accessible modes of transport. A comprehensive multimodal booking system is not available at the moment.

5.2.3.1 Multi Modal Electronic Ticketing

Throughout Europe, several systems for multimodal electronic ticketing have been established in the context of public transport. Most of these systems, which are aimed at the end user, are local or regional solutions using smartcard technology. So far, these are isolated applications and are based on different technology standards.

Touch&Travel

Touch&Travel is a smartphone-based solution for paperless ticketing in Germany. It was initiated in late 2011 and was, at first, only used for public transport in the Rhine-Main area.

The system works via mobile Internet, and is not dependent on special hardware at the transport facilities. On entering a bus or train, the user checks in with a smartphone app that localises him via GPS and mobile Internet. On leaving the train or bus, the traveller checks out the same way. All tickets used are accounted for at the end of the month.

Oyster Card (London, UK)

Oyster Card is the multimodal ticketing solution for greater London. It allows passengers to use all modes of public transport with only one smartcard ticket. It is based on a Smart-Card Service using RFID-technology. A pre-paid-system is used for accounting purposes. The Oyster Card is valid for bus, tube, tram, DLR, London Overground, riverboats and most national rail services in London. Using a transport mode, passengers check in via a card reader on entering the train or bus. With some transport modes, they also check out when leaving. On checking in, the card-reader verifies whether the passenger has enough money loaded onto their smartcard. If not, they will needs to top up or buy a paper ticket before entering the train or bus.

In addition to ticketing, the Oyster Card provides travellers with the opportunity of toping up their credit automatically via Credit Card using "Auto-top-up".

One special service for people who conduct multiple journeys a day is daily price capping. The system adds up the purchased tickets, and automatically switches to a day-pass if this proves cheaper. Oyster Card is operated by a private consortium composed of TfL, Cubic and EDS.

In addition to the Oyster Card, from 2013 on travellers will be able to pay for public transport using contactless payment via their contactless credit, debit or charge cards.

Brighton & Hove Multi Modal Travelling (CIVITAS Archimedes)

Brighton & Hove Multi Modal travelling is a smartcard system called “the Key” used by the city of Brighton & Hove in UK. Travellers in Brighton & Hove use public transport without paying cash for their tickets. In order to implement the smartcard technology, buses and trams have been retrofitted with smartcard readers.

Since April 2013, in addition to this technology smartphones can be used as the ticket medium. Passengers buy a ticket via their smartphone, and show the ticket to the driver on their smartphone screen. This m-ticket uses a special app that is available for iPhone and Android smartphones.

The intention of multimodal ticketing in Brighton & Hove is to create a user-friendly environment for public transport, so that travellers do not have to buy single tickets for every leg of their journey. The goal of using this integrated ticketing system is to motivate people to use public transport by offering a more comfortable way of travelling.

Brighton & Hove multimodal travelling is developed by CIVITAS, which is co-financed by the European Union.

OV-Chipkaart (NL)

Another smartcard solution is the Dutch OV-Chipkaart. The OV-Chipkaart is used in the whole of the Netherlands for (high-speed) trains, buses, metro trains and trams. Just like the Oyster Card, it makes use of the pre-paid process for accounting the fees. OV-Chipkaart was first introduced in 2008. It is a proprietary solution by Trans Link System (TLS), a consortium of the five largest public transport companies in the Netherlands. OV-Chipkaart itself is free of charge.

5.2.3.2 Multimodal Travelling Information System / Journey Planner

Multimodal travel planning is far from being revolutionary. Several Online services provide their users with information about multimodal travelling.

GOEURO (beta)

GOEURO is a multimodal journey planner for Europe. It was created by an international team in Berlin, and currently runs in beta-mode. It has been certified by various transport operators, such as Deutsche Bahn and Eurolines.

GOEURO offers multimodal journey planning from city to city only. It provides the user with the opportunity to sort through results according to the price or travel duration. The system supports three transport modes, bus, air and train. Although public transport is not part of the service, connections are proposed which could be carried out by car.

The platform does not provide the opportunity to book directly. For booking, the user is forwarded to each transport provider's own online booking service.

Rome2Rio

"Rome2Rio" is a multimodal travel planner with open API (application programming interface). It provides a complete door-to-door journey planner, which supports all modes of travel (air, rail, public transport, ferry, taxi, car). Rome2Rio provides fully detailed information on travel modes, travel time, real-time costs and CO2 emissions for proposed itineraries. In addition to these details, it provides an overview of the complete trip via integrated Google-maps. Although Rome2Rio does provide the user with current ticket prices for the specified travel date, it does not give them the opportunity to book through the journey-planning user interface. For booking, the user is forwarded to each journey stage provider's booking interface, and leaves the platform at this point. This means that every leg of a journey has to be booked separately by the user, and it cannot be guaranteed that the given price is held throughout the booking process - nor is the user provided with on-trip information.

Car sharing services and car-rentals have not yet been taken into account. In addition to the desktop-service, there is also an iPhone app available.

Route-Rank.com (CH)

RouteRank provides customers with city-2-city journey planning. Available modes are rail, air, and car. Proposing different routes, the journey planer also provides the user with detailed information about their journey, such as travel time, travel modes, CO2 emissions and price. For balancing CO2 emissions, it links to an organisation which offers a special service to offset the CO2 emissions resulting from the travel.

RouteRank does not provide the user with the possibility of door-to-door journey planning, however this feature is forecasted for the future.

In addition, RouteRank acts as a B2B technology provider for multimodal journey planning, to be implemented in commercial journey booking web-platforms. One example of a subsidiary is travel.panda.org, the travel assistant for the WWF (World Wildlife Fund), which calculates and offsets the environmental cost of each travel. (routerank.com; travel.panda.org; May 2013) The platform has been created by RouteRank Ltd., based in Lausanne, CH.

transportdirect.info/

Transport Direct is a multimodal journey planner for Great Britain. It provides the user with the possibility of comparing different modes of transport for a specific trip. The comparison is carried out regarding costs, time and CO2 emissions.

The journey planner covers public transport, (such as underground/metro, tram and bus), coach, rail, taxi, air, ferry and cable car.

In addition to a list of possible itineraries, the route is also shown on a map.

Waymate

Waymate is a webservice and Iphone-App for multimodal journey planning. It is currently mainly focused on the German market. The system enables the traveller to compare various public transport modes for a specific journey. This includes local public transport, rail, bus and car-sharing as well as air and other available transport modes. In order to gather information, Waymate has access to transport operator's web services APIs, and is also able to manage raw data rooted via GTFS standard.

Waymate is a combination of a meta search engine and an online travel agent. It crawls information from every available source and also sells tickets, e.g. for Deutsche Bahn, on a commission basis.

Google Transit

Google Maps is one of the most well-used online tools for journey planning. It offers the opportunity of finding every single destination in the world through a few details such as an address or a company name etc. In addition, Google Maps offers detailed journey planning for road journeys.

Besides roadmap planning, Google Transit also offers information about publicly available transport modes in order to provide an alternative to using the car for short and mid-range travel. Although it offers detailed information on publicly available transport modes such as train and public transport, it does not provide information on flight schedules. At the moment, the coverage is sometimes inconsistent and changes from country to country.

JourneyOn (Brighton & Hove, UK)

JourneyOn is a regional travel planner for the region of Brighton & Hove (UK). It offers the travel modes drive (car), cycle, walk and public transport, and provides the user with detailed journey information. It is conceptually connected to the Brighton & Hove key-card multimodal ticketing system.

The local government introduced the system as an approach towards making public transport in the region of Brighton & Hove more convenient. Payment on journeys planned via JourneyOn is executed via the key-card, an electronic, pre-paid smartcard ticketing solution.

9292 (NL)

"9292" is a national travel planner for the Netherlands. It supports public transport such as buses, rail, trams and ferries. In addition, it connects public transport modes with walking routes and provides links to taxi-booking platforms. This provides the user with door-2-door travel planning. Although 9292 provides the user with information about travel duration and costs, it does not give them the opportunity to book the trip or to purchase tickets online. Payment on most connections planned via 9292 can be carried out via the OV-Chipkaart.

Resrobot (SE)

Resrobot is a national journey planner for Sweden. It provides the user with detailed information about itineraries throughout the country. It is based on public transport journey planning, and does not deliver door-2-door journey planning. It supports all Swedish publicly available transport modes. These are in detail air, rail, express bus, bus, tram and ferry.

5.2.3.3 Multi Modal Travel Planner by Train Operators

National Rail operators mostly provide their customers with a multimodal journey planner. Although those journey planners only consist of rail and public transport, the background is the competitive situation between rail and air for medium distance travel within Europe.

In addition to the connections available using the rail operators' products, these travel planners provide the user with nearly end-to-end connection for travelling from their specific destination to the hub/station and back.

SNCF - transilien.com

Transilien is the multimodal travel planner by SNCF for Paris and the Ile-de-France region. It provides the user with schedule information for Metro, national rail, RER and bus connections in greater Paris and provides recommendations for bi-modal journeys (rail and public transport). Although it does give information on rail ticket pricing, it does not provide the possibility of booking or purchasing a ticket.

Bahn.de (D)

Bahn.de provides multimodal journey planning throughout Europe and gives information about tram, bus, and ferry schedules as long as these represent connecting travel modes to products offered by Deutsche Bahn. It is also possible to purchase tickets for Deutsche Bahn products via the user interface. Purchased tickets can be downloaded for printing out, or used as an electronic ticket. The electronic ticket consists of a QR-Code, which is shown on the display of the traveller’s smartphone. The conductor scans the QR-Code on the train to accept the ticket.

Although it is offered by Deutsche Bahn as a service to its customers, it does not provide information about competitors to the products of Deutsche Bahn. Therefore it does not provide any information about plane connections or long distance bus trips.

The Bahn.de service and its mobile and mobile app solution are based on Hafas, a product by the Hannover (Germany) based technology company HaCon.

belgianrail.be

Belgianrail.be is the multimodal journey planner of the Belgian Railway Association SNCB. It offers multimodal journey planning throughout Belgium, including public transport and rail. It provides the user with door-2-door journey planning by integrating walking routes into the journey plan. For rail connections, the system also provides the traveller with real-time data about current delays or travel interruptions.

Belgianrail.be is available in Dutch, French, English and German.

5.2.3.4 Multi Modal Bilateral Cooperations

Based on the channels and players, it is also important to address current cooperation within the market. Current cooperation examples mostly exclude specific players, and multimodal cooperation is mostly based on bilateral agreements. Today, the travel market is mostly split into the different travel sectors, such as air, rail, bus and local public transport. Based on bilateral contracts regarding the interoperability of certain products, current multimodal approaches are organised between the participating players. This is for example the case for the cooperation between Lufthansa and Deutsche Bahn, called **Rail&Fly**. This project substitutes short haul flights, such as Cologne-Frankfurt, with a high-speed train connection that can be booked directly via Lufthansa. In this particular case, an additional flight attendant is available on the train to take care of the Lufthansa passengers. The ticket is valid for several feeding connections to international airports.

Another multimodal approach, also offered by Deutsche Bahn, is the cooperation with local public transport operators (City+). Travellers who travel a distance of more than 100 km may use local public transport in the city they start in and in their city of destination free of charge.

AirRail by SNCB Europe is another approach for the integration of air and rail travel. It is intended to connect important airports such as Amsterdam Schiphol, Paris Charles de Gaulle and Brussels Airport with the BeNeRail high-speed rail network. This provides easier access between airports and cities in the region of Belgium, Netherlands, Western Germany and the North of France. This service is targeted towards European and non-European travellers, and is mainly to be sold via airlines as a connecting service. Therefore, according to BeNeRail International, railway operators will have to provide the airlines with inventory access in order to allow the creation of feasible multimodal products. The goal is an integrated travel information and sales AirRail platform that is connected to the rail ticket issuing system. It may connect multiple train operators such as Deutsche Bahn, Fyra, Eurostar and Thalys. For rail operators, this solution is intended to increase passenger numbers, as rail operators will take on a feeder function for international airports, thereby reaching a new customer segment.

5.3 Distribution Value Chains and Transaction Processes

The distribution value chains and transaction processes are quite different in the travel sectors. Due to the fact that distribution value chains are important for the development of a MMITS, this chapter will provide an overview of the distribution value chains of each sector with special regard to the players involved.

5.3.1 Air Distribution Value Chain

In the air industry, the distribution value chain consists of a huge number of steps. It must be distinguished between direct booking and booking via third parties, such as travel agents. The latter includes far more players than a direct sales process, even in the online market.

In addition to (online) travel agencies, parties involved in the process of filing, settlement and issuing include GDSs/CRSs, BSPs (Billing and Settlement Plan) and credit card companies.

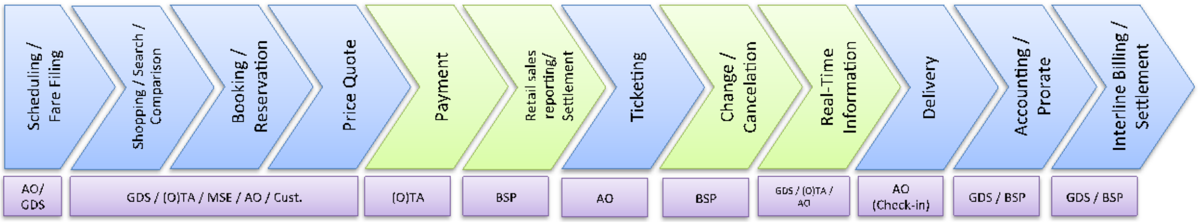

Figure 52: Air Distribution Value Chain and Involved Players
Source: Own illustration.

5.3.1.1 Direct Sales

While industry studies show that the cost of direct sales sometimes are higher than indirect sales via travel agents (often primarily caused by high referral charges by search engines and MSE, selling a ticket directly, e.g. on their own web service, call center, or via a ticket counter at the airport, is often the preferred way of selling a ticket from the airline's point of view. The ticket price is paid directly to the airline that issues the ticket, and no third parties are involved, except for the credit card company. The airline gets the customer into its 100% controlled "shop" where there is not comparison with other, alternative offers. The indirect channel allows comparison with competing offers. Additionally, no commissions or fees have to be paid to third parties.

Direct sales may also include connecting flights that are operated by other airlines, especially for airlines that are member of an alliance. If such a connection is booked, the airline selling the ticket acts as a merchant for the operating airline. In this case, the connecting flight is normally settled via the IATA Clearing House (ICH).

The air market in Europe is completely deregulated. Market behaviour in the distribution value chain above is regulated by Regulation 80/2009 (the CRS Code of Conduct).

5.3.1.2 (O)TA Sales

Selling tickets through a travel agent (TA) or an online travel agent (OTA) is the most common distribution channel in the air industry, and in general generates higher yield traffic to the airline, since business travel in general is managed by travel agents on behalf of corporate clients. Travel agents, including online travel agents, are formally speaking agents of the airline, and sell tickets on behalf of the airline. Very few airlines pay commission, and travel agents normally add a service fee on top of the fare to cover their cost and to make a profit. In some cases, travel agents buy allotments from airlines and sell these on their own behalf, or. Whichever channel they choose, a GDS and BSP is normally part of the process.

Figure 48 and 49 show two examples for transaction processes involving GDSs and BSPs. Both are credit card payments for tickets purchased by the traveller through a travel agent, in this case an online travel agent (OTA).

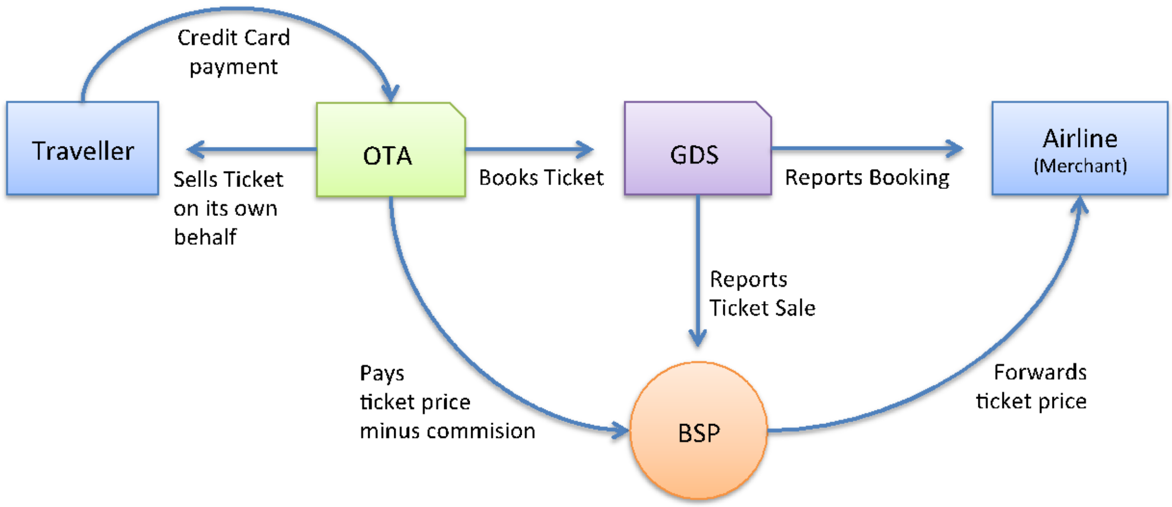

Figure 53: Transaction Processes of the Air Industry (Credit Card Payment via OTA)
Source: Own illustration.

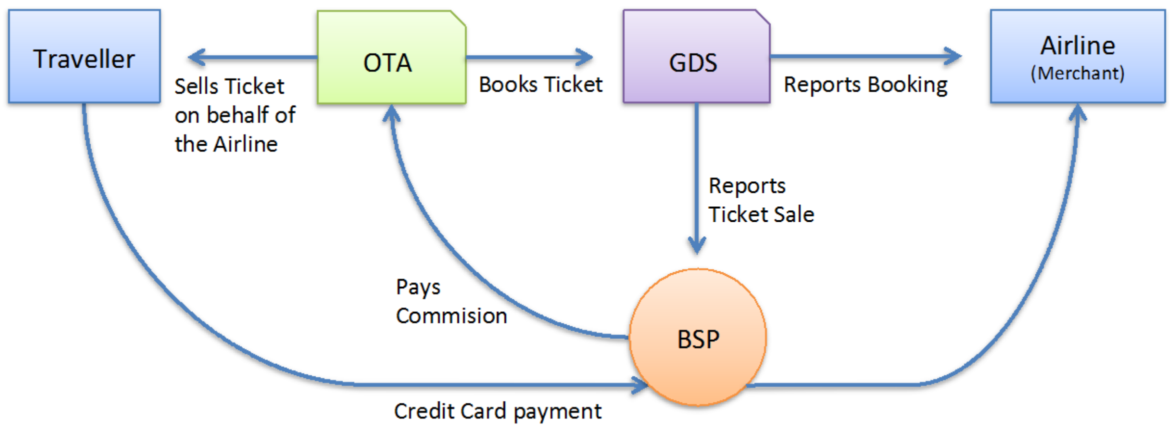

Figure 54: Transaction Processes of the Air Industry (Credit Card Payment via Airline)
Source: Own illustration.

If the travel agent sells a ticket on their own behalf, the credit card transaction is made to their bank account. During the booking process, the GDS reports the ticket sale to the BSP, which then bills the OTA for the ticket price minus their commission, and forwards the ticket fee to the airline. If the OTA sells the ticket on behalf of the airline, the credit card transaction is made directly to the airline's bank account. However, it is still processed through the BSP to ensure that it credits the commission to the OTA.

5.3.1.3 GDS & BSP

A Global Distribution System (GDS) enables travel agencies and airline operators to book journeys via a central hub that collects all the relevant information required for booking. Therefore every travel agency and every airline (except low cost carriers, which mostly do not take part in GDSs) is able to sell air products using connections operated by airlines taking part in the service. Connecting tickets are through-fares, and the traveller receives one bill from the merchant who sold them the ticket. The merchant can either be an airline or a travel agent. The main task of the GDS is the matching of schedule and fare data and seat availability, which it then provides to the travel agent.

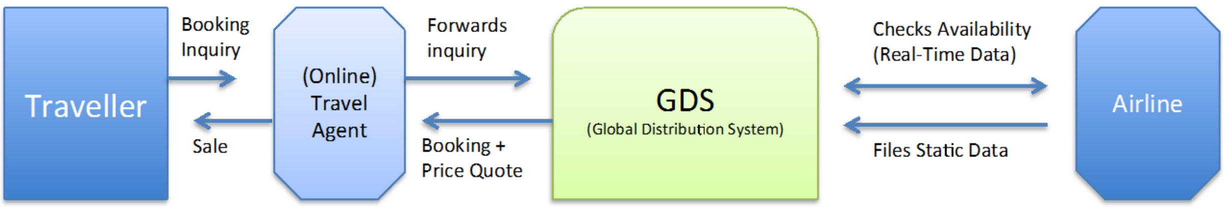

Figure 55: The Process of Booking Air Tickets via a GDS
Source: Own illustration.

Strongly connected to the GDS is the IATA Billing and Settlement Plan (BSP). A BSP is an intermediate system for billing and reporting sales which are processed via the GDS, and for facilitating the settlement process as a service for airline operators. If an agency sells an airline ticket, the GDS reports the ticket number(s) to the airline(s) and the sale to the Billing and Settlement Plan. Subsequently, the electronic ticket is generated by the GDS in a message to the airline requesting acknowledgement of ticket issuance. As a consequence, the BSP bills the travel agency for the amount of money for which the OTA billed the customer, minus the OTA's commission. Independent companies like Amadeus and Travelport provide GDSs. The BSPs are third party services that are provided by IATA. GDSs and BSPs are strongly connected in indirect sales.

5.3.1.4 Fare Filing & Schedule Aggregation

In order to provide a GDS with the necessary information, transport operators (airlines) file their schedule and fare data to the corresponding service providers. These assume important tasks like the aggregation of schedules and management of fares of different service providers. This information is then forwarded to the GDS, which matches schedule and fare information with freely available seats (free sale allotments) which they obtain filed directly from the airline. Using this information, the travel agent is able to sell and issue tickets to travellers.

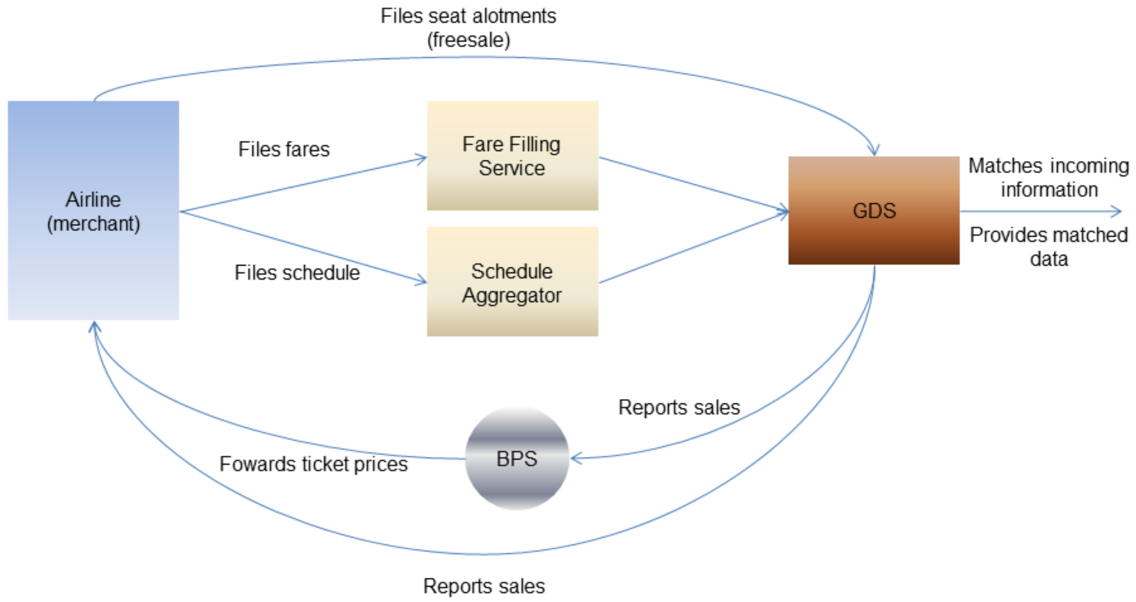

Figure 56: Fare Filing and Schedule Aggregation
Source: Own illustration.

5.3.2 Rail Distribution Value Chain (Medium and Long Distance)

Unlike the airline sector, the rail market in Europe still highly regulated, although the degree of and approach to regulation varies greatly between member states, The airline sector distribution needs have evolved since deregulation in 1994, on the basis of the new commercial paradigm. Moreover, the airlines industry has pioneered collaboration whereby sales and service functions can be provided by third parties. The distribution value chain of the rail industry therefore naturally differs from that of the air industry. Firstly, the proportion of direct sales is far higher in comparison to the proportion of direct air sales. Rail operators either sell directly via their own web services or via (online) travel agents. No matter what channel is used to purchase a ticket, tickets are always sold under the responsibility of the railway company that is operating the journey. Therefore, it is always the rail operator's obligation to manage complaints and compensations in case of incidents or disruptions in travel.

Rail operators take on different roles during the process of distribution. Firstly, the rail operator is the carrier who provides the transport service to the customer and provides general timetable and fare information. Secondly, the rail operator is the IT provider that offers the schedule and booking platform to potential customers. Aligned to this is the third role: the ticket vendor who sells tickets through their web service. Booking and ticket sales are also carried out by third parties like travel agents and online travel agents, who have access to the operator's online scheduler. In case of cross border rail travel, it is also possible to purchase rail tickets for cross border travelling via a single ticket vendor. SNCF, for example, sells cross border tickets for Thalys and Deutsche Bahn via Voyages-sncf.com..

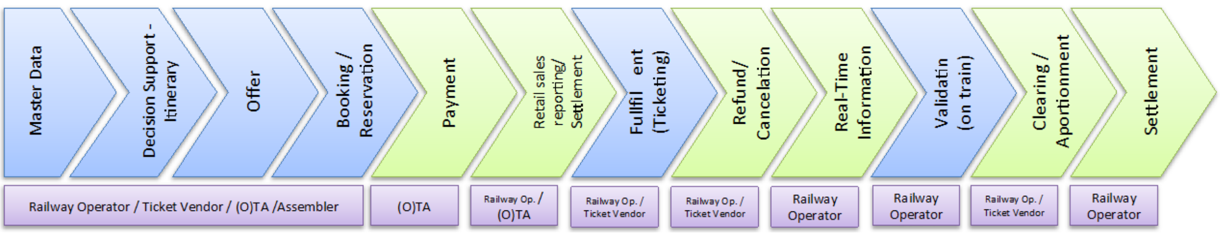

Figure 57: Rail Distribution Value Chain
Source: Own illustration.

Railways mostly act within a domestic market. Therefore, the relevance of GDSs is not as high as in the air industry and, they are only used by travel agents.

5.3.2.1 Direct Sales

In direct sales, the railway operator sells tickets and reservations on its own behalf. Railway operators sell offline at national train stations via their own ticket counters and ticket vending machines. Tickets are printed on special paper and are valid for journeys according to the booking. The ticket price is paid directly to the railway operator. The railway operator selling the ticket is, in most cases, the one operating the journey. In direct sales, no commission is generated for third party distribution partners.

Figure 58: Channels in Rail Distribution
Source: Own illustration.

In addition to rail journeys operated by railway operators selling the ticket, there is only a small amount of cross border travel with foreign railway operators involved. Cross border selling is usually based on bilateral contracts between bordering countries' railway operators with individually negotiated compensation. Moreover, there is cooperation between cross border railway operators like Eurostar and Thalys.

Direct sales is the most common sales channel in the rail industry, through which about 82% of the total amount of tickets are sold, according to the 2010 Amadeus rail market study.

5.3.2.2 (O)TA Sales

Distribution via (O)TA, or indirect distribution, includes a number of additional players in the sales process. These players are (online) travel agents, transport operators and also GDSs and MSEs. Besides these, the rail industry uses Self Booking Tools (SBT) for corporate customers.

In contrast to the air industry, the majority of railway ticket sales are conducted via direct distribution. Therefore, the GDSs are not as important as they are for airline distribution, and railway operators do not depend on GDS sales in the way that airlines do. GDSs and SBT are service tools provided by third party companies. Clearing is done by the rail operators themselves and the ticket vendors.

5.3.2.3 Railway Cooperation Projects

For international railway cooperation, railway operators from the European countries and the European Commission have founded several projects and organisations such as Rail-Team, TAP-FSM, IFM-project, AccesRail and CIRSRT.

Rail-Team, for example, is a cooperation between nine European high-speed railway operators. It is intended to improve reliability, comfort and punctuality on high-speed rail travel across European borders. The tasks of this sales organisation include the coordination of departure and arrival times, re-accommodation in case of missed connecting trains and a common reservation platform. This is intended to lead to seamless international high-speed rail services across Europe. Integrated ticketing has, according to the study 'Integrated Ticketing on Long Distance Passenger Transport Services' from 2012, not yet been realised. This is indeed true due to the high costs of booking systems integration and different ticket schemes, in particular non-reservation and integrated reservation tickets that are bound to a certain train.

AccesRail is a solution that provides rail tickets through GDSs. It is based on a cooperation between a number of international rail operators. The purpose of AccesRail is to support the intermodal integration of air and rail. Therefore, it enables travel agents to book rail tickets within the same GDS as air journeys. AccesRail has developed an interface that connects rail distribution systems with the existing airline GDSs via the ATPCO fare data integrator. Rail operators file their fare data at least a year in advance, and have committed to regular updates. Because of different booking horizons regarding air and rail, the number of rail tickets available via AccesRail is limited.

Looking at known future international cooperation initiatives, it is worth mentioning the EU long-term research programme **SHIFT2RAIL**. It represents a large-scale initiative focused on the research of future innovation in all fields of rail technology, and it features a dedicated Innovation Programme (IP4) on "*IT solutions for a seamless attractive railway*", valued today at €120M. This cooperation is currently at the 6-7-year programme definition phase with the European Commission, and it involves the European rail suppliers, forward-thinking operators and research institutes/universities. The purpose of the IP4 is to realise one of the key goals from the White Paper: "*By 2020, establish the framework for a European multimodal transport information, management and payment system*". Further Innovation Programmes are "Energy & Mass Efficient Technologies for High Capacity Trains" (IP1), "Advanced Traffic Management & Control Systems" (IP2), "Cost Efficient-High Capacity Infrastructure (IP3) and "Technologies for Sustainable & Attractive European Freight" (IP5). On 28th June, the European Commission published a public consultation for the creation of this new international cooperation initiative, including a roadmap that identifies reaching the objectives of the EU internal market, the "*Customer Experience Support Systems, including passenger information systems and ticketing and cargo tracking and tracing*"[23] as a key research activity. The innovative solutions developed in SHIFT²RAIL aim to encourage travellers to shift from individual car transport to public transport.

5.3.2.4 Rail Regulation TAP-TSI

TAP-TSI stands for 'telematics applications for passenger services - technical specification for interoperability', a project for the trans-European rail system. It was launched by DG Move of the European Commission and eventually formally adopted on 5 May 2011. It has been in force as the Commission Regulation (EU) 454/2011 since 13 May 2011, and is supposed to be put into full operation from January 2016.

According to the Commission, the regulation objectives of TAP-TSI are widely spread across the topic of passenger information systems. Article 2 explains that detailed IT specifications have to be established in order to develop and deploy a data exchange system for trans-European rail travelling.

While currently limited to cross-border trips in the EU, this system is to include a wide range of functionalities such as pre-trip and on-trip information, reservation and payment, luggage management, ticketing and the management of intermodal connections. Part of the regulation is the obligation for railway operators to make their timetable data publicly available, also for third parties such as other rail operators. As part of this obligation, railway operators have to make sure that timetable data is always accurate, up to date and available for at least twelve months after data expiration.

In general, the objective of TAP-TSI is the definition of standards for providing information and issuing of tickets in the European rail industry. Therefore, it also supports the exchange of availability data between railway operators and international ticket vendors. The project's approach is based on the use of widely available technology.

Regarding ticketing, the objectives of TAP-TSI include the aim for every kind of ticket, whether reservation or non-reservation tickets, open tickets or special fare tickets, to be made available through every European rail operator. Based on TAP-TSI, European rail operators founded the FSM-project to collaborate on the development of interoperable ticketing from an industry perspective. The **FSM (Full Service Modell)** is a project based on an initiative by rail industry players, and is strongly connected to TAP-TSI. It was launched to

[23] Source: Stakeholders' consultation on a proposal for an EU coordinated approach to R&I in the rail sector under Horizon 2020 in support of the completion of the Single European Railway Area, http://ec.europa.eu/transport/media/ consultations/2013-shift2rail_en.htm

fill the gaps of TAP-TSI, where important requirements were not covered. FSM is intended to implement an industry standard for rail data exchange, including door-to-door travel in Europe. Based on an agreement between the UIC and the EC's DG Move, FSM project is to deliver

"[t]he full service model and specification development plan that builds upon additional rail sector and ticket vendor requirements currently not addressed in TAP TSI, but deemed beneficial for the advancement of the rail retail market at large". (Source: FSM Requirements Document, TAP Phase One, 1.0, May 2012)

The FSM project is to deliver detailed IT-specifications for the implementation of such systems. It does not have current standards. Therefore, part of the project is to create a requirements document as a base for their further work. Apart from railway operators, ticket vendors are also involved in this project.

5.3.3 Local Public Transport Distribution Value Chain (Including Short Distance Rail)

The distribution value chain in local public transport and short distance rail is quite different to rail and air, in general due to the fact that single trip tickets are not purchased further in advance. In local public transport, single trip tickets are typically purchased prior to the journey, usually within the same day.

Therefore, booking platforms or even GDSs do not exist within the local public transport distribution value chain. Regarding distribution in local public transport, we must distinguish between bus and train/metro services. The latter often have gated access points. In addition, several linked transport systems exist that connect the local public transport services of different regions.

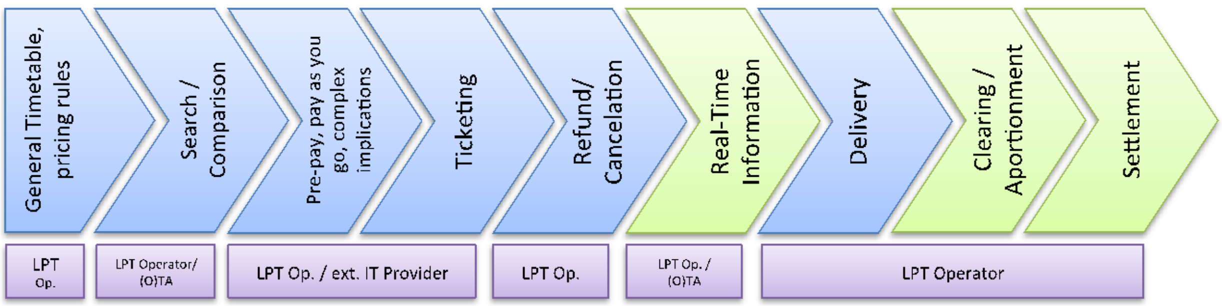

Figure 59: Distribution Value Chain in Local Public Transport
Source: Own illustration.

The value chain mainly consists of different roles played by the local transport operator. They not only provide the passengers with a planning tool but also play the role of the ticket vendor. Roles in the local public transport sector are governed by the ISO 24014.

5.3.3.1 Pay as You Go and Season Ticket

For local and regional train services, as well as for urban transport in general, tickets are mostly sold via ticket vending machines at stations. In addition, tickets are sold via sales counters at the stations, and also by train-attendants and train-based vending machines in the case of some rail operators. In the bus service business, tickets are frequently sold by the bus drivers.

Direct distribution is free of additional costs for the transport operator, because no commissions occur during the sales process. Vending machines usually accept a wide range of payment methods such as cash, credit card, and debit card. (Online) Travel Agents are usually not involved in the sales process, because booking horizons are too short and tickets prices too low. Tickets are bought just before the journey, and travel agents are rarely located within reach of local public transport stations. Therefore, some operators use kiosks as points of sale.

Additional players in the process are possible third party service providers, who provide the transport operator with full-service ticket vending machines.

For frequent travellers, local public transport providers offer special season tickets that are sold by subscription. These tickets are sold directly by the operator and distributed by mail. Payments are made via credit card, direct debit or cash at vending machines.

5.3.3.2 Ex-Post Electronic Ticketing

A relatively new solution for local public transport ticket distribution is electronic ticketing that is dependend on the actually covered distance. Unlike electronic rail tickets, these are not home-printed tickets that can be downloaded as pdf files. Ex-post electronic ticketing is mostly processed via smartphones and smartcards. Such solutions are currently in use in several cities around the world, such as London, Singapore, Hong Kong, or Berlin.

Electronic ticketing makes use of smartphones and smartcards as their main sales channels. The ticket price is paid ex-post and is calculated by the transport operator after the actual journey is travelled. The system calculates the applicable fares based on the travel data provided by the smartcard. The traveller checks in when entering a train, and checks out when leaving. In addition, electronic ticketing provides the operator with valuable information about their customers' travel behaviour and their habits in general.

5.3.4 Distribution Value Chains in Comparison

Compared with each other, the distribution value chains and involved players are as different as their respective scope of operation. Local public transport operators, who are heavily dependent on local authorities, act within a very local market with certain local regulations. National rail operators act within domestic markets, complemented by cross border railway undertakings, which operate through special connections and bilateral contracts with neighbouring countries' railway operators. Airlines typically act within a continental or global market. The number of players involved is strongly related to the scope of operations.. As can be seen in the matrix, the scope of operation and the number of players involved correspond.

Regarding the distribution processes, the air industry seems to be the most complex travel mode. The structure of the air distribution system derives from a pre-Internet era, and is highly complex from today's point of view. Back in pre-Internet days, GDSs were a necessary tool to enable travel agents to book tickets with all carriers present on the market. The data formats that are used in the GDS are highly restricted in terms of data diversity. As a consequence, NDC (New Distribution Capability) has been developed to evolve GDSs to suit the modern world. For airlines, GDSs are necessary due to the high percentage of indirect and international sales. In contrast, the rail industry sells more than 80% through direct distribution channels. This relies on the fact that rail operators typically sell at a national level, and have little competition in the market. However, a motivation to be integrated into the airline GDS exists. This can be seen through the various attempts conducted to make train tickets accessible via airline GDSs.

Totally different in every way is the local public transport distribution value chain. LPT does not provide the opportunity, nor create the necessity, of booking tickets in advance. Therefore, booking systems in general do not exist and the operator themselves fill most roles in the value chain.

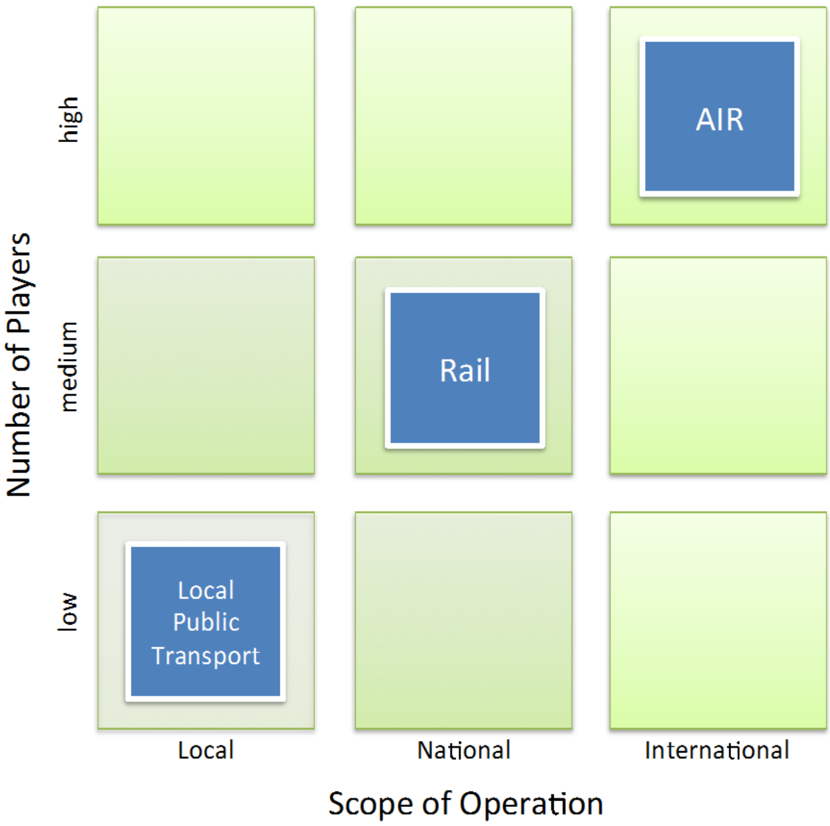

Figure 60: Distribution Value Chain Matrix
Source: Own illustration.

As there is no common ground in the distribution process across travel modes to develop interoperable ticketing on a multilateral level, new platforms might be required. In order to tackle the high level of complexity, it might be necessary to get new players involved in the value chain of the rail and local public transport sector, to raise the scope of operation. If interoperable ticketing becomes reality, players like GDSs and clearing service providers will join the multimodal distribution value chain on a highly integrated level including LPT, rail and air transport. As the figure shows, a linear correlation exists between the rise in the scope of operation and the number of players involved in the distribution process. Therefore, it would appear that additional players will join the distribution value chain of LPT in order to realise a nationwide or even continent-wide distribution. This also applies to rail distribution regarding Europe-wide distribution.

In this context, it is necessary to be aware of potential dependencies that might occur between GDS providers and transport operators. Rail operators, for instance, might not be willing to join a solution if there is a risk of future dependence. Rail operators are highly motivated to keep their independence and their high level of direct distribution.

5.3.5 Data Interfaces and Formats

Supplementary to the differences among the distribution value chains, there are also differences in technology that might lead to certain interoperability issues. These are for example the different data formats used for data transfer.

For multimodal journey planning, access to static and dynamic information on travel modes involved is required. This information can either derive from an API (Application Programming Interface) or consist of raw data, for example via the GTFS Standard (General Transit Feed Specification) that is filed periodically. The difference lies not only in the kind of data itself but also in the way data is processed.

If deriving from an API, the API provider carries out routing or scheduling. This means that the service provider who uses the API only routes the inquiry to the API provider and receives scheduled results as a response within a matter of seconds. As a consequence, the aggregation of multimodal schedule data is rather superficial. In addition, the API provider is responsible for the quality management of the packaging of alternative routes. This means that quality management is in their hands, too. Usually, the API is provided by the transport operators, and derives from their own web service.

If data supplied via GTFS standards is directly sourced from the operators' database, the service provider who uses the GTFS data carries out scheduling by themselves. This requires the development of complex algorithms to calculate the best journey propositions. Compared to API data sourcing from the transport operators' database service, GTFS-generated information may deliver slightly different results. Due to a lack of experience with specific transport modes or operational issues, this may lead to results of a different but not necessarily worse quality compared to API data.

Due to the fact that most transport operators work with local solutions regarding their online information and ticketing systems, every transport operator uses a different language and vocabulary. For a multimodal travel information and ticketing system, these languages will have to be translated. Current projects, such as FSM, for setting up industry standards for the travel sectors, are a step forward in the direction of multimodal trip planning.

Besides the technological issues, legal issues are also generated. Seen from a technological perspective, data access is generally possible if the transport operator uses web services to provide journey planning to their customers. Legally, this is only possible with permission from the originator of the information.

So far, most transport operators provide users with web services containing their own products. Therefore, multimodal approaches can, with the exception of those based on bilateral agreements, only be found with third party service providers such as goeuro.com or

Waymate. These are meta search engines which aggregate valuable information and which might be able to combine information from different operators to provide the user with one truly intermodal journey proposition. Meanwhile, some meta search engines are also able to process booking via their own user interface. One new approach, supported by Deutsche Bahn, is Qixxit. Qixxit is a platform for multimodal journey planning that will be launched in autumn 2013.

5.3.6 Classification of Tickets

Throughout the travel industry, many different ticket schemes are in use. In the rail industry, tickets can generally be separated by combining sales channels and security elements.

Regarding sales channels and according to the UIC classification of tickets, we have paper tickets, issued by a stationary travel agent or a transport operator, and tickets that do not require physical media to be issued. These are home-printed tickets, paperless tickets (e.g. QR-Codes via smartphone apps) or chip cards such as the London Oyster Card or the Dutch OV-Chipkaart. Regarding security and the fight against fraud, several security systems are installed in the different kinds of tickets. Electronic tickets, for example, contain additional information through which the correctness of basic information can be checked, the so-called “Checksum’. The Security in Data (SiD) is thereby able to check whether the information contained in the code is correct, but it is not able to detect if the ticket is a copy or not. While the contract itself is digitally stored on a web server, the issued ticket is only a reproduction and serves for information purposes.

In addition to the sales channels, there are also commercial differences regarding fare systems. For rail travel, we distinguish between Non Reservation Tickets (NRT) and Integrated Reservation Tickets (IRT). The latter are, similar to airline tickets, bound to a specific train and a specific date. In contrast, NRTs are issued for a specific routes or distances, but the choice of train is free to the traveller. For air travel, only IRTs are issued, while in LPT only NRT tickets are available.

5.4 Trends

Future trends cannot be predicted with certainty, but some trends can indeed be identified today that are already on their way towards implementation. The rising number of smartphones, for example, has led to airlines providing in flight Wi-Fi access to customers who want to use their smartphones during a flight so they can read emails and browse the web. This gives travellers the opportunity to check their travel plans in real-time during flight.

In some regions, the number of long distance bus services is rising, so therefore an additional international or even pan-European travel mode might become accessible.

However, in order to describe future trends, we must distinguish between trends deriving from the market itself, and technology trends that may affect the market for travel information and booking in the future.

5.4.1 Trends and Future Solutions in the Market

5.4.1.1 Incentives for Cooperation

It seems to be clear to transport operators that the integration of transport modes will be a necessary development in the following years. In particular, cooperation between air and rail is important for the industry. Airlines usually act globally and think globally, as they connect destinations all over the world. In comparison, the rail industry tends to act locally. Railway companies usually act within domestic markets because they evolved from state-operated authorities, and the majority of provided connections is at a domestic level. In a European context, globally-thinking railway operators may take over short haul or even medium haul flights from airlines with the purpose of an integrated connecting service for long distance flights. This already happened with Thalys on the Paris-Brussels route. They would thereby gain additional market shares through connecting hubs. This makes sense for airlines and railway operators, because most airlines are unable to run short haul flights profitably. Due to the fact that airport slots are becoming more expensive, shifting to rail makes sense economically for airlines, railway operators and even for the customer. In a second step, this may also apply to local public transport, which could act as a tributary for medium and long distance mobility hubs such as train stations and airports.

By now, several local solutions for interoperable ticketing have been developed, mainly on the basis of two-sided contracts. In addition, players all over Europe are working on innovative solutions to make intermodal travelling easier.

5.4.1.2 Booking & Pricing Innovation

One future system being developed, which may improve booking for the future is the NDC, the 'New Distribution Capability' by IATA. NDC will be a new industry standard for the distribution of customisable airline tickets, focusing on the shopping part of travel distribution. NDC will provide operators with the possibility to offer personalised products according to the specific preferences and requirements of their customers, such as extra leg room, WiFi access, special meals and other ancilliaries. Up to now, this is only possible through direct distribution channels. When providing information to their own web service, airlines use XML (Extensible Mark-up Language), an Internet language used for data mark-ups containing a nearly endless range of possible information to be added. In order to provide GDSs, airlines use a less comprehensive language that is not capable of handling such a quantity of rich data. Therefore, travel agents are not yet able to book customized tickets. Although IATA developed the NDC standard, the implementation of the system is to be carried out by third party IT providers.

The development of customised tickets may also involve ancillary fees. According to Skift Travel IQ 2013, ancillary fees will become normal in the world of travel through a process of unbundling products and further personalisation. In addition, price transparency is to be provided through several search engines. Along with unbundled products, this will have a further influence on modal decisions (See WP2, Demand Side). Unbundling may include ancillaries such as on-board WiFi, extra leg room, special meals and other additional services.

5.4.1.3 Ticketing Innovation

In order to facilitate international booking and ticketing, the UIC's (International Union of Railways) innovative ticketing group TAP-NT is aiming at further standardisation in the rail sector. Therefore, TAP-NT has introduced IATA-like codification for European railway stations to enable travel agents to book train journeys via the same GDS as they do with air journeys. But the main task of TAP-NT is the development of PET, Paperless Electronic Ticketing, which has resulted in home-printable tickets as are meanwhile offered by many European railway operators.

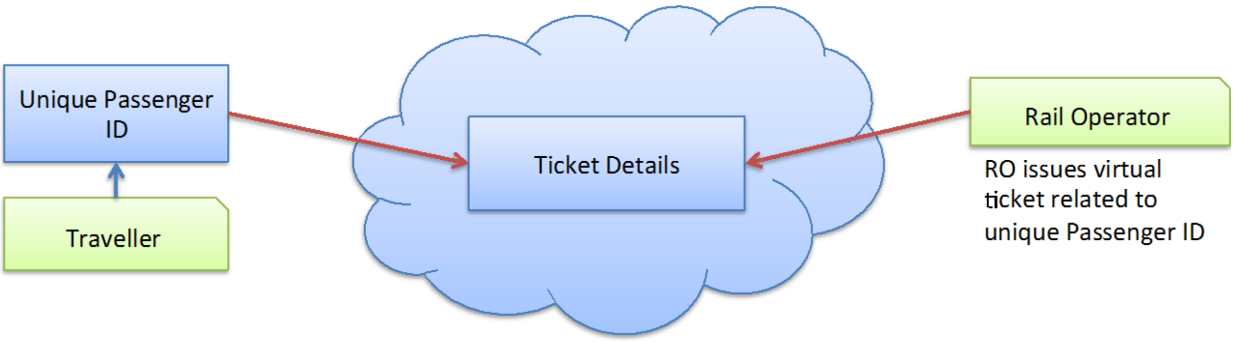

Figure 61: Cloud-based Virtual Ticket Storage
Source: Own illustration.

One innovative approach to the ticketing process in the rail industry is ticketing based on personal passenger identification, as illustrated in the figure above. In this way, tickets may be stored on a web server only, and the identification of the holder is validated via an electronic ID card, a driver's license or frequent traveller card. Tickets will not have to be printed or even sent via email. For on-trip validation, however, mobile Internet access is necessary. This solution is also called account based ticketing because the tickets, or tokens, are stored online in a unique personal account.

As a result of this approach, tickets based on passenger ID may become reality. This may also be a way to develop intermodal integrated ticketing. Tickets from several operators and carriers may be stored on a central server. These tickets might be related to a single unique passenger ID. In this way, the passenger only needs to handle a single ticket containing their unique traveller ID, which refers to the server-based tickets for check-in.

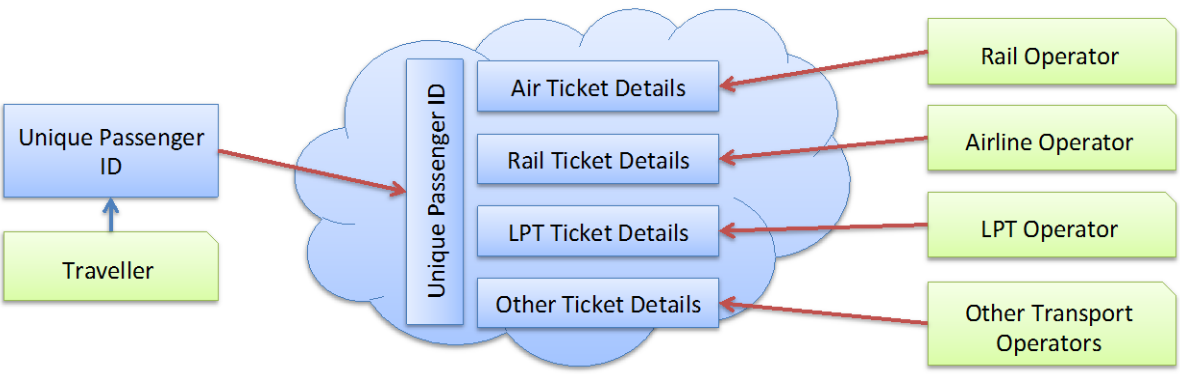

Figure 62: Extended Passenger ID Scheme for Multimodal Ticketing
Source: Own illustration.

A further trend in the online industry is the digital wallet. These are software applications that store digital tickets in a single app. Here the user is able to manage a large number of digital tickets without having to use several apps on their smartphone. Ticket wallets work with any form of downloadable ticket, such as QR-Codes or bar codes.

5.4.2 Technology Trends Affecting the Market

Apart from trends in the market itself, several technological trends may also have a huge impact on upcoming solutions for multimodal travelling. As shown in a previous chapter, the number of smartphones used is increasing strongly, aligned with mobile Internet access to travel information. This may lead to certain changes in user habits and expectations for the future of travel services. As Digital Maps and GPS are standard on today's smartphones, it is easy for travellers to find the next bus or train station. This enables transport operators and other service providers to offer special location-based services to improve travel experiences for their customers.

Services like Google Maps, which run on nearly every smartphone, provide the user with the ability to locate their exact position to a very high accuracy, and thus may give them advice and directions to a publicly available transport mode within seconds. In addition, GPS gives service providers the opportunity to offer further services, based on location information provided by the travellers' mobile device.

The smartphone is the key channel of the future for travel information and booking. Travellers always have their smartphones at hand, and will become increasingly used to mobile shopping over the next years.

5.4.2.1 Mobile Payment

On the subject of payment, especially in local public transport, for which tickets are usually not bought in advance, mobile payment systems of today may have an impact on future payment solutions for the whole travel industry. There are several kinds of services offering mobile payment, such as Google Wallet, which use different kinds of technology.

Some services are NFC-based. Near Field Communication (NFC) is a technology that is based on Radio Frequency Identification (RFID). This enables a device, e.g. a smartphone, to be identified by another device, e.g. an in-vehicle ticket sales terminal, within a range of only a few centimetres. For contactless payment, the NFC-enabled device is tapped by a scanner and instantly identified. The device then runs a check to see if valid payment information is activated, after which the payment is processed. This service is provided by third party service providers. One example of contactless payment is Google Wallet and, in particular with regard to the transport sector, the London Oyster Card.

Another solution for mobile payment is payment via bar codes. In this case, the device's display shows a bar code that refers to a coupon or even a credit card account. For payment, an automated scanner or the cashier scan the bar code, and payment is processed immediately.

On the one hand, paying via NFC is faster and less complicated because no visual information is to be transmitted. On the other hand, security and fraud risk may be an issue regarding the possibilities of hacking into a wireless system. Therefore, reliable security systems need to be implemented. Whereas there is always a certain risk that someone might be able to gain access to a secure connection, this risk does not occur with bar and QR-codes, because a visible connection is necessary for validation. As bar and QR-codes are often hard to read with handheld-scanners, a product innovation making use of light signals is available for a limited number of smartphones.

While a smartphone and mobile payment app are required to use such systems, credit card companies have invented the contactless credit card. This works very similar to the solution using NFC-enabled smartphones, but is not dependent on a working smartphone or even a mobile Internet connection. However, the risks are the same,. The RFID chip may be scanned by third parties; hence the risk of fraud is equally high.

5.4.2.2 Internet of Things

The "Internet of things" connects real-world objects with the Internet. This does not only include cars, buses or traffic lights. It also includes any kind of real world object like consumer electronics, home appliances, personal objects and personal mobile devices. By connecting everything with the Internet, new services may evolve. A connected refrigerator, for example, is able to monitor the processes of filling and emptying, thereby knowing its current inventory. With this information, it knows if the residents are running out of specific products and can report this to their smartphones. This may lead to complete shopping lists on the householder’s phone, generated by the fridge’s inventory list.

One practical solution deriving from the topic of mobility is the connection of cars and roadside units. By connecting vehicles amongst each other, vehicles ‘know’ the exact positions of the cars around them. This helps to avoid accidents and can support drivers in finding the ideal route. In addition, it delivers valuable information about traffic and may help to reduce CO2 emissions by optimising routes and helping to find parking slots.

The Internet of things uses several connecting technologies such as RFID, 4G and web services. RFID, as already mentioned in the context of mobile payment, works with passive chips that can be attached to nearly everything, even to a price tag. These chips can only be activated via RFID scanners, and may transmit limited information like a unique ID. 4G, referring to the 4th Generation of mobile Internet, is a mobile broadband connection used with the latest smartphones available.

5.5 Key Drivers for Future Development

5.5.1 General Aspects

Key drivers for future development are widely spread across the industry. Firstly, a key driver for multimodal travelling is the international and intermodal collaboration between European transport operators in order to develop new multimodal products at a European level. This way, for example, a common use of high-speed trains to substitute short haul flights may develop across Europe. This might free up further long and medium distance slots at the airports, thereby reducing costs for the airlines and simplifying travel for customers. At the same time, passenger numbers for the railway industry might increase. By integration of local public transport on a wider field, complete integration may lead to a complementary usage of all public transport possibilities.

Another key driver is the strong increase in the number of smartphone users and mobile Internet devices in Europe. The proportion of travellers using smartphones, which make use of mobile Internet for travel information, is growing. Therefore the demand for reliable and accurate real-time information will grow as well. As the trend towards mobile-commerce is also growing, many travellers will demand mobile journey booking in the near future.

Accompanying mobile Internet devices is the Internet of things and 'anytime, anywhere and anything connectivity'. Putting things online is becoming easier from day to day. Smart City is the buzzword, describing the connection of nearly everything in cities of the future. This means that vehicles will be connected with other vehicles, traffic lights and road signs. Even devices within a household will be connected to the Internet and interact with other devices. Therefore, connecting public transport vehicles with the Internet and adding GPS services which show the customer the current position of the vehicle might not be an issue, but in fact of interest for the customer of the future. Knowing the exact position of a specific vehicle someone is currently waiting for might improve their travel plans.

Furthermore, the availability of static and dynamic information regarding travel data, schedules, fares and availability data might lead to new products in the market. With open data access, third party companies may be able to offer new services to the customer. If transport operators provide access to their data, these companies as well as other transport operators might be able to offer multimodal mobility solutions for everyone.

There will be also a strong influence on future development stemming from changes in the socio-demographic framework. As we can already observe today, the behaviour of (potential) travellers in Europe is changing. A different attitude with respect to mobility patterns (car usage, acceptance of multimodality) is becoming apparent. The usage of media among younger people is different from previous generations. There are also concerns about the availability and the future development of the transport infrastructure within Europe. Enhanced pressure on mobility through rising energy prices and a scarcity of fossil fuels may form a contrast to increasing mobility needs in the society. Notably the latter issues will have an influence on the market chances of Multi Modal Information and Ticketing Systems, because the usage of MMITS is able to improve the efficiency of travelling and the perceptibility of sustainable travel options.

5.5.2 The Role of Key Players in the Market

The future development of the market for information and ticketing systems in Europe not only depends on technological issues, but also on various socio-economic impacts. First of all, the potential future growth of the travel market has to be addressed. As pointed out in WP2, the travel market will continue to grow and therefore will create a solid basis for the development of Multi Modal Information and Ticketing Systems (MMITS). The most important issue raised for discussion in this chapter is the expected conduct of the current players in the market with respect to a MMITS. Because a MMITS needs a rather high level and intensity of cooperation of companies from the relevant travel and transport industries (across different modes), the incentives for cooperation in particular must be outlined. Another critical question is whether there are legal conditions and regulations hampering the cooperation of participators in a MMITS. This issue is strongly related to the discussion of the future regulation of the market for MMITS systems, and should, therefore, be considered critically in WP 6. In general, the discussion of barriers and limitations in WP 6 will further elaborate and refine the preliminary propositions of this chapter.

The evolution of Multi Modal Information and Ticketing Systems (MMITS) in Europe is strongly dependent on the role and conduct of the various players in the value chain of the travel market. If companies currently acting in the market are interested in establishing a MMITS, they will contribute to this development. This also seems to be the case for market entrants assessing a MMITS as a business model. On the other hand, if an actor in the market perceives MMITS as a threat for their business model, they will tend to try to prevent the market entry of a MMITS. They will at least be cautious with respect to any cooperation necessary for the establishment of a MMITS.

As pointed out before, the percentage of online travel sales in the European travel market is growing steadily. Online travel agencies (OTA) are becoming more and more important for the travel market. OTAs already enable customers to compare offers from different transport operators. OTAs will be interested in developing and using Multi Modal Information and Ticketing Systems to attract and hold additional customers and to strengthen their market position in the value chain. In any case, there are no noticeable incentives for OTAs to be sceptical with respect to the realization of a MMITS. This seems to be quite similar with meta search engines.

With regard to transport operators, the key players belonging to the different travel modes must be mentioned. They also act at different geographical levels of the market. First of all, there are the airlines, which provide travel services on a European or a national level. At the moment, airlines distribute via Global Distribution Systems (GDSs) to provide travel information and booking solutions. In the rail industry, passenger rail service operators act mainly at a national level, and, due to the stepwise opening up of the rail markets over the last decade, also to a certain extent at an international (European) level. At the moment, the various national railway undertakings mostly rely on their individual solutions for schedule information, bookings and settlement. This is also true for international and national long distance bus services. At a local level, we see plenty of local transport authorities and local public transport providers. Sometimes big European transport operating companies offer public transport services at a local level after having acquired tenders by the local authorities. As local transport authorities are responsible for public transport in their region, they are mainly interested in their local solutions for travel information and ticketing.

Against this background, the attitude of transport operators in the market towards Multi Modal Information and Ticketing Systems may differ. It depends on the current structure of their distribution value chain, the role of online travel information, booking and ticketing for customer service and the sales strategy of the particular company.

In the airline sector, we can observe a rather complex distribution value chain, which has been analysed in detail above. The structure of the distribution system has developed on the basis of the historical regulations concerning service schemes and tariffs. Therefore, we find standards for booking and ticketing applicable for the whole airline industry, but not compatible with other transport modes. “Traditional” airlines are used to cooperating with Global Distribution Systems that offer information about prices and availability of trips. A GDS even allows them to sell connecting flights operated by other airlines. Basically, a GDS (together with a BSP) works as an information and ticketing system for a single mode that allows the customer to compare the services offered by different airlines. In spite of the problems of technical harmonisation, airlines may be interested in becoming involved with the broader approach of a MMITS, because a MMITS will offer additional services for travellers, especially with respect to the first and last mile.

At first glance, there are no general negative effects of joining a Multi Modal Information and Ticketing Systems for airlines, as long as a MMITS does not lead to the anticompetitive conduct of other participants. Theoretically, the position of airlines in the travel market could be affected by competing rail services now observable for potential customers in the MMITS as a substitute for an air trip. However, the integration of air and rail products in a MMITS will not affect the market position of airlines, because airlines and rail operators do not serve the same relevant market, especially with respect to the trip distance. As case studies concerning the cooperation between airlines and rail service providers have clearly shown, airlines in Europe are not very interested in offering short distance flights that could be substituted by rail. Therefore, airlines can make use of the benefits of a MMITS without having to fear losing a part of their business.

On the other hand, it is not clear whether rail operators in Europe will be strong promoters of Multi Modal Information and Ticketing Systems. In the past, long distance rail operators have restricted themselves to their national markets. Cross border rail services were only offered on the basis of bilateral agreements. In January 2010, the cross border passenger rail market was opened up by the European Union (including cabotage). Since then, services can be provided on a competitive basis, but European legislation has not generally liberalised the national markets for long distance passenger rail services until now. Another goal of European transport policy has been the improvement of technical interoperability within the rail sector. Technical interoperability with respect to infrastructure and rail operations addresses a lot of questions like the harmonisation of power supplies, or train control and security systems. It explicitly does not cover the interoperability of information and booking schemes.

Looking at the market, we have to note that the degree of intra-modal competition between operators in the European rail passenger markets is much lower than in the airline sector. In most countries (except for the UK) the long distance passenger rail market has been fully dominated by the national (state-owned) railway until today. Therefore, national railway undertakings developed their own individual solutions with respect to tariffs, booking systems and ticketing. Because there was no threat from competition on the national networks in the past, and international rail traffic was organised via bilateral agreements, there was no need for the harmonization and integration of information and booking schemes across Europe.

This lack of harmonisation can be illustrated by the different ticket philosophies applied in Europe which hinder travellers from making use of integrated tickets when travelling in Europe:

-	The majority of railways in Europe use non-reservation tickets which are issued for a specific route, but which are not fixed to a specific train or even a single seat. The traveller is free to make their choice.

-	Some railways offer integrated reservation tickets, which are fixed reservations for a specific seat on-board a specific train, similar to airline tickets.

It would appear that the coexistence of non-reservation and integrated reservation tickets impairs the attractiveness of international passenger rail transport, because international through-ticketing is not possible. Even if a non-reservation ticket is used, the price for an international ticket is calculated by adding up the single prices for the national segments, leading to lower competitiveness of rail transport compared to other modes.

The integration of national tariff and ticketing schemes within the rail sector is a big challenge. This is confirmed by the experiences made with the Railteam alliance, established in 2007. Whereas Railteam has been fairly successful in providing information on the schedules for high-speed rail services operated by the members, only little progress has been made concerning ticketing integration.

Bearing this in mind, one can better understand the potential attitude of European rail operators towards a MMITS. The integration of booking and ticketing systems at a European level might cause fundamental changes and high costs. On the other hand, the market potential for long distance cross border trips is limited because of the competitive advantage of aircraft on distances longer than 400 km. Therefore, the national railways do not seem to take an active part in implementing MMITS on a European level. In any case, the future development will depend on the results of the implementation of the TAP TSI regulation.

Last but not least, we need to analyse the role of public transport operators and public transport authorities. There are some opportunities here for public transport operators, because being part of a MMITS will improve the visibility of their product and attract additional customers. This may lead to increasing revenues. On the other hand, local public transport providers will have to adapt their individual local standards for ticketing to the standards of a MMITS. This not only means additional costs for adjustment, but also dependency on the operator of a MMITS. In the end, the incentives of local transport providers for joining a MMITS are limited because most of their business is local, and so the benefits of the MMITS seem to be lower than the disadvantages, at least at first glance.

5.5.3 Determinants of Industry Cooperation with Respect to Travel Planning and Ticketing Services

The discussion above shows that travel agents and transport operators may have quite different incentives to promote or join a Multi Modal Information and Ticketing System. Therefore, the development of MMITSs depends on the readiness for cooperation shown by the various partners. On the other hand, incentives for cooperation depend on how the participation in one or several MMITSs affect the business model of a potential participant. Before analysing the relevant business models of the relevant players, we can only derive rather general conclusions.

In any case, OTAs and Meta Search Engines will be interested in cooperation because joining a MMITS will positively affect their business. Airlines mainly benefit from being part of a MMITS because they can offer additional services to their customers without being affected by increased competition from railways - and, seen from a different perspective, it makes sense for them to reduce the number of short haul flights if they can be substituted by rail transport. Furthermore, the complexity of the distribution chain will not increase significantly because airlines are used to cooperating with numerous partners in their value chain.

This is not the same with rail and public transport operators. If they want to increase the scope of their operation to a European level to become part of a pan-European information and ticketing system, the complexity of their value chain will increase decisively. As mentioned above, they will have to work together with additional service providers (like GDSs) and partners from all relevant modes. As a consequence, transaction and adaptation costs will increase tremendously.

There is also the problem of dependency. Airlines already sometimes complain about their dependency on Global Distribution Systems. Therefore, the so called low-cost Airlines refuse to cooperate with a GDS, and organise the distribution of tickets on their own. Rail operators, which were focused on their domestic markets in the past and developed individual distribution systems as part of their business models, will also be cautious to cooperate with a MMITS, if there is a risk of increased dependency. In particular, they will want to keep their high level of direct distribution because they fear a loss of margins. Furthermore, cooperation with other rail operators appears to be difficult at the moment, as mentioned above.

Cooperation will be most difficult for operators at a local level. In the past, local transport operators organised their distribution on a local basis according to local requirements. They now have to work together with multiple partners on a European level, in lieu of movements towards interoperability of information and ticketing systems. There may be exemptions, but in general, expectations of cooperative behaviour by public transport operators seems rather unrealistic because of the imbalance of benefits and costs.

5.6 Existing and Upcoming Business Models for Multimodal Information and Ticketing Systems (MMITS)

The objective of the following chapter is to provide factual information on selected examples of multimodal journey planning business models. The examples are categorized according to the type of actor, and are separated into two major categories, a combination of online travel agents (OTA) and meta search engines (MSE) as well as rail carrier-driven solutions. OTAs / MSEs fill the role of the service provider for online booking tools and gain revenues from commission on sales and advertising. The examples are arranged from national to international scopes of operation. Today, the market for MMITS is just emerging. Seeking and booking connections among different modes of travel – seamlessly – remains a challenge. Today no solution exists at a local, national or international scope of operation that combines static information and real-time data on available connections for all modes of transportation.

The data collection for this chapter was conducted through interviews with executive committee representatives and senior managers in the MMITS context of Waymate, Lufthansa, Deutsche Bahn, and NMBS/SNCB Europe, supported by secondary data.

5.6.1 Online Travel Agents and Meta Search Engines

Several OTAs and MSEs provide their users with information, booking, and ticketing capabilities for multimodal journey planning; only a comprehensive MMITS is not available, yet. Existing solutions vary from national services (e.g. Waymate) to international systems (e.g. Google, Rome2Rio) and show that multimodal journey planning is generally feasible. Although, multimodal booking and ticketing is possible.

5.6.1.1 Waymate

Waymate (former Byebyehello) is a commercially funded software start-up founded in Berlin in 2010. Waymate’s iPhone app allows the comparison of various transport options. Important transport modes are bundled and compared in the app: Worldwide flight connections, Deutsche Bahn connections, Hamburg-Köln-Express (HKX), subway, bus, tram, as well as car, taxi and car-sharing by car2go and DriveNow. Whether for long distance connections or short distance rides in urban areas, the app provides information about available connections. In a similar vein, the Waymate website allows travellers to search, compare and book a journey. Transport options within a city will also soon be added to the web service. Furthermore, long distance buses are planned to be added to the app and the website for the near future.

Both the app and the website provide planning through an integrated booking process for a small number of modes only. Travel options are displayed in a visual timeline using API and selected GTFS data feeds. Results can be sorted according to personal preferences, by criteria such as travel duration, price, and comfort. Different modes of transport can be filtered in or out by type. Waymate is available in German and English. It now focuses on the German market, but is considering successive pan-European expansion.

Waymate's revenues derive from commissions on sales for every booking through the platform. OTAs and MSEs similar to Waymate in terms of scope of operation and level of integration are: GoEuro, Wanderio, Moovel (an initiative on behalf of Daimler AG), and Qixxit (an initiative on behalf of DB Vertrieb GmbH).

The major benefits of Waymate lie in the reduction of complexity for multimodal journey planning and the partial integration of information and ticketing at regional scale. In terms of audience, the main competitors of Waymate and similar, regionally focused OTAs / MSEs are journey planners offered by service providers with global coverage (e.g., Google Transit and Rome2Rio) and platforms projected by major rail and flight carriers. Moreover, it can be inferred that the audience and brand recognition of only multimodal information providers such as Google Transit is by far superior to Waymate.

At present, Waymate's timetable information covers national and regional rail and flight traffic. However, seen mid-term and long-term, it remains to be seen whether regionally focused OTAs / MSEs, such as Waymate, can succeed through a higher integration level and data quality at regional scale, or if other OTAs / MSEs, deriving from major carriers or meta search engines, will implement integrated solutions at a similar performance level to consolidate the market.

5.6.1.2 Google Transit

Google Transit was integrated into Google Maps in 2007 to support travel planning, a feature that Google has extended to several hundred cities. The service allows the user to compare train and public transport information with car routes for short and medium-range distances. Although it offers detailed information on transport modes such as train and public transport, it does not provide information on flight schedules, and includes only an indirect booking and ticketing option. Currently, more than 500 transport operators worldwide provide their schedule information via Google Transit. The service is expanding rapidly and is already available in 12 different languages. Google Transit is available in hundreds of cities and also entire countries such as China, Japan, and Switzerland. Google Transit is available on selected mobile devices via the Google Maps mobile app.

Travel planning is currently supported by providing traffic conditions and alternate routes, by suggesting which trains or buses are next when coming close to the station, and by displaying train connections based on GTFS feeds, a standardized data format for public transport schedules and route information originally developed by Google. In addition, Google Transit offers fare information for a small number of transport operators which include pricing data in their GTFS feeds. The relationship between the transport operators and Google is based on a closed purse approach. Google does not charge transport operators for integrating their data in Google Transit, and does not pay for this data.

Google Transit has particularly low access barriers for users, and already provides several components belonging to the scope of a MMITS. Moreover, the GTFS data standard has contributed greatly to the widespread utilization of the Google Transit journey planner.

For public transport operators, Google Transit provides a cost-efficient channel – free of charge – to provide schedule information to a wide audience, including international travellers. Overall, Google Transit fits Google's general business model to provide mass services in order to generate turnover through advertising based on advanced user profiling technology.

By offering public transport information together with car route information, transport operators may have the chance to motivate more travellers to a modal shift. In addition, Google Transit enables locally-acting operators to target foreign customers visiting the city or country. Therefore Google Transit could provide a superior solution to well advanced journey planners, such as Rome2Rio.

Transport operators and authorities are reluctant due to the contractual conditions that allow only limited control on data, and about the limitations of the GTFS format, which cannot handle complicated cases. A related potential shortfall may limit operators' resources for updating and maintaining the static information on a regular basis, meaning that the information may become out-dated. However, as long as Google Transit is a free service for operators who are willing to share their data with Google, and if GTFS is updated for real-time utilisation, Google might seize the market for a potential MMITS, include almost every transport mode in future.

Subsequently, as a positive network effect, Google Transit might provide the foundation for a market for region-wide niche MMITS systems such as Waymate, and also provide the cornerstone for a future MMITS ecosystem.

5.6.1.3 Rome2Rio

Rome2Rio was founded in Melbourne in September 2011, supports nearly all modes of travel and has built up a unique repository of train, public transport, ferry, car, taxi, and air routes. Car-sharing services and car rentals have not been yet taken into account. The aim is to assist in building up complex, multi-stop itineraries. For proposed itineraries, Rome2Rio delivers fully detailed information about travel modes, travel time, real-time costs and CO2 emissions. The web platform is capable of long distance (inter-city) trip planning as well as local (intra-city) journey planning. Over 600 transport operators are represented in its database, which is the largest online repository of surface transport routes on the web. The repository is constantly expanding as new data is added from a variety of sources. Rome2Rio also searches flight schedules for over 670 airlines licensed from OAG Aviation, covering the full spectrum of low cost carriers and full service airlines. In addition, data from Open Street Maps is used to provide driving and walking directions for most countries worldwide. Within Europe, Rome2Rio features extensive coverage of the train network. Bus coverage is provided in Croatia, and some metropolitan transport is available such as airport links and the London Underground.

Although Rome2Rio does provide the user with current ticket prices for the specified travel date, it does not provide them with booking and ticketing options through its user interface. For booking and ticketing, the user is forwarded to each journey stage provider's booking interface, and leaves the platform at this point. This means that every leg of a journey has to be booked separately by the user, and it cannot be guaranteed that the given price is held throughout the booking process

The platform gains revenues through hotel and rental car commissions. It also gains revenues from airline and transport providers' affiliate programs as well as from licensing of their search technology and transport repository. The platform is available for integration into web and mobile applications via API and White Label solutions. Through the targeting of online travel businesses, such as travel agencies, destination sites and guidebooks, as well as carriers (e.g., Lufthansa just launched its Rome2Rio based journey planner) to be customers of its multimodal search technology, Rome2Rio aims for converting potential competitors into partners. In return, such partners are supported in strengthening their direct sales channels and independency.

The timetable information is intermodal, covers a broad range of transportation modes and mostly offers a point-to-point pricing feature. Rome2Rio meanwhile offers a variety of advantages for multimodal journey planning compared to services like Google Transit. Rome2Rio already provides a comprehensive set of available options for getting from A to B by combining various transport modes. It also offers a far broader coverage of inter-city train, bus and ferry routes and shows multiple flight options from various airports near the traveller's starting location and destination as well as directions to and from those airports.

Within the next few years, it is very likely that we will see Google and other up and coming multimodal journey planning players, such as carriers, focusing on improving or rolling out products for travel search by expanding inter-city coverage and offering reliable, truly multi-modal, door-to-door travel search results. In the meantime, by delivering its technology to partners and other websites (since Rome2Rio now pivoted to B2B) which have traffic already, Rome2Rio may be able to defend its leading position on a global scale while continuing to focus on improving Rome2Rio's transport coverage and data quality. In summary, the product is already very useful for travel into or within regions with excellent public surface transport, such as Europe. In addition, Rome2Rio has introduced a carbon scheme with offset options that shows the environmental options for a trip.

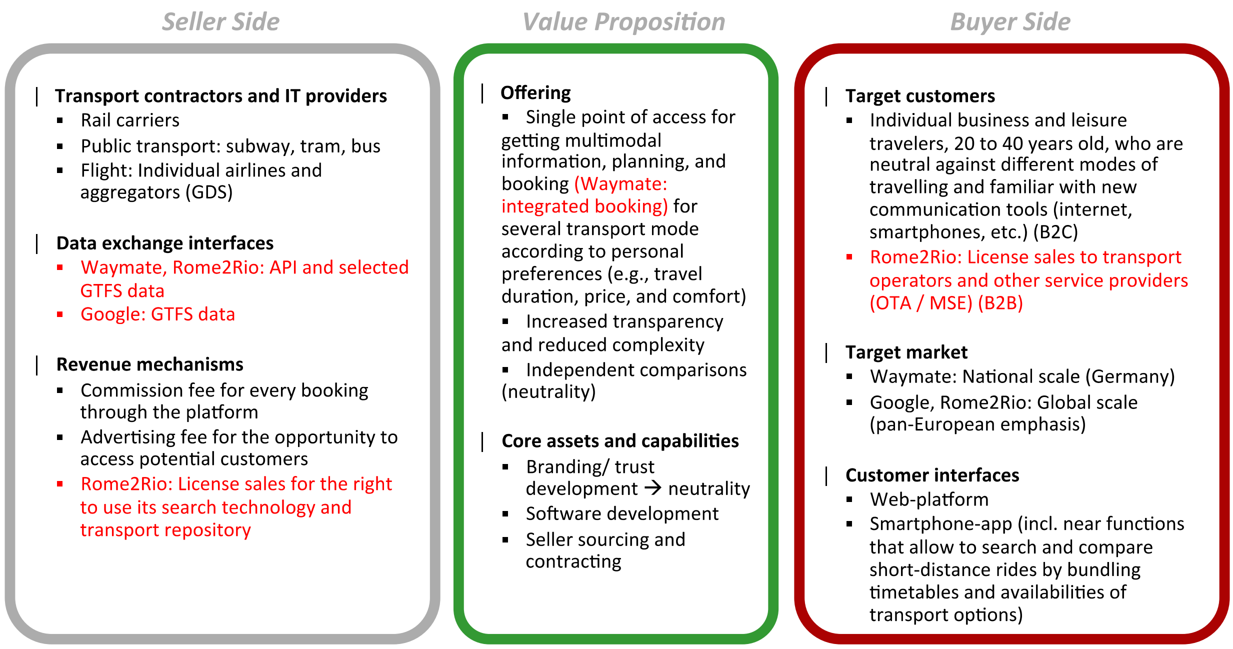

Figure 63: Two-Sided Market Business Model Showing the Abovementioned Examples (Red Marks Highlight Differences between the Illustrated Cases)
Source: Own illustration.

5.6.1.4 Two-Sided Market Business Model

The previously analysed business models follow the general logic of a two-sided market. In a two-sided market, a third party provides a platform that brings together the seller side (transport contractors) and their (potential) buyer side (customers / travellers) through its service offers. This third party possesses core assets and capabilities for the facilitation of both groups' transactions. With regard to the latter, as confirmed across all the interviews and secondary data, it takes a strong brand, in-depth software development capabilities on API and GTFS-based systems and proven seller sourcing and contracting capabilities to create and deliver the promised service offers. Target customers in the B2C context have further been described during the interviews as middle-aged individual business and leisure travellers who are flexible concerning transport modes and are familiar with today's new solutions for communication.

The core necessity for the two-sided market platform model is to reach a critical mass. This describes a minimum number of users on both sides of the market so as to make the service valuable for the seller and the buyer side customers. In order to achieve a critical mass, services are most often offered for free, at least for the period of the commercial launch. Revenues are often generated later on, after the platform has gained a certain importance for both parties. If the critical mass is not achieved on both sides of the market, the platform will not add any value. This is also the biggest risk of the two-sided market business models: The core asset of the intermediary platform is to bring together distributers and potential buyers of goods. If one of the both groups is not existent in a sufficient number, the platform will not be of any value for both sides.

A general business model of an online travel agent could be as shown in figure 65. Figure 64 shows the general business model of a two-sided market.

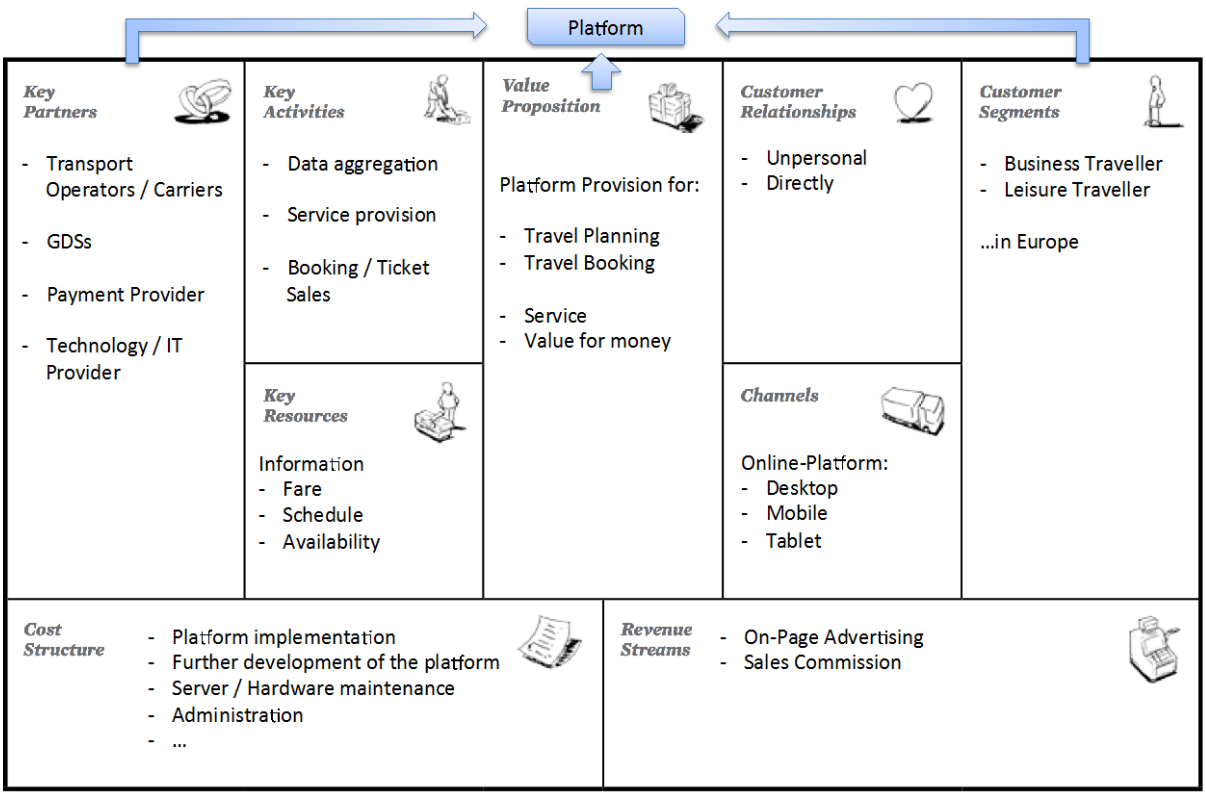

Figure 64: Two-Sided Market Business Model Using the General Example of an OTA
Source: Own illustration.

5.6.2 Air-Rail Cooperation between Carriers

Until recently, air-rail cooperation, including seat reservations, has been based on the creation of blocked spaces in railway inventory systems and on the issue of separate tickets for air and rail journey stages. In this model, during booking, there is no communication between the GDS/CRS and the train inventory system. The whole operation involved manual procedures (back office included), was costly and not customer friendly. Railways are increasingly connecting to CRSs, and the interconnectivity in place allows for airline-like and real-time information exchange between the CRS and the railway inventory systems. However, important airports are already connected with European high-speed rail networks. The European high-speed rail network provides access to the major catchment areas for airlines operating from these airports.

For scheduled airlines, high-speed rail complements their “hub and spoke” model, or may even replace short haul flights. An integrated air-rail product may allow airlines and railways to strengthen their position, especially in new areas. It is expected to become an alternative for short haul flights, and represents a competitive advantage over non-integrated air-rail products. Currently, BENE International, Swedish Rail (SJ), Deutsche Bahn (DB), and KLM offer integrated air-rail products in cooperation with airports and carriers such as the Lufthansa-BeNe AirRail Project

BeNe AirRail Project

BeNe Rail International, a joint venture of SNCB Europe and NS Hispeed, has developed a system to facilitate air-rail integration with the partnership of Accesrail, matching the needs of both air and rail operators. The BeNe AirRail project aims at the integrated, global distribution of both modes of transportation and may be the first system for selling rail segments in the flight mode of GDS/CRSs on the primary screen and based on real-time communication with the rail inventory system. Accesrail offers a very complete and flexible system for railways, which can be adapted to the different air-rail integration requirements. Basically, Accesrail provides message conversion from AIRIMP to a generic rail web service protocol provided by BeNe Rail as an interface to the BeNe distribution system. The BeNe distribution system then provides access in a generic manner to different inventory systems. Moreover, some railway companies already operate long distance buses that could also fit into this system. The business scope covered by the BeNe AirRail project includes pre-sales, booking, irregular flows after booking and check-in, issuing of an IATA-E-Ticket, check-in (desk & web check-in), registration that the passenger segment has been travelled, after sales, and settlement. The system targets long distance passengers travelling through or connecting in European hubs (further development for intra-European connection flights under consideration) and can be accessed by travel agencies, web platforms (OTAs, individual airlines), and airlines' call centres, using CRSs. Customers are charged according to standard airline agent revenue mechanisms. Currently, the business requirements include a flexible system supporting multi-airline agreements between one train operator and different airlines, multi-train operator agreements between different train operators and one airline (which requires the support of different pricing systems and the provision of links to multiple rail inventory systems), and multi-airport, as well as multiple business models – sold separately, interlining, and code-sharing.

Airlines and railway operators agree on the price and revenue level the railway will receive as an operating carrier. This revenue is settled based on 'passengers flown or travelled' according to standard practice in the airline world. In turn, revenue for BeNe AirRail comes from a fee per segment booked via the solution as multiple operators use it. This fee is paid by the transport operators for rail and air, depending on their agreed business model (see above). Together with Deutsche Bahn, BeNe AirRail is currently discussing how to organize air-rail sales on ICEs from/to Germany from/to Belgium and the Netherlands. This will be based on an Accesrail-BeNe Rail or Accesrail-Deutsche Bahn type of implementation, or a combination of both. Carriers such as BeNe Rail and Deutsche Bahn are not intending to sell their solution to other operators. Their main aim is to implement the solution for every relevant transport offer in which SNCB or NS participates.

With its global perspective, the BeNe AirRail project is one of the most ambitious examples of air-rail collaboration currently operating such as the German based, bilateral AIRail system by Deutsche Bahn and Lufthansa. The direct benefits from the project for air & rail operators are:

- Airlines only have to pay per traveller subject to a blocked seat or a flight
- Railways can develop better capacity management compared to blocked seat
- Integrated distribution via GDS and airlines' web services
- 100% e-tickets and links with airlines' CRSs
- Rail segment is integrated into airline (travel) processes to check passengers on-board the train, based on a check-in process which supplies a railway boarding pass to allow the railway operator to continue on-board control processes as usual

Indirect benefits from the project for the air & rail operators are:

- Price decreases, because no departure taxes nor arrival taxes need to be paid for the train journey stage
- Achievement of new markets (airlines not offering direct flights to all major hubs can use high-speed rail feeders from / to other major cities)
- A reliable, well-integrated, well-accepted, cost-effective and environmentally friendly feeder product
- Extra passenger volume for railway and airline companies

Moreover, benefits for the customer are:

- Hassle-free, convenient, reliable, comfortable, and well-integrated products for the passenger
- "One-stop shop" (packaged pricing for air and rail)
- Distribution via GDSs and .com's by airline partners.

Therefore, from a (high-speed) train perspective, the project will lead to more passengers, originating both outside the train's immediate catchment area and from other distribution channels; will provide a feeder function from/to airports from/to city centres, and will offer a perfect alternative for other transport modes. From a (scheduled) airline perspective, the high-frequency, high-quality feeder product strengthens the airports' catchment area, high-speed rails can substitute short haul flights, and an integrated air-rail product is a competitive advantage. Therefore the BeNe AirRail project complements rather than competes with established approaches. However, in case the journey is sold as an end-to-end intermodal trip, the airline might want to ensure that the part of the trip that is operated by, for example, a railway or bus operator has a minimum and guaranteed service level for the customer. In this way, the transport partner of the airline has to perform to the same service standards in order to offer the customer a consistent and reliable end-to-end service. From a competitive perspective, Amadeus also develops a “fly by rail” tool that will propose “codeshare-interline” capabilities in a seamless way. Moreover, OTAs / MSEs are working on projects to gather railway content next to air content on a number of major routes, and can integrate them in one display for the end user while also integrating booking / ticketing steps in one platform. The following figure provides an overview on the carrier-based MMITS business model, which also follows the aforementioned two-sided market or platform approach.

Seller Side

Transport contractors and IT providers
- Railway carriers
- Flight: Individual airlines and Aggregators (GDS)

Data exchange interfaces
- Accesrail provides message conversion from AIRIMP to a generic rail web service protocol provided by BeNe Rail as interface to the BeNe distribution system
- The BeNe distribution system gives access in a generic way to different inventory systems

Revenue mechanism
- Commission fee charged to the transport operators (rail and/or flight) per segment booked via the solution

Value Proposition

Offering
- Single point of access for getting intermodal information, planning, booking, and integrated, electronic ticketing for flight and rail through GDS/ CRS (“one stop shop”)
- Seamless journey planning that bridges the gap between airline and rail systems and procedures

Core assets and capabilities
- Flexible platform supporting multi airline, train, and airport agreements as well as multiple airline business models
- Technology Partnership with Accessrail

Buyer Side

Target customers
- Long-haul passengers travelling through/ connecting in European hubs

Target market
- Global scale

Customer interfaces
- Travel agency GDS screen
- Web platforms (OTA, individual airlines)
- Airlines’ call center

Revenue mechanism
- Standard airline agent revenue mechanisms (Cfr IATA)

Figure 65: Carrier-based MMITS Business Model
Source: Own illustration.

5.6.3 Outlook: Positioning of Platforms

The previous chapter reviewed examples of existing and upcoming multimodal journey planning business models of OTAs, MSEs and rail carriers at a local, national, and international level. Moreover, our review highlights differences in the respective levels of integration in terms of the number of covered transport modes and system functionalities for integrated booking and ticketing. The variety of successfully practiced business cases justifies the on-going co-existence of several multimodal journey planning platform providers drawing on similar business models. However, we will refrain here from making general conclusions on which approach will be most successful and which will not – we feel that each example proves through its sound basis and systematic expansion that the rationale behind it is relevant. At present and in the near future, the different multimodal journey planning platforms will co-exist, and each one has the potential of complementing and destabilizing the others. It remains uncertain how much further the market will go before hitting consolidation phase. The figure below illustrates the reviewed case examples of multimodal journey planning platform providers with their current and targeted positioning with regard to the scope of operation and the level of integration of transport modes and functionalities.

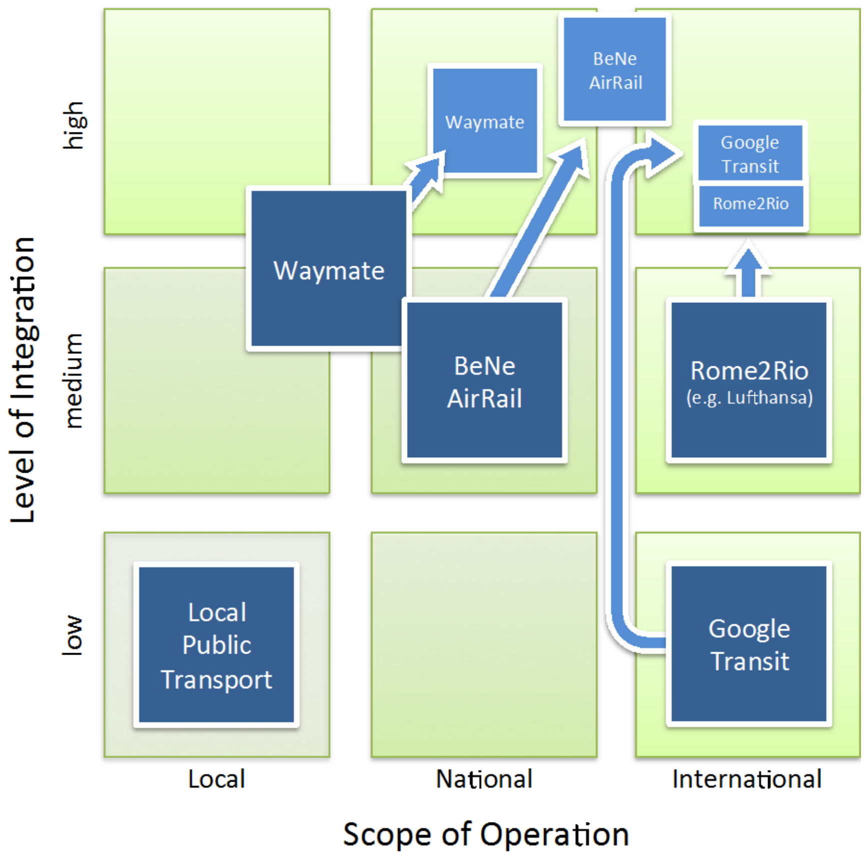

Figure 66: Current and Future Strategic Focuses of Multimodal Journey Planners Today
Source: Own illustration.

5.7 Business Model Patterns in the Evolving MMITS Ecosystem

From the above evaluation, it is possible to visualise that different actors are able to provide pan-European MMITS platforms based on different business models. Following the analysis of different actors aspiring to provide a MMITS, three potential business models can be proposed for an evolving MMITS ecosystem that cater for different contexts and help companies to adjust their business models to the changing demand landscape – including the success factors, drawbacks and pitfalls associated with each business model. The sequencing order for the business models in this chapter reflects the on-going and expected series of innovation horizon associated with each business model in the MMITS ecosystem.

All presented business models are based on the assumption that general, non-exclusive data accessibility is ensured.

5.7.1 Commission and Advertising

The commission and advertising business model is typically used for two-sided markets or platforms, where business interactions between sellers (transport operators) and buyers (business or leisure travellers) are submitted by a third party service provider (OTA / MSE). The key for this is that there must be a single point of access for both intermodal transport and supplementary services such as information, booking, and ticketing. An OTA / MSE adopting this business model offers any traveller a platform through which they can plan, book and pay a journey built on the core asset of a user-friendly customer interface. OTAs and MSEs create marketplaces connecting transport operators and travellers in their role as aggregators. In other words, the platform serves as an intermediary through which a service provider tries to reach as many users as possible in their target group. In turn, providers of such platforms can monetize these services through commissions and/or advertising. While further business opportunities and revenues are possible with regard to the traveller, it is presumable that free services featuring basic MMITS functions will initially emerge. Once a critical mass is reached, a MMITS can be properly monetized by charging travellers a monthly or usage-based extra fee for access to premium services (see the figure below). This may be additional beverages, extra leg room or other ancillaries that may be unbundled during the process of product customization.

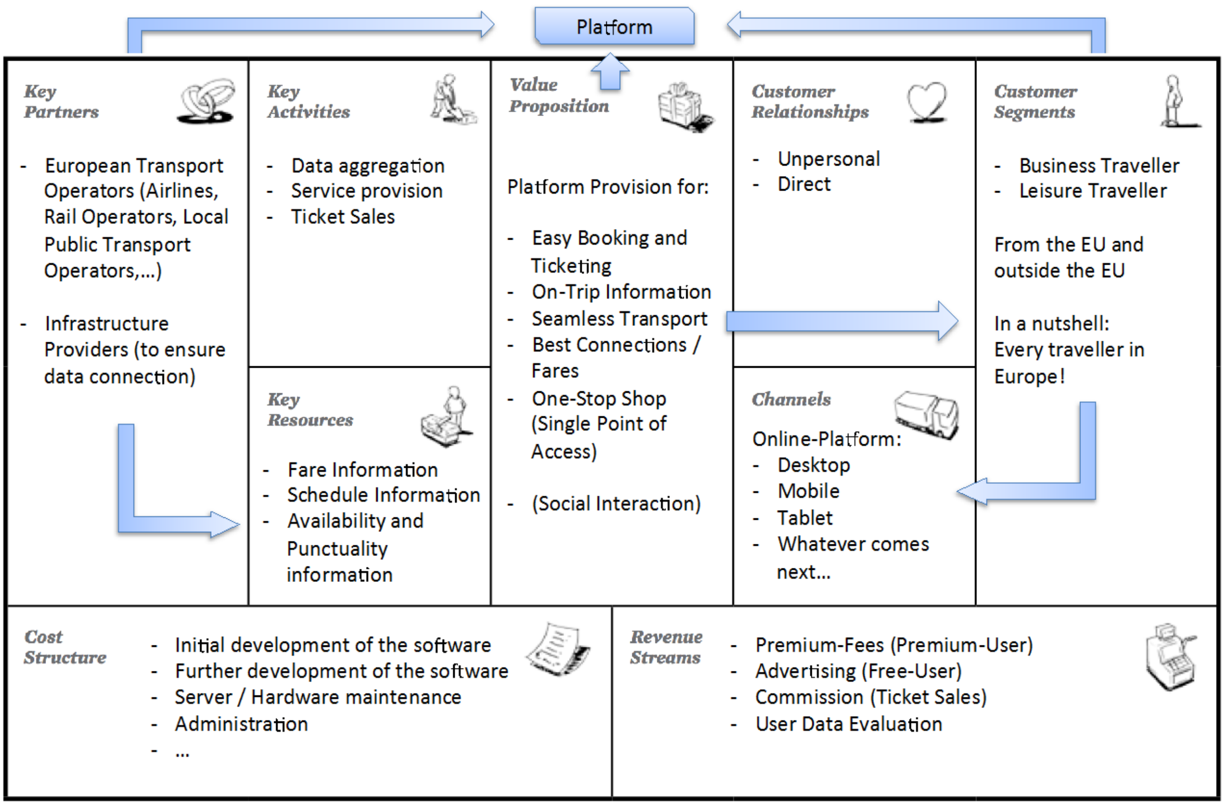

Figure 67: Commission/Advertising and Freemium-Based MMITS Business Model
Source: Own illustration.

Platform-based commission and advertising business models have several strengths: They recur constantly (travellers typically keep coming back if they have a positive user experience; they are scalable (user acquisition costs are low), and they benefit from aggregation. On the other hand, this kind of business model is notorious for “chicken or egg” situations and indirect network externalities, which makes running them a delicate balancing act. Before a transport operator invests in MMITS platforms, he might want reassurance that there will be a sufficient number of users seeking multimodal journey planners (uncertainty on the demand side); but travel users will only use the platform if they are reassured that there will be a sufficiently comprehensive partner network of different transport modes (uncertainty on the supply side) and therefore will receive a certain benefit.

5.7.2 Collaboration

This model is based on an association of transport operators which pool their resources in partnership with an IT provider to develop a MMITS with a special focus on integrated ticketing solutions for, for example, a pan-European distribution of rail segments through the airline industry's CRSs. The main goal of this collaborative approach is to implement a solution for every relevant transport offer in which the transport operators participate. The costs are allocated to its members according to the percentage of forwarded travel receipts. In addition, revenue for the service providers comes from a fee per segment booked via the MMITS by unaligned transport operators. Any net income achieved by the association is then returned to the members in the form of a redistribution of profits. In other words, a collaborative business model allows an association of transport operators and IT providers to work together and to provide services for other businesses.

It is very likely that an increase in competition within the transport sector would make the bilateral agreements that are currently in place obsolete. Joint ventures between multiple transport operators at an international level could also be viable. By using a collaborative business model, smaller transport operators in particular can compete alongside larger organizations. However, further steps towards a MMITS might be hampered by the high investment costs needed to harmonize the different operators' systems and philosophies.

The collaboration would also overcome the risk of dependency on third party solutions such as GDSs. All transport operators involved are also shareholders in the solution, and therefore have an influence on the development and allocation of costs.

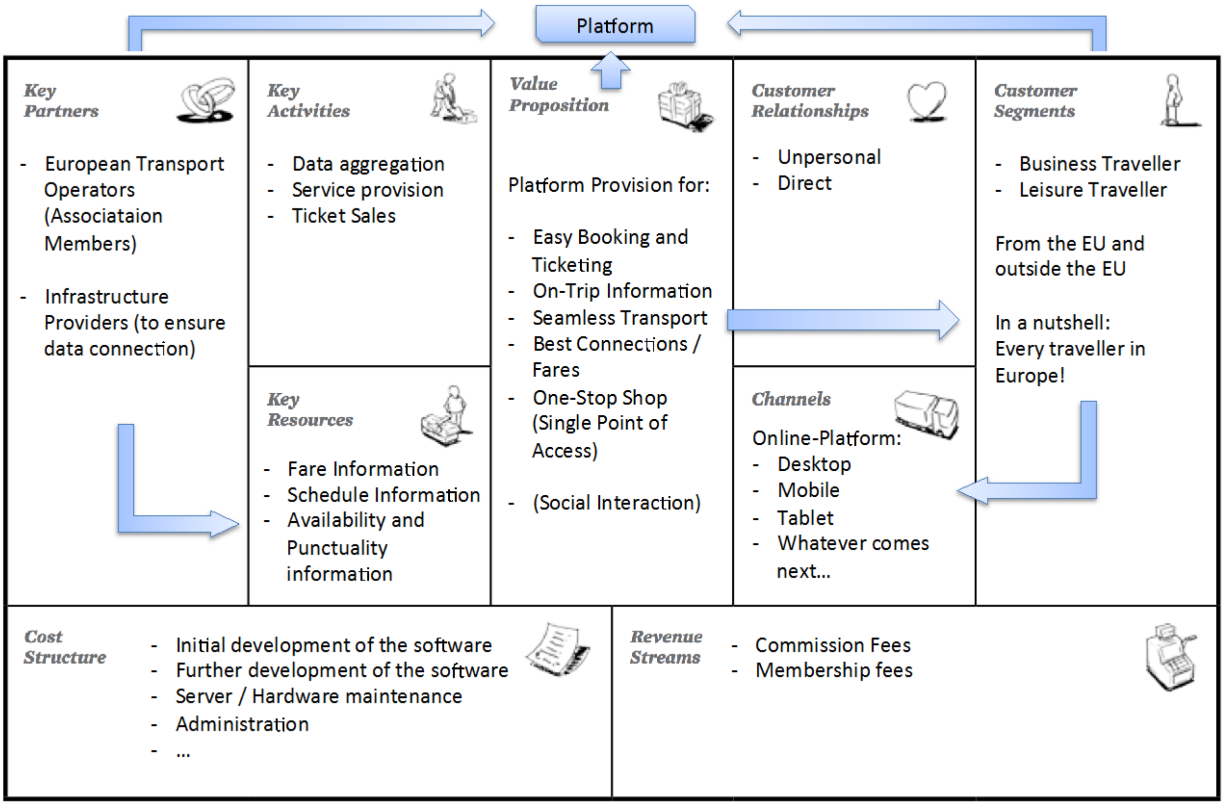

Figure 68: Collaboration-Based MMITS Business Model
Source: Own illustration.

5.7.3 Licensing

In the licensing model, a service provider sells the right to use MMITS software to B2B customers such as transport operators and OTAs / MSEs. The service provider can be an OTA / MSE,a single transport operator, an association of transport operators (horizontal license sales), or an IT service provider (vertical license sales). The MMITS software then can be implemented in the back end of partner websites to generate revenues from licensed search technology and to transport repositories. In other words, a service provider adopting this business model acts as a system integrator and contractor for the components of a MMITS, and sells it on a global scale.

The licensing business model is becoming increasingly attractive, since it offers a way of delivering the technology to partners and other websites who are already generating traffic, and of achieving a substantial B2B presence in the online travel market. Limited development potential and resources are another reason for the switch to a licensing model. However, by not simultaneously focusing on a consumer-facing site, the company could miss out on increases in the large volumes of end-user transaction data and feedback, which is invaluable for enhancing the user experience. Another critical success factor associated with this business model is the ability to generate recurring sales of license rights. A provider of a

MMITS could define a monthly recurring license that works like a monthly subscription. Please see the table below for an overview of the different kinds of business models.

Additionally, licensing and modular systems in particular represent a current trend in the online industry. As recent market investigation shows, the number of web-shop and mobile app out-of-the-box solutions available is increasing greatly. These solutions enable B2B customers to build their own web-shop or mobile app without any coding. This may also be a possible approach for MMITS systems. If IT specialists develop a modular system to build individualised MMITS systems, carriers would be able to make use of this solution and implement MMITS technology much cheaper than if based on individually developed software. This could be a cost-efficient way of gaining Europe-wide currency for MMITS technology, and thereby general acceptance in the transport industry.

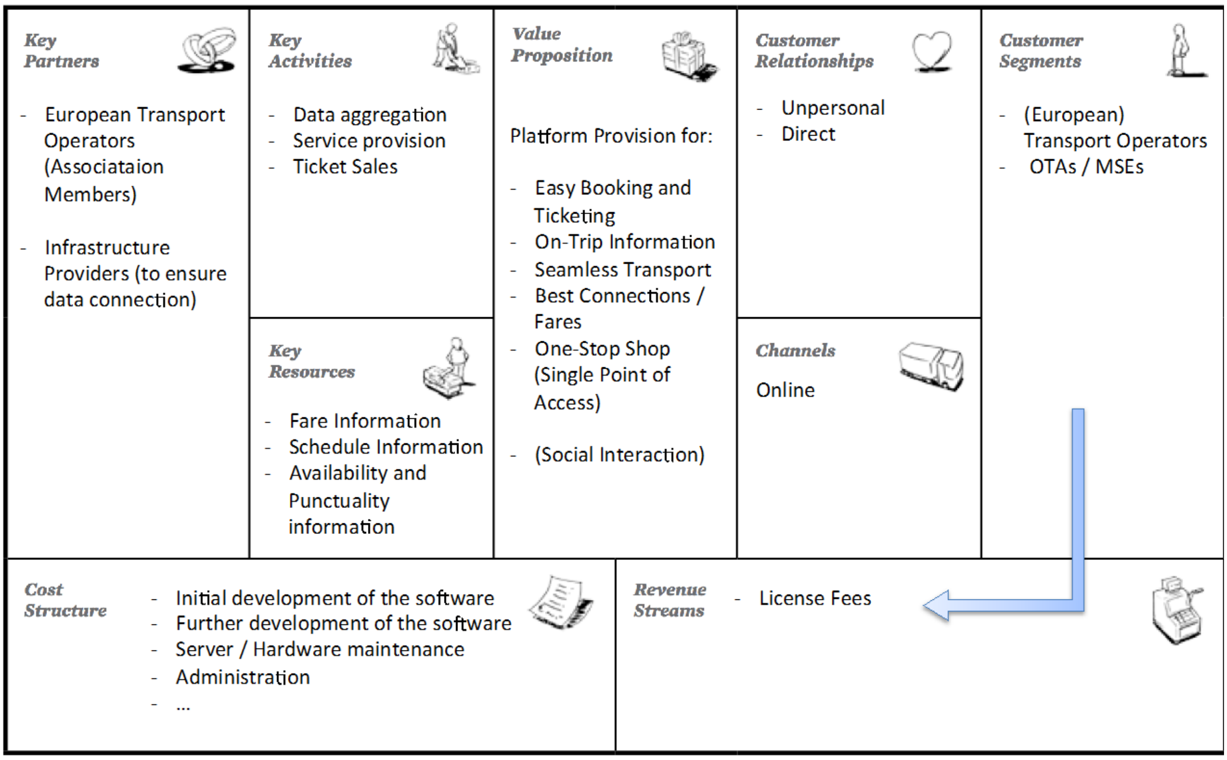

Figure 69: License-Based MMITS Business Model
Source: Own illustration.

5.7.4 Conclusions on MMITS Business Models

A MMITS provides an entire ecosystem connecting transport modes, services, technologies, and business models according to the best option for each travel purpose. Although basic journey planning platforms originated in the online industry with commission and advertising business models, the demands and inputs needed to create a true MMITS may go far beyond the scope or areas of expertise of pure OTAs and MSEs. In fact, it is important to emphasize that, given the state of flux and change multimodal trip planning is currently in, it may be the case that associations of transport operators in cooperation with global IT providers are better prepared to offer integrated solutions. In contrast, if the traveller information environment continues to evolve in the direction of open source development and third party applications, the future role of transport operators in traveller information service provision may change. In particular for rail carriers, both scenarios give rise to a trade-off between the opportunity to increase indirect sales through central distribution of rail segments via the airline industry's GDSs and through neutrally acting OTAs / MSEs versus the cannibalization of direct sales. As confirmed by the interviews with stakeholders, potential future customers who have not yet decided on a preferred transport mode, but who represent an immense market potential, are expected to search for reliable information on a neutral, trustworthy MMITS platform. Furthermore, it is assumed that these users will disregard the data quality behind a MMITS platform, but that they care about the editorial trustworthiness of their preferred MMITS. MMITS should therefore encourage rail carriers and other transport operators to engage in new business models through which to better exploit complementing market potentials. Potential risks regarding the success of these business models can mostly be found in not reaching the critical mass. As already mentioned in the chapter about two-sided markets, it is essential for an intermediary platform that a sufficient number of customers is available on both sides. If the number of transport modes available through the platform is too low, the added value for the traveller is too low as well and travellers will not use it. If the number of travellers using the platform is too low, there is no incentive for transport operators to take part in the MMITS platform. Therefore, it might be necessary to align the interests of the MMITS eco-system provider and the transport operators.

In general, as can be seen in the table below, current and future market players can adopt a number of business models for MMITS solutions. However, further business models might be possible, which may evolve from the online and travel industry. Concluding the business model analysis, it can be said that a lack of possible business models cannot serve as an excuse for not offering MMITS solutions. Business cases as well as certain business models exist. However, to realise these business models, a high level of collaboration is required within the travel market. Without extensive collaboration at a European level and between all publicly available transport modes, none of those business models will ever be realised in a usable way. Intermodal industry collaboration therefore is a key driver for any MMITS business model.

Business model (actors)	**Target customers**	**Offerings**	**Core assets and capabilities**	**Revenue sources**
Commissions and advertising (OTA / MSE)	▪ Traveller community at large (B2C)	Single point of access for getting information, planning, booking, and ticketing for a journey.	▪ Brand ▪ IT enabled platform with user-friendly customer interface and real-time data exchange interfaces ▪ Seller sourcing and contracting	▪ Commission fee ▪ Advertising fee ▪ Extra fee for premium service
Collaboration (association of transport operators/ IT provider)	▪ Traveller community at large (B2C)	Integrated ticketing solution for seamless journey on rail and flight through GDS/ CRS ("one stop shop").	▪ Open boundaries ▪ System integration and contracting ▪ Close partnership with IT provider	▪ Commission fee
Horizontal licensing (OTA / MSE, transport operators) Vertical licensing (IT provider)	▪ OTA / MSE ▪ Transport operators (B2B)	Tailored, integrated MMITS on a turnkey basis. Out-of-the-box modular system.	▪ Brand ▪ Technology leadership ▪ End-user transaction data and feedback	▪ Case specific ▪ Fee for service

Table 9: Business Model Outline
Source: Own illustration.

5.8 Key Findings of WP3

1. MMITS systems basically rely on the three pillars of information, booking & ticketing and settlement/payment.
2. The main technological issue for interoperability is a lack of common data standards for the purpose of information as well as for ticketing and ticket schemes.
3. The travel market in Europe is increasing greatly in size. Online systems, and mobile devices in particular, will be the most important information channel in the future.
4. There are currently several multimodal journey planners on the (European) market. While these provide valuable services, none of them offers a comprehensive multimodal information and booking solution.
5. As a consequence of deregulation, competition and the large share of international trips made by air, airlines have come to rely on indirect distribution through travel agencies using CRSs. Less than 5% of rail trips in the EU are international, and rail operators currently enjoy near monopolies in their domestic market. Rail operators sell more than 80% of trips through direct distribution channels. Local public transport sells almost 100% directly. While the share of indirect distribution by rail operators is increasing and expected to increase with deregulation, willingness to participate in a MMITS other than its own could vary among the transport modes.
6. The scope of operation of transport modes and the number of players involved in the distribution value chain is strongly aligned. Therefore, local, regional and national players in particular might have to deal with additional players entering their distribution value chain. This may also lead to unwanted dependencies.
7. Future trends in the market itself may lead to booking and pricing innovations and new approaches to the ticketing process (e.g. offering multimodal ticketing via a unique passenger ID). The main technological trends affecting the market are developments in mobile payment and the Internet of things.
8. Inter-modal and intra-modal collaboration is a key driver of future development towards a MMITS.
9. Today, the market for MMITS is just emerging. There are a variety of platforms offering services showing fundamental differences regarding the number of modes covered and functionalities for booking and ticketing. For the future, several business models, such as commission and advertising, are possible. They all rely on a high level of industry collaboration.

10. The future development of MMITS will depend on the on-going deregulation in the rail sector and the incentives for industry cooperation in the market, such as cost effective access to a wider audience. Whereas the benefits prevail for airlines participating in a MMITS, rail operators could be deterred by fundamental changes and high costs. Cooperation will be most difficult for operators at a local level.

6 Cost Benefit Analysis (WP5)

6.1 Methodological Framework

This section briefly summarises the methodology of economic assessment of the Multi Modal Information and Ticketing System (MMITS).

- First: The general decision for the cost-benefit analysis as an assessment method is explained.
- Second: The impact areas of a MMITS are illustrated. Further it is clarified, what kind of impacts could be expected, and which kind of impacts can be assessed within this study.
- Third: The effects of MMITS are caused by modal changes. The relevant modal changes from unimodal road travel to other travel modes are described.
- Fourth: Data limitations restrict the socio-economic assessment. Therefore, the impact appraisal reflects only some benefits, but not the full reachable societal profit.
- Fifth: The applied methods have to be reliable and politically accepted. The methodological sources are disclosed.
- Sixth: The calculation of economic effects is only possible by having information about travel data. The applied data sources are presented.

6.1.1 Economic Assessment of Multi Modal Information and Ticketing Systems

The objective of the cost-benefit analysis (CBA) with the ALL WAYS TRAVELLING project is to provide information on the dimension of possible resource savings caused by the usage of the Multi Modal Information and Ticketing System (MMITS). The reason for choosing the CBA as an economic assessment approach for this study is to provide an undisputable methodological background. The main advantages of the CBA are:

- The absence of a weighting schemes lead to objective results.
- The CBA can provide input to the financial analysis, the cost-effectiveness analysis, the break-even analysis, the multi-criteria analysis and to the business case calculations.
- The CBA can be performed under conditions of incomplete information about benefit and/or cost components.
- The CBA is a traditional method used to ensure efficient use of public financial means (maximization of the gross national product), by summarizing direct (=internal) and indirect (=external) costs and benefits.

- The procedure of the cost-benefit analysis formally corresponds to the capital investment budgeting: The accumulated social benefits during the lifetime (resource savings) are discounted to the point of investment.

The theoretical foundation of the CBA comes from welfare economics, which is a well-developed economic branch seeking to evaluate economic policies in terms of their effects on the well-being of the community. Welfare economics requires a strict application of the Pareto Criterion: By introducing any policy measure makes at least one individual better off and no individual is made worse off. The general formulation of this optimal objective is that by introducing any kind of MMITS at least one individual is made better off and no individual is made worse off. Obviously, the consequent application of this criterion is impractical because it would be impossible to identify all winners and losers of MMITS.

A pragmatic approach is chosen by introducing the Hicks-Kaldor Criterion (HKC). The HKC generally considers an intervention as acceptable if the amount of gain by some individuals is greater than the amount that others lose. That means it is important to reach a net-benefit, so that in principle, winners could compensate losers for their costs. No actual cash transfer is required. An intervention may therefore be considered efficient even if some individuals lose, as long it generates net-benefits (Boardman, Greenberg, Vining & Weimer, 1996: 29-34). From that point of view, a measure is advantageous to the economy if the economic benefits are bigger than the costs (i.e. the cost-benefit difference is greater than zero or the benefit-cost ratio is greater than 1).

The result is the benefit-cost ratio (BCR). Setting absolute numbers for the costs and benefits ensures the BCR as a reliable indicator of the cost-effectiveness. This provides an objective economics-based method of maximizing/minimizing the benefits/costs and helps to avoid false decisions and bad investments. In order to assess the benefit, the saved costs are being determined (costs as loss of benefits). The economic success scale is the saving of resources. The benefits can occur on both a microeconomic and macroeconomic level. However, it is decisive that the resource saving is not included twice. The BCR can be expressed as follows:

$$BCR = \frac{\sum_{t=0}^{T-1} Bt(1+i)^{-t}}{\sum_{t=0}^{T-1} Ct(1+i)^{-t}}$$

with:

CBR:	Cost-benefit ratio
t:	Examination time period
BT:	Benefits per year t
Ct:	Costs per year t
i:	Interest rate

The results of the CBA for MMITS in terms of the BCR are most important for every kind of decision-maker interested in the evaluation of MMITS before deciding on market introduction, deployment or promotion of the travel information system. Thus, the results should be presented in a way that is both comprehensive and coherent. As a consequence, ranges of BCR are given, which illustrate the variance of evaluation results. In this context, classes for CBA results are introduced to expose a grading of the results. The following classes can be distinguished:

1. **0 < BCR < 1:** The BCR is rated "poor" showing that a socio-economic inefficiency of MMITS is given.
2. **BCR < 3:** The BCR is rated "acceptable" meaning that the social benefits associated with the implementation of a safety system exceed the costs up to three-times which can be labelled as an acceptable absolute efficiency.
3. **BCR ≥ 3:** The BCR is higher than "3" indicating an "excellent" result of the socio-economic assessment. The system evaluated as "excellent" should be in first line for market deployment.

6.1.2 General Impact Channels of MMITS

The following figure gives an overview over the general MMITS impact channels and their embedding with the CBA process. Relevant impact fields are:

- **Safety impacts**: Modal shifts will have direct and indirect safety effects. Direct effects arise for the mode-changing consumers because of different accident likelihoods of the various transport modes. In the case of modal changes from road travel to other transport modes the reduction of vehicle kilometres lowers the accident risk of the remaining cars and also for the road freight transport.
- **Mobility impact** fields cover all kind of effects which are generated by the optimized travel choice due to MMITS. It can be assumed that MMITS highly contributes to a more efficient usage of all kind of transport modes and enables efficiencies gains by better utilization, routing and scheduling. Beneath these direct effects, indirect effects due to vehicle kilometre reduction arise because of lowering congestions leading to time-, fuel-, emission- and accident savings.
- **Environmental impacts** are clearly reduced in the case that vehicle kilometre reductions of unimodal road transport can be reached by an unchanged capacity supply of the other transport modes. The crucial question is, whether modal shifts from road transport to other transport modes will lead to a necessary increase in their capacity. Obviously MMITS will re-allocate the travel choice inducing efficiency gains by higher utilization, demand-oriented routing and scheduling (=mobility impacts). Therefore, it can be assumed that modal shifts from road to other transport modes will also enable the opportunity to reach emission reductions for the other modes.
- **Investment and operations costs** for MMITS. These will have to be identified as pilot tests and live cases provide required insights, in order to provide a complete cost-benefit ratio.

Due to the limited resources for the project, and the general lack of appropriate data, it is only possible to identify, with a reasonable degree of accuracy, the environmental savings from modal shift from unimodal road travel to other travel modes. It is also clear that such modal shifts will have direct and indirect effects on safety, time savings, and vehicle operating costs, as we will see below, although these effects can only be roughly estimated at this time. For the purposes of analysing the environmental impact, moreover, no efficiency gains of other transport modes are assumed, and the environmental costs of other transport modes are therefore assumed unchanged. This might be a pessimistic assumption.

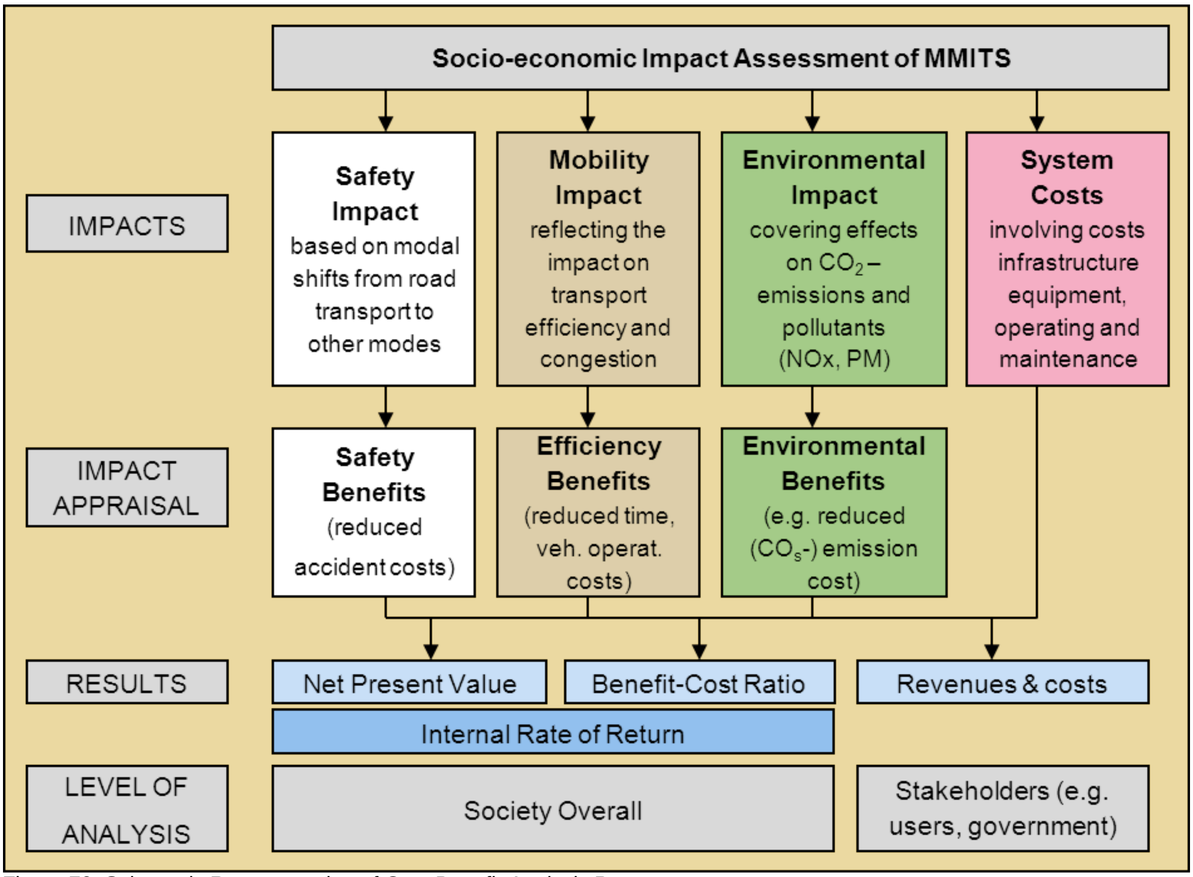

Figure 70: Schematic Representation of Cost-Benefit-Analysis Process
Source: Own figure.

6.1.3 Selected Modal Changes

The modal change can be calculated for the group of users, which are using only the car for their intra-zonal and inter-zonal trips. The change to another transport mode was estimated for following cases:

- Case 1: change to car sharing, rental car
- Case 2: change to aeroplane
- Case 3: Change to train
- Case 4: Change to bus (not urban transit)

The following restrictions of the cases and their implications have to be regarded:

- **Case 1** does not change the transport mode. Therefore, it is assumed that the vehicle kilometres will not be changed. Indeed using the rental or car-sharing indicates that the unimodal road transport chain will be changed because taxi-rides and rail trips to reach the rental and/or car-sharing points are now induced. Empirical relations to estimate these effects of the slight changes of the transport chains are currently not available. These effects cannot be calculated.

- **Case 2** means that there is a switch from unimodal road trip to an air mode transport chain. The change from unimodal road trips to air mode trips seems only plausible for inter-zonal trips. Vehicle kilometres changes are only calculated for the inter-zonal trips and not for the intra-zonal trips. Within the air transport trip a part of the trip kilometres will be still used by other modes (road and rail). An average by 20% of the air trip kilometres can be allocated to road and/or rail (INTERCONNECT 2011).
- **Case 3** and **case 4** cover both inter-zonal and intra-zonal trips.

The resource effects are calculated for the reduction of vehicle kilometres. For the other modes, it is assumed that the modal change will not lead to an expansion of transport capacity. The assumption is: neither resource savings nor resource increases occur for the other travel modes.

6.1.4 Data Limitations

The socio-economic assessment faces some evident data limitations, which have to be considered:

- Generally, the empirical knowledge about the impact channels is incomplete. The general lack of evidence leads to the consequence that not all possible beneficiary effects (such as avoiding road accidents, reduction of transaction costs) can be calculated.
- Harmonised European travel data for unimodal road trips and multimodal trips are yet not available. Some European projects (e.g. DATELINE, KITE, CLOSER, INTERCONNECT) started to gather data. However, the travel data picture is still incomplete and impressionistic.
- In addition, a lot of various modelling tools exists (e.g. TREMOD), but they are influenced by individual experts and their views. Some other modelling tools like TRANSTOOLS are free-to-use, but not easy-to-use.
- Travel surveys are conducted by some European member countries. Different methods of data gathering and definitions hinder the comparability of data and the aggregation of national data sources on a European scale.

6.1.5 Applied Methods

The economic cost-benefit analysis model was used and has previously been applied in the following projects:

- HEATCO, Developing Harmonized European Approaches for Transport Costing and Project Assessment, Deliverable 2, State-of-the-art in project assessment (HEATCO, 2005).
- SEiSS (Exploratory Study on the potential socio-economic impact of the introduction of Intelligent Safety Systems in Road Vehicles. Study for the Directorate-General Information Society) (SeiSS, 2006).
- AUTOFORE (Study on the Future Options for Roadworthiness Enforcement in European Union, Study for the Directorate-General for Transport and Energy) (AUTOFORE, 2007).
- eIMPACT (Assessing the Impacts of Intelligent Vehicle Safety Systems, Contract no: 027421, Sixth Framework Programme DG Information Society and Media) (eIMPACT, 2008a;2008b).
- Handbook on estimation of external costs in the transport sector. Produced within the study Internalization Measures and Policies for All external Cost of Transport (IMPACT), Version 1.1, Delft 2008.
- Ökonomische Bewertung von Umweltschäden, Methodenkonvention zur Schätzung externer Umweltkosten (UBA, 2007).
- TEDDIE: A new roadworthiness emission test for diesel vehicles involving NO, NO2 and PM measurements (Study for DG-Move), Brussels 2011 (TEDDIE 2011).
- Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles.

This experience ensures that the results of the CBA will be comparable with other national and European analyses, and will represent the current scientific state-of-the-art.

6.1.6 Applied Traffic Data

The main source for the traffic data is the ETISplus-study (ETISplus, D6 Database Manual, Passenger database construction (WP9), Annex Report D6: Metadata – passenger trips by car, Base Year 2010). The next table presents the starting data for the quantification of MMITS-effects. It covers passenger kilometres for unimodal road travel divided into intra-zonal travel and inter-zonal travel. The ETISplus project provides the passenger trips by car at NUTS 3 level (both intra-zonal and inter-zonal). For the intra-zonal road trips four distance bands have been defined for the estimation of local transport demand:

- Distance Band 1: trips between 0 and 3 Km
- Distance Band 2: trips between 3 and 25 Km
- Distance Band 3: trips between 25 and 50 Km
- Distance Band 4: trips > 50 km.

The modelling of inter-zonal trips follows the classical 4-step approach:

1. Generation model;
2. Distribution model;
3. Mode choice model;
4. Assignment model.

	Passenger kilometre in thousand millions (pkm)		
EU-28	Intra-zonal	Inter-zonal	Total
Austria	33.39	38.10	71.40
Belgium	43.93	62.60	106.50
Germany	390.82	482.50	873.30
Denmark	32.83	19.40	52.20
Spain	202.55	127.80	330.30
Finland	42.46	24.00	66.40
France	435.15	296.00	731.20
Greece	71.20	32.40	103.60
Ireland	31.13	14.30	45.40
Italy	528.51	178.80	707.30
Luxembourg (Grand-Duché)	2.18	4.70	6.90
Netherlands	67.24	73.10	140.40
Portugal	49.05	32.90	82.00
Sweden	73.00	26.80	99.80
United Kingdom	410.05	165.30	575.40
Bulgaria	31.19	15.50	46.70
Cyprus	5.94	0.10	6.00
Czech Republic	35.41	31.90	67.30
Estonia	7.64	2.40	10.00
Hungary	32.95	19.00	51.90
Lithuania	23.76	6.90	30.60
Latvia	11.33	4.70	16.00
Malta	1.65	0.40	2.10
Poland	208.18	90.40	298.57
Romania	54.19	39.50	93.70
Slovenia	16.81	7.30	24.10
Slovakia	16.36	12.00	28.40
Croatia	15.52	11.80	27.30
Total	2874.42	1820.60	4694.77

Table 10: Comparison between Inter-Zonal and Intra-Zonal Passenger Kilometres (Pkm) in EU-28 for the Year 2010.
Source: ETISplus 2012.

In 2010, the passenger kilometres of unimodal road trips are 4,695 thousand million pkm.

6.2 Modelling

6.2.1 Calculation Model

The next figure presents the calculation model with two pillars. The first pillar contains the calculation procedure for the vehicle kilometres used in the year 2010 for unimodal road travel. This number is necessary for the impact appraisal of the reduction potential by MMITS. The second pillar models the possible modal changes from unimodal road travel to multimodal travel. The modal change effect has to be linked to the first pillar to identify the vehicle kilometre reduction potential. The reduced vehicle kilometres are leading to emission reductions. The quantified emission reductions can be transformed by cost-unit rates into monetary savings, which are representing the overall benefits in a general economic perspective. These benefits have to be confronted with the costs of MMITSs. The costs of MMITSs comprise capital outlays (private investment costs, public investment costs), running costs (e.g. operating costs, maintenance costs), and other costs, which are for example costs for supplemental equipment, implementation of a travel information centre and training costs.

The main calculation steps are as follows:

1. The passenger car fleet and the related passenger kilometres (pkm) are available for the year 2010 and for each EU-Member State. The passenger kilometres can be split to intra-zonal travel and to inter-zonal travel.
2. The passenger kilometres can be now transformed to vehicle kilometres. The relation between vehicle kilometres and passenger kilometres can be described as follows:

$$VKM = PKM * OR^{-1}$$

with:

VKM: vehicle kilometres

PKM: passenger kilometres

OR: occupancy rate.

That the relation between VKM and OR is equal to an equilateral hyperbole follows because the vehicle kilometre elasticity of the occupancy rate is -1.

3. The vehicle kilometres can be divided into inter-zonal and intra-zonal vehicle kilometres. Further, it is possible to derive the vehicle kilometres driven by diesel cars and the vehicle kilometres driven by petrol cars. The distinction between diesel car vehicle kilometres and petrol car vehicle kilometres is

important with respect to the calculation of the effects of particle-emissions (PM).

4. The possible reduction of total vehicle kilometres can be calculated by the input of the travel choice pillar.

5. The last level comprises the calculation of emission reductions, their transformation by cost-unit rates into the monetary benefit for the society and the confronting with the costs of MMITS presented by the benefit-cost ratio.

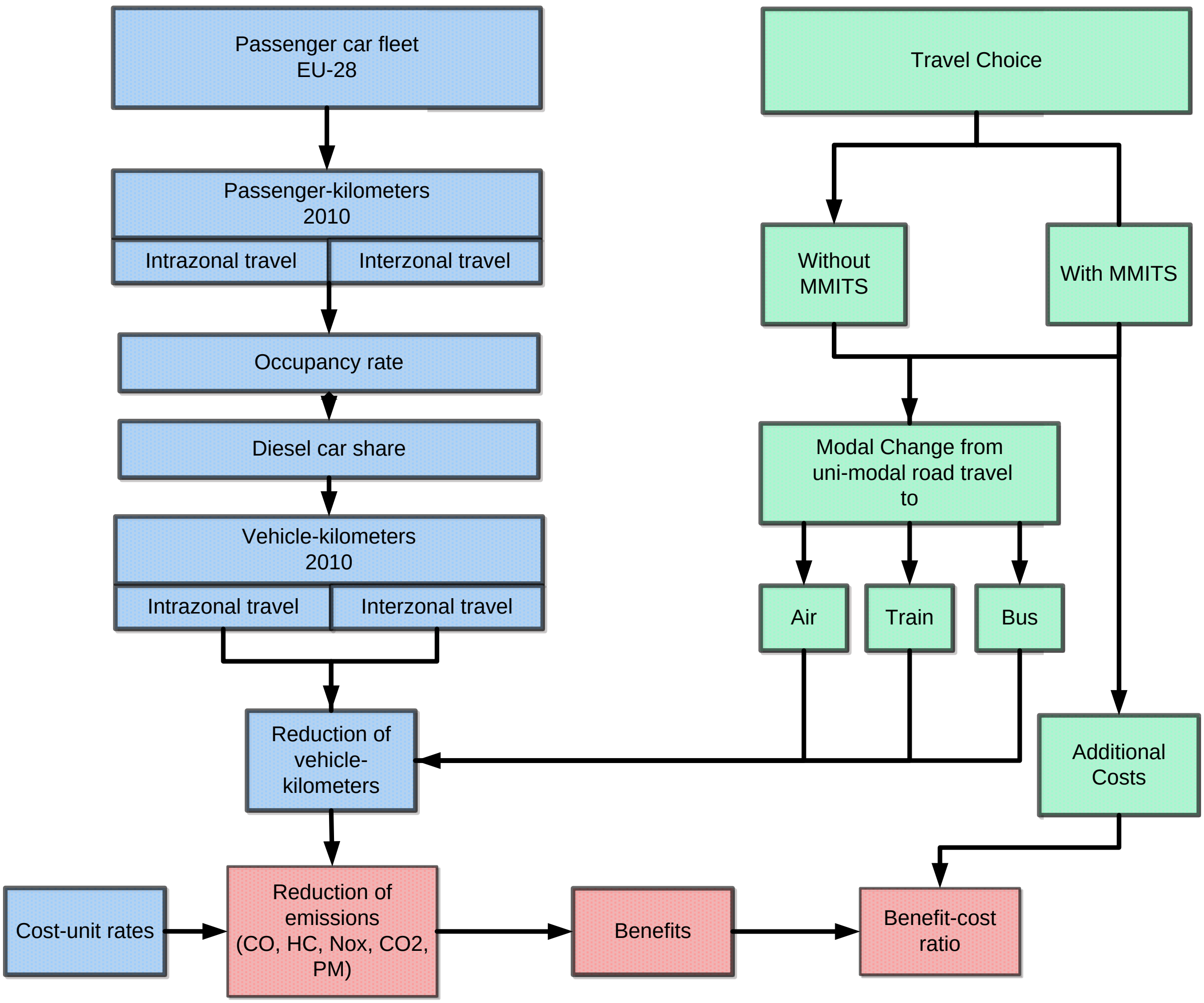

Figure 71: Calculation Model for Vehicle Kilometres Effects of Modal Changes Induced by MMITS.
Source: Own figure.

6.2.2 Modal Shifts from Road Passenger Transport to Other Modes

The input to the modal shifts comes from the customer survey done in WP 2 of the study in six European countries. The relevant question in the questionnaire was:

The multimodal information and ticketing system provides you the possible itineraries with different means of transport, allows you to book and pay a valid ticket for all means of transport and provides you information about possible changes in time table and routing during your travel via your smart phone.

The scale of the question is from 1 to 5. Crossing 1 stands for no readiness to switch to another travel mode and crossing 5 represents a 100% readiness to use another travel mode. The assumption, which has to be made is, that the average values of the respondents are representative to all unimodal road traveller. The average answering values are given by the following table:

Cases	**Could you envisage your mode of transport choice changing due to the use of the multimodal travel information and booking system?**	**Modal shifts from unimodal road travel to multimodal travel**	
		with MMITS **in average answering values**	**without MMITS** **in average answering values**
Case 1	Change to car sharing, rental car	2,25	2,09
Case 2	Change to aeroplane	2,53	2,51
Case 3	Change to train	2,72	2,47
Case 4	Change to bus	2,22	1,95

Table 11: Average Answering Values of Shiftable Vehicle Kilometres of Previous Unimodal Road Traveller to Another Mode without and with MMITS.
Source: Own calculation.

With that assumption, the scale can be transformed to values representing the modal shift from road to other modes in percent. Behind the 1, 2, 3, 4, 5-scale of the question is theoretically a linear distributional curve and can be used to calculate the percentage shifts (see figure 72). The general linear-equation is:

$$MS_i = b_{i0} + b_{i1} \times s_i;$$

with:

MS: modal shift from unimodal-road to transport mode i in percent

i: air, train, bus

b_0: constant term

b_1: regression coefficient

s: answering scale between 1 and 5

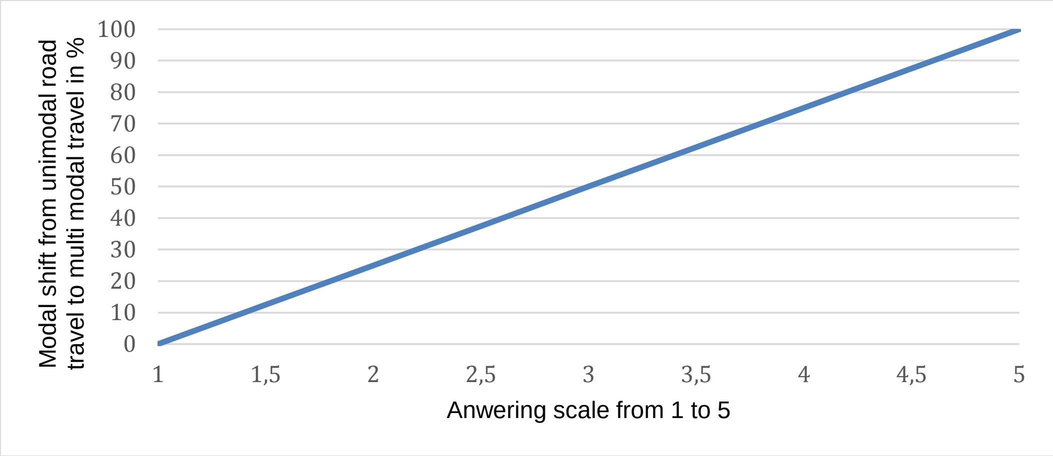

Figure 72: Theoretical Linear Transformation Curve of Answering Scale to Modal Shifts from Unimodal Road Travel to Multimodal Travel.
Source: Own calculation.

This theoretical distribution of the readiness to switch to another transport mode is obviously too optimistic, because several impacts foster the overestimation of probabilities. Following impacts have to be considered:

- The questionnaire implicitly incorporates the assumption of a common marginal utility of income (MUI). However, respondents will have statistically different marginal utilities of income. Therefore, the assumptions of a common MUI will lead to an overestimate of willingness values. Empirical prove give studies for willingness to pay and travel demand, which show that consumers overestimate by factors between 3 and 4 (HEATCO (D2, 2005), Alberini, Hunt & Markandya (2004), Murphy & Topel (2005), Viskusi & Aldy (2003), Bohlinger (2006), Schulz & Schuldenzucker (2010)).
- It is even unclear whether the respondents were full-informed about the travel modes (quality-, comfort-, reliability aspects of train, airplane and bus) and their travel costs. The risk exists that the survey failed to observe consumers´ informed choice.
- Further the choice between travel modes is a discrete decision. That means that is complicated for the respondents to match their preferences into the dichotomous choice options 1 to 5 of the above question.
- Following internal subjective beliefs have to be considered:

- o Plausibility beliefs: People tend to perceive events to be more plausible than is possible because of confirmatory processes characterizing the selective testing of a hypothesis (Sanbonmatsu, Posavac, Stasney (1997)).
- o Normative beliefs: an individual's perception of social normative pressures, or relevant others' beliefs that he or she should or should not perform such behaviour (Ajzen 1991).
- o Subjective norms: an individual's perception about the particular behaviour, which is influenced by the judgment of significant others (e.g., parents, spouse, friends, teachers) (Lakitsch 2009).

Based on both theoretical and empirical findings a general quadratic function is introduced with the factor c1, which is equal to 1/3, to regard the overestimating of probabilities to change from unimodal road travel to multimodal travel. The equation is

$$MS_i = c_{i1} \times (b_{i2} \times s_i + b_{i3} \times s_i^2)$$

with:

c1: adjustment factor for the overestimation of probabilities

b2: regression coefficient

b3: regression coefficient

Figure 73 shows the upward sloping convex curve representing the quadratic transformation.

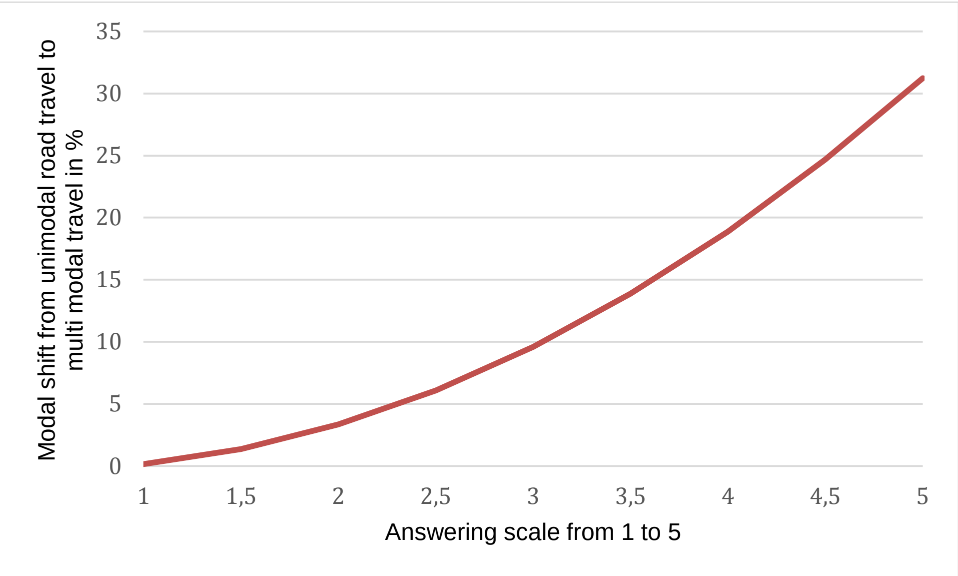

Figure 73: Empirical Transformation Curve of Answering Scale to Modal Shifts from Unimodal Road Travel to Multimodal Travel.
Source: Own calculation.

Using the adjusted distribution the average values of the questionnaire present the percentage share of shiftable vehicle kilometres from unimodal road travel to multimodal travel. The average values of the questionnaire can now be transformed to percentage shares:

- The average willingness from a car driver for example to switch to train as a main transport mode of his trip is obviously 2.47 (see table 12). Using the adjusted distributional equitation (see figure 72) the 2.47 present a percentage share of 5.88% of unimodal road travellers, which are generally ready to use another multimodal travel chain. This readiness for modal shift exists independently of the existence of the MMITS. Why these potential is not indeed using multimodal chains, is a question, which has to be investigated separately. It is not relevant for this study. However, a short explanation is given at the end of this chapter.
- Further the respondents answered that their willingness to shift the mode will increase from 5.88% to 7.52% by introducing MMITS (see table 12). Obviously, the cause for this shift is the introduction of MMITS. That means surely that MMITS will also enable more shifts from the 5.88% willingness, but primarily MMITS is causing the increase by 1.63% of modal shifts to train. This effect directly linked to MMITS is the measurable effect, which has to be taken into account for the CBA.

The complete transformed values are presented in the following table.

	Question	**Modal shifts from unimodal road travel to multimodal travel**		
Cases	**Could you envisage your mode of transport choice changing due to the use of the multimodal travel information and booking system?**	**with MMITS in %**	**without MMITS in %**	**Additional modal shifts because of introducing MMITS in %**
Case 1	Change to car sharing, rental car	4,63	3,80	0,83
Case 2	Change to aeroplane	6,31	6,17	0,14
Case 3	Change to train	7,52	5,89	1,63
Case 4	Change to bus	4,45	3,15	1,30

Table 12: Percentage Share of Shiftable Vehicle Kilometres of Previous Unimodal Road Traveller to Another Mode without and with MMITS.
Source: Own calculation.

Case 1 is for the CBA not relevant. The description of the table therefore is focused on the other cases. Case 2 means that in general 6.2% of the current unimodal road travellers have a general willingness not to travel by car but by aeroplane. The 6.2% represent an adjusted value because subject beliefs and other overestimating tendencies are subtracted out. 5.9% of current unimodal road traveller are ready to use train within a multimodal travel as main mode, and 3.1% are ready to use bus instead of the car for their travel.

The fundamental question, which has to be answered, is why the people talk about their readiness leaving the car for travel purposes behind, but do not use the other transport modes. It can be assumed that the other respondents for example 93.8% are not ready to switch from unimodal road transport to multimodal air transport. They are not ready for a modal shift because of hard factors like time restrictions, transaction costs and other economic factors. This major group of unimodal road travellers have definitive barriers to modal shifts. So what kind of barriers faces the minor group of unimodal road travellers? It can be presumed that they have behavioural barriers. A behavioural barrier is a limitation of changing a certain behaviour or a pattern of behaviours. When a person decides to change a specific behaviour it is beneficial to identify what psychological barriers may be in place preventing him from changing. These behavioural barriers can be overcome by gentle nudges from the appropriate regulatory institutions (Thaler, Sunstein 2008). It has to be accepted that it is not clear, whether MMITS might be also a nudge to enable modal shifts of this group of unimodal road traveller. However, the questionnaire gives the answer that due to MMITS unimodal road traveller of the major group with hard barriers will switch to multimodal travel. In further research, it can be examined whether the MMITS is suitable as a nudge to overcome the behavioural barriers.

6.2.3 Transforming Passenger-Kilometres into Vehicle Kilometres

The next table shows the results of transforming passenger-kilometres to vehicle kilometres by using the average occupancy rate of passenger cars. 60% of unimodal road travelled vehicle kilometres belong to intra-zonal travel, and 40% are inter-zonal travel. The share of intra-zonal travel measured by vehicle kilometres is slightly lower than the share of intra-zonal travel measured by passenger kilometres.

The occupancy rate as indicator enables to monitor the efficiency of passenger transport through vehicle occupancy rates. Although comparative data are only available for five years (2004 - 2008), the data suggest that passenger car occupancy rate is generally stabilizing in Western Europe (UK, DK, NL, NO, AT, ES, IT) but is declining, from a higher baseline, in the Eastern European countries (CZ, SK, HU). This would be expected given that car ownership levels are growing more rapidly in Eastern Europe. Unfortunately, the indicator is discontinued. Especially transforming passenger-kilometres to vehicle kilometres without this indicator is much more difficult.

EU-28	Average occupancy rate (persons per car)	Vehicle kilometres of unimodal road travel (in thousand millions km)	
		Intra-Zonal	Inter-zonal
Austria	1.1	30.4	34.6
Belgium	1.4	31.4	44.7
Germany	1.4	279.2	344.6
Denmark	1.4	23.5	13.9
Spain	1.6	126.6	79.9
Finland	1.4	30.3	17.1
France	1.4	310.8	211.4
Greece	1.4	50.9	23.1
Ireland	1.4	22.2	10.2
Italy	1.6	330.3	111.8
Luxembourg (Grand-Duché)	1.4	1.6	3.4
Netherlands	1.3	51.7	56.2
Portugal	1.4	35.0	23.5
Sweden	1.4	52.1	19.1
United Kingdom	1.5	273.4	110.2
Bulgaria	1.4	22.3	11.1
Cyprus	1.4	4.2	0.1
Czech Republic	1.3	27.2	24.5
Estonia	1.4	5.5	1.7
Hungary	1.8	18.3	10.6
Lithuania	1.4	17.0	4.9
Latvia	1.4	8.1	3.4
Malta	1.4	1.2	0.3
Poland	1.4	148.7	64.6
Romania	1.4	38.7	28.2
Slovenia	1.4	12.0	5.2
Slovakia	1.4	11.7	8.6
Croatia	1.4	11.1	8.4
Total	--	1975.3	1275.4

Table 13: Calculation of Vehicle Kilometres for Inter-Zonal and Intra-Zonal Road Travel Using Occupancy Rates. Source: European Environment Agency 2010; ETISplus 2012; own calculation.

6.3 Vehicle Kilometre Reduction

With table 12 it is now possible to extract the vehicle kilometre reductions from table 13 due to the realisation of a MMITS. The results are shown in table 14. Table 15 provides the vehicle kilometre reductions divided into inter-zonal and intra-zonal travel. Further, the total reduced vehicle kilometres are subtracted to reduced vehicle kilometres of petrol cars and to reduced vehicle kilometres of diesel cars. The vehicle kilometre reduction of diesel cars is needed to calculate the particle-emission savings.

	Reduction of vehicle kilometres in thousand millions				
EU-28	**Case 2**	**Case 3**		**Case 4**	
	air	**Train**		**bus**	
	inter-zonal	**inter-zonal**	**intra-zonal**	**inter-zonal**	**intra-zonal**
Austria	0.05	0.56	0.49	0.45	0.40
Belgium	0.06	0.73	0.51	0.58	0.41
Germany	0.49	5.62	4.55	4.49	3.63
Denmark	0.02	0.23	0.38	0.18	0.31
Spain	0.11	1.30	2.06	1.04	1.65
Finland	0.02	0.28	0.49	0.22	0.39
France	0.30	3.45	5.07	2.75	4.05
Greece	0.03	0.38	0.83	0.30	0.66
Ireland	0.01	0.17	0.36	0.13	0.29
Italy	0.16	1.82	5.38	1.45	4.30
Luxembourg	0.00	0.05	0.03	0.04	0.02
Netherlands	0.08	0.92	0.84	0.73	0.67
Portugal	0.03	0.38	0.57	0.31	0.46
Sweden	0.03	0.31	0.85	0.25	0.68
United Kingdom	0.16	1.80	4.46	1.43	3.56
Bulgaria	0.02	0.18	0.36	0.14	0.29
Cyprus	0.00	0.00	0.07	0.00	0.06
Czech Republic	0.04	0.40	0.44	0.32	0.35
Estonia	0.00	0.03	0.09	0.02	0.07
Hungary	0.02	0.17	0.30	0.14	0.24
Lithuania	0.01	0.08	0.28	0.06	0.22
Latvia	0.00	0.05	0.13	0.04	0.11
Malta	0.00	0.00	0.02	0.00	0.02
Poland	0.09	1.05	2.42	0.84	1.94

Romania	0.04	0.46	0.63	0.37	0.50
Slovenia	0.01	0.08	0.20	0.07	0.16
Slovakia	0.01	0.14	0.19	0.11	0.15
Croatia	0.01	0.14	0.18	0.11	0.14
Total	1.83	20.79	32.19	16.60	25.72

Table 14: Vehicle Kilometre Reductions by MMITS from Unimodal Road Travel to Other Travel Modes. Source: Own calculation.

EU-28	**Partial total reduction**		**Total**		
	thousand million				
	inter-zonal	**intra-zonal**	**thousand million**	**diesel cars**	**petrol cars**
Austria	1.07	0.89	1.96	0.96	0.99
Belgium	1.38	0.92	2.29	1.12	1.17
Germany	10.60	8.18	18.78	3.47	15.31
Denmark	0.43	0.69	1.11	0.08	1.03
Spain	2.46	3.71	6.17	2.18	3.99
Finland	0.53	0.89	1.42	0.18	1.24
France	6.50	9.11	15.61	8.88	6.73
Greece	0.71	1.49	2.20	0.57	1.63
Ireland	0.31	0.65	0.97	0.14	0.83
Italy	3.44	9.68	13.12	10.02	3.10
Luxembourg (Grand-Duché)	0.10	0.05	0.15	0.05	0.10
Netherlands	1.73	1.52	3.25	0.60	2.64
Portugal	0.72	1.03	1.75	0.45	1.30
Sweden	0.59	1.53	2.12	0.11	2.01
United Kingdom	3.39	8.01	11.40	2.18	9.23
Bulgaria	0.34	0.65	0.99	0.26	0.74
Cyprus	0.00	0.12	0.13	0.01	0.11
Czech Republic	0.75	0.80	1.55	0.24	1.31
Estonia	0.05	0.16	0.21	0.03	0.18
Hungary	0.32	0.54	0.86	0.12	0.74
Lithuania	0.15	0.50	0.65	0.17	0.48
Latvia	0.10	0.24	0.34	0.09	0.25
Malta	0.01	0.03	0.04	0.01	0.03
Poland	1.99	4.36	6.35	1.37	4.97
Romania	0.87	1.13	2.00	0.52	1.49

Slovenia	0.16	0.35	0.51	0.13	0.38
Slovakia	0.26	0.34	0.61	0.16	0.45
Croatia	0.26	0.33	0.58	0.15	0.43
Total	39.22	57.91	97.13	34.25	62.88

Table 15: Vehicle Kilometre Reduction (Inter-Zonal, Intra-Zonal, Total, Diesel Car Vehicle Kilometres, Petrol Car Vehicle Kilometre).
Source: TEDDIE (2011); own calculation.

6.4 Emission Saving by MMITS

To derive the quantities of NOx-, HC- and CO-emissions emission factors are used:

- The emission factor for NOx is 0.0845 g per km,
- for HC the emission factor has the value 0.0663 g per km,
- the emission factor for CO is 0.9808 g per km, and
- for CO2 the emission factor is 134.6389 g per km

The emissions of CO, HC, NOx are transformed by toxicity factors into NOx equivalents. The toxicity factors are: HC 1.5; CO 0.003; NO and NO2: 1. The emission factor used for PM is 0.00303 g per km (TEDDIE 2011).

For the calculation of benefits following cost unit rates for 2010 are used:

- NOx-Equivalent: 4.680 Euro per ton.
- PM: 92.546 Euro per ton.
- CO_2: 42.5 Euro per ton.

The costs for emissions in road transport are based on the EC-Directive 2009/33. In accordance to the Directive, the cost unit rates given by the Directive were adapted to inflation by using the Harmonized Index of Consumer Prices (HICP). For the time period 2007 to 2010 the average price increase is 2.08% per year.

EU-28	Reduction of emssions in NOx-equivalents			
	NOx in tons	**HC in tons**	**CO n tons**	**Total NOx-equivalents in tons**
Austria	165.20	194.43	5.75	365.39
Belgium	193.93	228.24	6.75	428.92
Germany	1587.14	1867.94	55.27	3510.34
Denmark	94.10	110.75	3.28	208.13
Spain	521.17	613.38	18.15	1152.70
Finland	119.68	140.85	4.17	264.70
France	1319.41	1552.85	45.94	2918.21
Greece	186.13	219.06	6.48	411.67
Ireland	81.63	96.07	2.84	180.54
Italy	1108.70	1304.85	38.61	2452.15
Luxembourg (Grand-Duché)	12.58	14.81	0.44	27.83
Netherlands	274.25	322.78	9.55	606.58
Portugal	147.86	174.02	5.15	327.03
Sweden	178.92	210.57	6.23	395.72
United Kingdom	963.58	1134.06	33.55	2131.19
Bulgaria	83.96	98.82	2.92	185.70
Cyprus	10.70	12.59	0.37	23.66
Czech Republic	131.24	154.46	4.57	290.28
Estonia	17.97	21.15	0.63	39.75
Hungary	72.78	85.65	2.53	160.97
Lithuania	54.85	64.56	1.91	121.32
Latvia	28.77	33.86	1.00	63.64
Malta	3.66	4.31	0.13	8.10
Poland	536.17	631.03	18.67	1185.87
Romania	169.21	199.14	5.89	374.24
Slovenia	43.30	50.96	1.51	95.76
Slovakia	51.22	60.29	1.78	113.29
Croatia	49.37	58.10	1.72	109.18
Total	8207.48	9659.57	285.80	18152.85

Table 16: Reduction of NOx-, HC- and CO-Emissions
Source: Own calculation.

EU-28	Emission reductions					
	NOx-equivalents (NOx, CO, HC)		CO2		PM	
	in tons	in million Euro	in tons	in million Euro	in tons	in million Euro
Austria	365.39	1.71	263227.06	11.20	2.91	0.27
Belgium	428.92	2.01	308996.06	13.15	3.40	0.31
Germany	3510.34	16.43	2528878.45	107.60	10.53	0.97
Denmark	208.13	0.97	149938.09	6.38	0.25	0.02
Spain	1152.70	5.40	830416.96	35.33	6.60	0.61
Finland	264.70	1.24	190693.96	8.11	0.53	0.05
France	2918.21	13.66	2102302.23	89.45	26.92	2.49
Greece	411.67	1.93	296568.45	12.62	1.72	0.16
Ireland	180.54	0.85	130061.99	5.53	0.41	0.04
Italy	2452.15	11.48	1766551.78	75.17	30.37	2.81
Luxembourg (Grand-Duché)	27.83	0.13	20046.47	0.85	0.15	0.01
Netherlands	606.58	2.84	436984.58	18.59	1.83	0.17
Portugal	327.03	1.53	235595.63	10.02	1.37	0.13
Sweden	395.72	1.85	285081.82	12.13	0.32	0.03
United Kingdom	2131.19	9.98	1535328.55	65.33	6.60	0.61
Bulgaria	185.70	0.87	133780.09	5.69	0.78	0.07
Cyprus	23.66	0.11	17043.47	0.73	0.04	0.00
Czech Republic	290.28	1.36	209117.40	8.90	0.74	0.07
Estonia	39.75	0.19	28638.72	1.22	0.09	0.01
Hungary	160.97	0.75	115961.57	4.93	0.38	0.03
Lithuania	121.32	0.57	87397.29	3.72	0.51	0.05
Latvia	63.64	0.30	45844.74	1.95	0.27	0.02
Malta	8.10	0.04	5835.13	0.25	0.03	0.00
Poland	1185.87	5.55	854313.12	36.35	4.15	0.38
Romania	374.24	1.75	269606.93	11.47	1.57	0.14
Slovenia	95.76	0.45	68984.87	2.94	0.40	0.04
Slovakia	113.29	0.53	81616.10	3.47	0.47	0.04
Croatia	109.18	0.51	78656.25	3.35	0.46	0.04
Total	18152.85	84.96	13077467.78	556.45	103.78	9.60

Table 17: Emission Savings in Tons and Million Euro for NOx-Equivalents, CO_2 and PM in 2010 due to MMITS Induced Vehicle Kilometre Reductions.
Source: Own calculations.

Based on the survey results, the availability of an MMITS increases the likelihood of modal shift by 21%, to an estimated 7.52%. This incremental modal shift from private cars, will provide overall emission savings (2010 values) of 651 million EUR. The following figure shows the percentage split of emission savings to the different emission categories (CO2, NOx, PM).

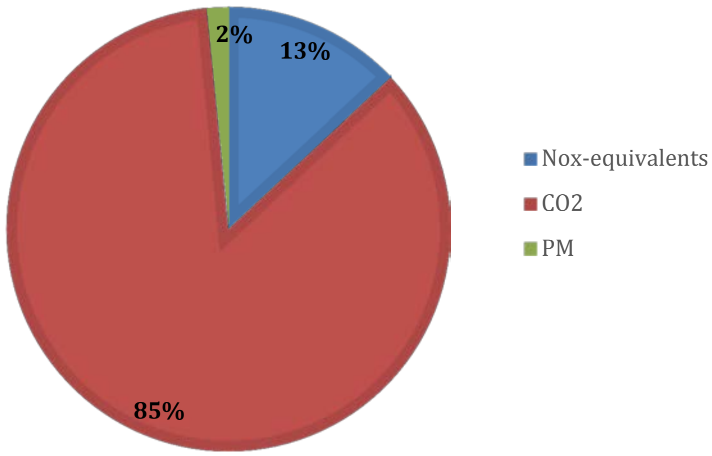

Figure 74: Share of Various Emission Savings in Percent in 2010 by MMITS Reducing Vehicle Kilometres.
Source: Own figure.

The upper part of table 18 represents the quantity effects of MMITS in terms of vehicle kilometre reductions and the monetary benefits of MMITS by emission savings. The lower part of table 18 shows the minimum annual costs for investing in MMITS and operating MMITS to reach the defined grades for Benefit-Cost Ratio (poor, acceptable, excellent).

MMITS-effects	**Dichotomous choice option of respondents from 1 to 5**			
	Linear transformation		**Convex transformation**	
	With the risk of overestimation	**With a reduced risk of overestimation**	**With the risk of overestimation**	**With a reduced risk of overestimation**
Vehicle kilometre reduction	423 million vkm	141 million vkm	291 million vkm	97 million vkm
Emission savings	2834 million Euro	945 million Euro	1953 million Euro	651 million Euro
Poor BCR	2835 million Euro	946 million Euro	1954 million Euro	652 million Euro
Acceptable BCR	977 million Euro	325 million Euro	673 million Euro	224 million Euro
Excellent BCR	914 million Euro	304 million Euro	630 million Euro	210 million Euro
BCR-Grades	Minimum annual MMITS-costs for different BCR-Grades			

Table 18: MMITS-Effects under Different Assumptions and Related MMITS-Costs per Year for Different BCR-Grades.
Source: Own calculations.

6.5 Additional Potential Benefits of MMITS

As we have shown, a "perfect", ex ante CBA for MMITS is yet not possible, primarily because of a lack of relevant data, including actual costs for the implementation and operating of MMITS (investment and operating costs). We have, however, evaluated the available information to arrive at a high-level estimation of potential benefits beyond those related to NOX/CO2/PM.

The estimation is based on the willingness to shift from passenger cars to other transport modes as a consequence of an MMITS from the survey. The main assumption for the calculation is that the capacity of other transport modes is sufficient to absorb additional demand for rail-, bus- and/or plane trips. This is a necessary assumption, because the need to enlarge the capacity of the other transport modes is highly uncertain.

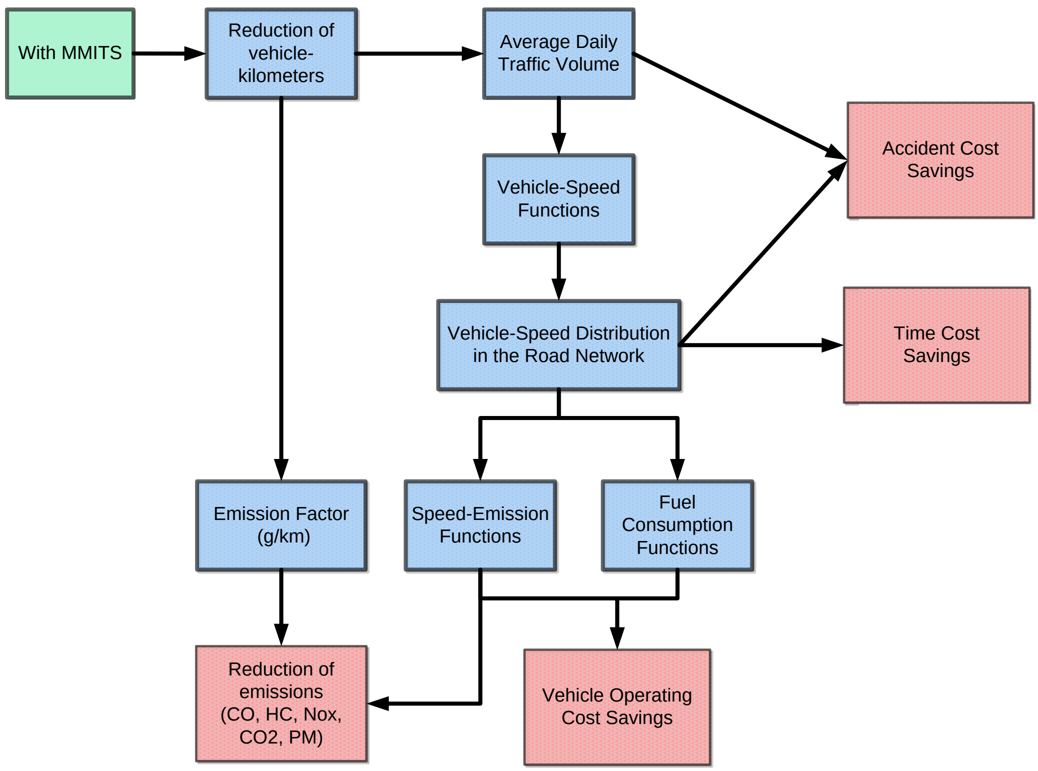

Figure 75: Calculation Approach for Savings of Time Costs, Vehicle Operating Costs, and Emission
Source: Own figure.

The figure gives an overview over the general calculation procedure for resource savings by reducing time costs, vehicle operating costs, accident costs and emission costs. To investigate what effect the changes of vehicle-kilometres will have on the different components of traffic amount (Traffic amount = Time + Energy + Accidents + Environment), the following research steps are required:

- The average daily traffic volume has to be derived from vehicle-kilometres. The decrease of vehicle-kilometres leads directly to a decrease in traffic volume. A spatial distribution of the changes in vehicle-kilometres has to be developed. For an accurate analysis, exact data on the distribution of vehicle-kilometres on the road network is required. Currently, this information is not available for all European Member States.
- Furthermore, daily traffic volume has to be converted into hourly traffic volume. The hourly traffic volume is the necessary input for the functional context between the amount of vehicles and the speed of vehicles. The speed of the vehicles depends on the hourly traffic volume, the structure of the vehicle fleet (e.g. car or trucks) and the road design (e.g. curve radius, slope/gradient). The main influencer of speed is traffic volume.
- The output of the vehicle-speed distribution is the input for the fuel consumption functions. Using the fuel consumption functions, one part of the vehicle-operating cost savings can be calculated. The fuel consumption depends on vehicle-kilometres, vehicle-speed, vehicle type, and road design. There are different cost unit rates for the fuel consumption. The monetary evaluation of fuel consumption is integrated in the evaluation of the total vehicle operating costs. The function consists of two terms. The first term is fixed for every vehicle type, and it describes the basic costs for vehicle operation. This cost component is independent from the vehicle-kilometres. The second term is the product of fuel consumption and fuel price.
- The emission costs savings can be derived, as we have seen above, by using emission factors in grams per kilometre based on the total amount of vehicle-kilometre reduction. More accurate, of course, is the use of emission/speed functions, but this calculation procedure is only possible with the knowledge of the vehicle-speed distribution within the road network.
- Trustworthy and reliable calculation of accident cost savings requires information on the impacts on the traffic volume on different road types and for the severity effects of accidents the change of speed is needed.
- Time cost calculation depends also on the speed variance within the road network.
- Impacts on accidents, time, emission and vehicle operating costs can be direct and/or indirect. Direct means impact on a traffic situation without congestion (free traffic flow). Indirect means that congestion can be reduced.
- For a complete calculation, it has to be further proven whether the reduced vehicle-kilometres by modal switch will not lead in some case to induced increase of vehicle-kilometres, because other members of the traveller's household will switch from other modes to passenger car transport because of the availability of the car.

- Time savings and reduction of transaction costs should also occur for users of a MMITS, compared to their current way of searching for or organising their trips. Further insights into this aspect of MMITS benefits should be developed in the second stage of the project. We have therefore not considered this element in the estimation, which is therefore limited to the impact on time-savings from reduced vehicle-kilometres.

Obviously, the best way for calculating the benefits of MMITS is yet not available. The only way to get an impression about the possible benefits dimensions of MMITS is to use known relations between emission cost savings and the other components (time, accidents, vehicle operating costs) from the area of other ITS-measures, which have an impact on the vehicle-kilometres. For this potential analysis the average relations based on the findings of the Conference of European Directors of Road for hazardous location notification, traffic jam ahead warning, decentralised floating car data, road work warnings, in-vehicle signage, traffic information and recommended itinerary are used, which are

- 14.5 for reduction of time costs,
- 0.7 for accident cost reduction, and
- 3.1 for savings of vehicle operating costs[24].

In addition to the annual 651 million EUR savings of emission costs enabled by MMITS, they provide the following estimated impact:

- 10,091 million EUR time cost savings per year,
- 456 million EUR accident cost savings per year,
- 2,018 million EUR vehicle operating cost savings per year.

The total benefits would under this structure amount to 13,216 million EUR per year. This value has to be seen as a possible dimension that could be reached for the case that vehicle-kilometre reductions take place as it was worked out, and that they are similar in their impact-channels to the vehicle-kilometre reductions caused by c2x-measures. The CBA for example for c2X is in terms of available data, impact simulation and field-tests (e.g. DRIVE and the German project simTD) are more advanced than ITS-research for multimodal travel. The field project simTD was conducted in the metropolitan region around Frankfurt (Germany). It focused on the implementation of V2X-communication assuming that this technology would lead to increased traffic safety and efficiency. It, thus, provides important

[24] Conference of the European Directors of Roads (2012). Meeting of the Amsterdam Group, 19th April 2012, Business Models, Cost-Benefit-Analysis.

results from practical field experience and allows the calculation of concrete socio-economic impacts based on real figures.

In terms of sensitivity the 13,216 Million Euro per year are reached by MMITS because the willingness to change: from 'car to train' increases by +21% from 5.88% to 7.52%, for 'car to aeroplane' from 6.17% to 6.31% (+2.2%) and 3.15% to 4.45% (29.2%) for 'car to bus'.

Given that the survey respondent indicate that a MMITS (that they have not yet seen) will increase their willingness to leave their private car at home by more than 20%, it can be argued that it is relevant to base calculations on more optimistic assumptions of the actual impact on the willingness to shift mode of transport. If we, hypothetically, assume that a well-functioning MMITS will increase modal shift by 41%, or just above 4 percentage points, the resulting socio-economic benefits total 17,455 million EUR per year. For the shift from 'car to bus' and 'car to aeroplane' the same proportions of increase are assumed as in the realistic case.

For a pessimistic case a benefit of 10,743 Million Euro per year can be estimated. In this case, it assumed that the willingness to change increases by only 2% to 6%. Again, the same proportions as in the realistic case are assumed for the other modes.

Altogether, this strongly underlines the need for live tests using the demonstrators proposed in Phase 2 of the project. This testing will be important to identify another essential benefit by MMITS: the reduction of transaction costs for the MMITS-user. The willingness to switch to another travel mode is normally under the economic assumption of rational behaviour given because the act of choice itself will lead to primary savings of transaction costs. The secondary savings generated by the usage of other transport modes were addressed in this study. Therefore, demonstrators are needed, and enable the methodological possibilities to estimate the transaction cost savings for the MMITS-user. Knowing the impact channels on the transaction costs is crucial for the development of effective multimodal business models.

Key findings

1. MMITS has the potential to achieve significant improvements for safety, mobility and environment. Survey results indicate that the effect from MMITS is at least a 21% increase in the willingness to shift transport mode from private cars. In addition to the annual 651 million EUR savings of emission costs at this level of modal shift from private cars, the additional estimated costs savings are:
   - 10,091 million EUR time cost savings per year
   - 456 million EUR accident cost savings per year
   - 2,018 million EUR vehicle operating cost savings per year
   for a total of 13.22 billion EUR per annum. A more positive assumption of modal shift of +41% to just above 4 percentage points provides an estimated total cost saving of 17.5 billion EUR per year.
2. Environmental resource savings of MMITS are mainly caused by modal shift from unimodal road travel to multimodal travel. The reduction of vehicle kilometres leads to savings of NOX, CO, HC, PM – emissions and carbon dioxide.
3. MMITS might be an essential future nudge to make modal changes for road travellers possible. MMITS could play an important role within a wider bundle of measures to nudge modal shifts in passenger transport from road to other modes.
4. The modal shift by MMITS will lead to further effects because the increasing demand for other transport modes allows investing and increasing efficiency. Especially the public transport can profit directly by joining MMITS by creating new travelling opportunities. These improvements support the European policy for consumers and can change the citizens' life for better.
5. Understanding the functionality of MMITSs by introducing a demonstrator will enable the economic assessment of the direct and indirect effects of MMITS to efficiency and road safety.

7 Barriers and Limitations (WP6)

The previous work packages have analysed the potential for a MMITS on the travel market from the customer and business perspective. Next, a cost-benefit analysis investigated the socio-economic effects of a pan-European MMITS. The analyses identified a market potential on customer and business side. It was also shown that there are positive socio-economic effects. Considering a generally positive environment for the development of a MMITS, work package 6 is dedicated to possible barriers and limitations that could impede the successful development and implementation of a pan-European MMITS. Therefore, this work package is structured as follows:

The first chapter analyses barriers and limitations from a business strategic perspective. By applying the general approach of game theory, strategic considerations regarding the collaboration between the players are described.

As the legal framework significantly determines or fosters market developments, legislation is analysed in detail. For this purpose, three main aspects are considered. The first aspect affects regulatory measures to prevent collusion and cartelisation. Next, multimodal travelling requires special regulations regarding the liabilities in the case of delays. Finally, necessary regulations for multimodal trips are analysed.

Afterwards, technological challenges are described. In this regard, the challenges of data standards are discussed. Furthermore, data distribution is analysed distinguishing central and distributed networks. Finally, the importance of data access modules and trip trackers with regard to their challenging aspects are challenging. In this context, barriers and limitations around information provision are discussed.

The next chapter analyses the role of local public transport in MMITS ecosystems. First the structure of LPT and its relevance in the transport system is described. From this chapter, special barriers and limitations can be derived for the integration of LPT in MMITSs.

The last chapter analyses the barriers and limitations from a market-side perspective. It is analysed if a MMITS market had the potential for market failure. Therefore, the market is examined if the market could fulfil one of the possible causes for market failure (market power, information failure, externalities, or public good).

7.1 Business Policy and Strategic Barriers for Collaboration

Within the market for public transport and public transport information and retail, several barriers and limitations exist in case of internal business policy and strategy. After the liberalisation of the market in Europe, European travel operators, in particular rail operators, got into stronger competition with carriers from other countries and other transport modes. Rail operators nowadays face increasing competition from rail operators of bordering countries and long distance bus services. There is also competitive pressure by air transport on long distance trips and the general pressure from other transport alternatives such as the private car.

Under these conditions, the problem is to find a balance between competition and collaboration in the market. To realise a MMITS, a lot of collaborative efforts are necessary that seem not naturally to be guaranteed in the transport and travel sector because of the immaturity of the competitive environment. Mistrust and cautiousness regarding the potential benefits of the realisation of a MMITS can be observed in the market. To develop a business case for a MMITS might be difficult because benefits for the players are uncertain and the potential MMITS-providers are facing high complexity. A basic problem for transport operators, however, is the fear to lose competitive advantages and the control over their distribution channel when participating in a MMITS, e.g. by providing information on schedules, fares and availability to a MMITS provider.

This perception fits with the finding of a study done by the Dr. Manfred Bischoff Institute for Innovation Management of EADS [25] which has shown that several aspects are rated differently with regard to collaboration with other companies in an outside open innovation process. The study was held with 107 companies in Europe in 2010. As a result of the study, it can be said that 'loss of intellectual property' and 'drain of knowledge' are rated the highest risks in an open innovation process. Further risks are for example 'increased complexity', 'coordination costs', 'malinvestment' and the 'loss of core competences'. This leads to the conclusion that the fear to lose an advantage to their competitors is stronger than internal operative issues. Therefore it can be assumed that mutual trust among the industry players is the core problem of collaboration and European transport operators might be unwilling to join intensive collaboration in case of a MMITS due to the fear other carriers might not be cooperative in an equal manner.

This general assessment is not disproved by single cases of successful cooperation of e.g. rail operators and airlines or rail operators and local public transport operators. To achieve a

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[25] Dr. Manfred Bischoff Institute for Innovation Management of EADS is led by Prof. Dr. Ellen Enkel, Chairholder for Innovation Management at Zeppelin University.

Multimodal Information and Ticketing system on a pan-European level, much more willingness to cooperate seems to be necessary. Whereas the problems of cooperation of (potential) competitors in the long distance travel market (especially in the rail market) will be analysed in the following using a game theoretic approach (the "Prisoner's Dilemma"), the cooperation between rail/air operators with local transport providers – these are not competitors – will be analysed in the chapter 'The Role of Local Public Transport'.

Game theory derives from microeconomics and is about the behaviour of (two) actors in a game and corresponding strategic interdependencies. According to game theory, the main issue concerning collaboration are incentives for non-cooperation, which results in a question about trustworthiness of the other player(s). If one player decides to be cooperative, his opponent might take advantage of such cooperative actions without acting cooperative in the same manner, thus acting defective. The problem is that both parties will most likely act out of self-interest. In a single game, there is no opportunity to reward cooperation and punish defection. If one player assumes the other player to cooperate, defecting will give him a higher individual pay-off than cooperating. If he assumes his opponent to act defective, acting defective as well will result in mutual punishment but at the same time prevent the risk of being exploited. These pay-offs are shown in the table below.

Player A \ Player B	Cooperate	Defect
Cooperate	(2;2)	(3;-1)
Defect	(-1;3)	(0;0)

Table 19: Pay-Off Matrix Game Theory
Source: Own figure.

Regarding the incentives for non-cooperative action, the dominant strategy in a single and finite game is most likely to defect and, in this example, results in the (0;0) solution. For both players, this is most rational decision from the individual point of view but also the worst with regard to both players' individual outcome and does not imply to result in a positive pay-off or even advantageous outcomes for the players. The example shows, that individual rational decisions may lead to a worse outcome compared to potential cooperation. The negative result of the game can only be overcome if cooperative behaviour can be promoted by credible commitments or if mutual trust can be developed in a series of games.

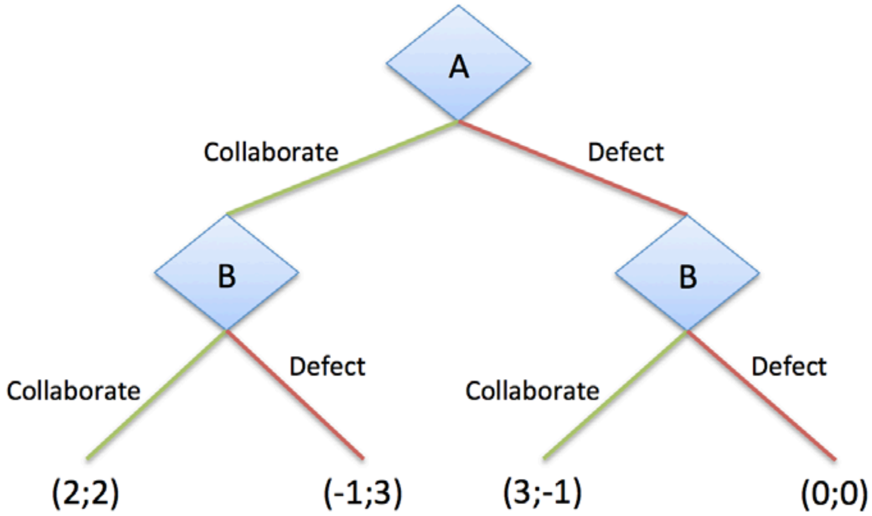

Figure 76: Game-Theory Decision-Tree regarding Travel Information Sharing
Source: Own figure.

A possible approach to the strategic decision process of competing players regarding information provision is quite similar. If carrier A chooses to share his information (e.g. for use in the MMITS of the competitor) and thereby to collaborate in an honest manner, carrier B still has the choice to cooperate and share his information as well, or to defect. As the figure below and the pay-off matrix above show, defecting gives a higher individual output (3) if the other player initially cooperates. This results from the fact that the defecting player benefits from the cooperative action of the other player without losing a competitive advantage by cooperating as well. This is an incentive of non-cooperation. If both players decide to cooperate, both gain a lower individual pay-off compared to the pay-off they would have gained if they decided to defect while their opponent collaborated. Nevertheless, their individual pay-offs sum up to a larger economical pay-off (2+2=4) if both collaborate. If both players decide to defect, their individual pay-off is zero, as is the economical pay-off. Therefore, defecting might be the dominant strategy for the individual player in case the other player cooperates. As both know about this fact, both might possibly act defective and thereby result in gaining nothing due to their fear of losing their competitive advantage. The figure below shows the strategic decisions and the pay-offs the different combination result in.

In an infinite sequential game, the initial situation changes because the possibility of metagame analysis evolves. On the first move, players still do not know about the probable acting of their opponent. However, after the first move the players gain experience how their opponent may act and can use several strategies. The most known and also most effective strategy is 'Tit for tat'. This strategy implies that one player begins with a collaborative move whilst his opponent might act defectively. To punish the defective action, he will copy the action of his opponent and act defectively in the following move only to return to collaborative action in the move after next. ‘Tit for tat’ punishes defection and honours cooperation by repeating the previous move of the other player. Using this strategy, the opponent has the opportunity to ‘learn’ that any kind of defective action will be punished and any kind of collaboration will be rewarded. This can result in a climate of confidence, even among competitors, and thereby lay the foundation of collaboration for the long run. Additionally, a wide range of other strategies is possible. Academic research though has shown that other strategies are most likely less successful than ‘Tit for tat’ in an infinite game. In a finite game, ‘Tit for tat’ is only successful until the very last move when the dominant strategy will change to defective action as it is in the single game. The reason simply is that after the last move there won’t be any chance to punish defection or reward cooperation.

Transferred to the development of MMITSs, this process might lead to different situations depending on the first move of the players. European carriers that are, at least partly, competitors might decide to collaborate by publishing complete schedule, fare and availability information via a common MMITS ecosystem and/or to provide freely accessible interfaces for interoperable booking and ticketing. In an atmosphere of missing confidence, carrier A is not sure if the other carriers will offer as much information as they committed to, and therefore decides to publish only a minimum of required information either. Because this might be the dominant strategy, the other players will act in equal manner and they will also publish only a minimum of the required information. The players do not trust in their initial mutual commitment and therefore act defectively on the first move. Because all carriers act defectively and do only publish a minimum, carriers see their concerns being confirmed and will not extend the amount of information shared. In the end, this leads to the situation that all carriers publish only as less information as possible. Thereby, the goal of complete information and traveller access to pan-European travel information and booking capabilities will not be achieved. To achieve the goal of MMITSs, defective behaviour needs to be reduced and incentives to overcome this “prisoners dilemma” need to be set up. If at least one carrier would take on the risk of the first mover disadvantage he might enable the other players to play ‘Tit for tat’. If the players once learn that mutual cooperative behaviour is more successful than defective behaviour regarding the overall payoff, the willingness to collaborate might increase. If one carrier shares comprehensive data access in the first move, according to ‘Tit for tat’, the other players may follow and provide comprehensive data access as well. This may enable the industry to implement corresponding solutions for multi modal travel information and booking.

The process shown above is not only relevant for the aspect of information provision. It can also be applied to collaboration with regards to the implementation of a common standard for information provision. Additionally, it is in general relevant for the cooperation with travel agents and software providers as well. Regarding the future development of MMITS, many different players acting as competitors in some cases will have to collaborate in comprehensive way to realise multimodal journey planning with MMITS.

In real live, the players are not allowed to make commitments regarding their behaviour in advance due to European and national competition law. Collaboration is only possible under observation from European cartel authorities; this is an additional factor leading to disincentives with respect to cooperation.

To overcome this problem, European transport policy could develop guidelines for cooperation in the MMITS market motivating actors to behave cooperatively. Additional compensation, such as knock-on funding and further research funds, might probably promote industries' efforts to collaborate in the implementation of MMITSs. Therefore it might be important to set up a regulatory framework that gives confidence to the players in the market. It seems obvious that individual players want to achieve their own goals. Quite often, individual goals are contrary to economic goals and society welfare. At least, they might differ a lot and are not easy to get aligned. To promote goals, such as the implementation of MMITS, individual goals of the players need to be aligned with economical goals of society.

Key Findings

1. Competitors in the market generally act in an atmosphere of mutual mistrust
2. Collaboration is only possible in an atmosphere of trust
3. It is not easy to find a balance between collaboration and competition because the competitive environment in the market for passenger transport is still immature

   To develop a business case for a MMITS might be difficult because benefits for the players are uncertain and the potential MMITS-providers are facing high complexity
4. To overcome the issues of mistrust, rules are necessary for the players to have a guideline on how to act in collaboration
5. Common incentives for the industry might help to trigger comprehensive collaboration in terms of MMITS implementation

7.2 Legal Barriers and Limitations

In this chapter the business models developed in the preceding chapter are evaluated from a legal perspective. First of all it is necessary to deliver data to every market actor to create a market. Beside these basic conditions, MMITS models raise two basic issues. On the one hand, the required cooperation between market participants involves the risk of cartelization. To be sure, this risk varies greatly with regard to the individual models. In any case it would have to be obviated through regulatory measures. This problem is examined below.

Secondly, a multimodal regulation regarding liability issues particularly in case of delay or denied boarding (e.g. in case of accidents with injuries or death) is required to ensure acceptance of such a regulation. The sufficiency of currently existing regulations is examined below in Section 2.

Section 3 presents an overall analysis regarding the necessary regulations for multimodal travel.

7.2.1 Precondition: Non-Discriminatory Access to Information

The most important precondition for a properly functioning MMITS market is that each market actor has access to all relevant information, at least price and timetable.[26] As we have seen before, neutral and comprehensive information is required to meet the increasing demands of the consumer. This allows finding connections by using all possible combinations. It is essential that all market actors can use this information to offer optimised connections for their customers. Regulation may therefore be necessary, to ensure the provision of timetable and price information in a non-discriminatory manner. Regulations for mandatory participation have been used in the airline industry, to stimulate competition as a part of liberalising a market, even mandating third party retailing (US). Mandatory participation is prescribed in the CRS Code of Conduct for carriers controlling a CRS ("Parent Carriers"), to avoid bias.

The retailing process, however, is not necessarily connected to information provision. Retailing requires a contract between the carrier and the seller, e.g. to settle commissions and to manage commercial risk.

[26] To put it the other way around, a MMITS market will not evolve without anti-discriminatory access to information. Please find details in the chapter on information provision.

7.2.2 Antitrust Limitations

In the most general sense, Art. 101 Par. 1 of the Treaty on the Functioning of the European Union prohibits cooperations between companies which are apt to affect trade between the member states or have as their object or effect the prevention, restriction or distortion of competition within the internal market. Such agreements may however be permissible pursuant to Art. 101 Par. 3 of the Treaty on the Functioning of the European Union, insofar as they contribute to improving the production or distribution of products or promoting technical or economic progress, while allowing consumers a fair share of the resulting profits, and insofar as they do not impose any restrictions on the companies concerned, which are necessary for the attainment of these objectives, or afford any possibilities of eliminating competition in respect of a substantial part of the products in question. This is the basic framework which applies to the MMITS models and creates problems to a greater or lesser extent depending on the degree of collaboration between the different market actors. This is simulated for the individual models.

7.2.2.1 Commissions and advertising

Basic Structure

In the simplest model, the transport companies (airlines, railroad, bus, etc.) provide their information (connections and prices) in a standardized format so that online travel agencies or other retailers can access these data, thus enabling multimodal travel. The need for additional cooperation is at its lowest in this scenario. The transport companies provide their data independently, or subject to established industry standards, as in the case of airlines, and journeys are arranged independently by the transport companies. The multimodal offer is, generally speaking, introduced as an additional offer.

Risks for Competition

Competition is generally not restricted in this scenario because the market conditions are basically not changed. However, this constellation is not devoid of risks for competition, either. For even if a cooperation is not required initially, the special offer for the customer creates incentives in the new system for individual companies to enter into cooperations and to coordinate their individual transport offers so that competition and market conditions can change to the disadvantage of competition.

To assess these risk potentials, the market conditions must initially be considered from the perspective of competition law. According to the Commission Guidelines of 1997 and jurisdiction, the relevant product market encompasses all products and/or services which are regarded by the consumers as exchangeable or substitutable with regard to their properties, prices and their intended purpose. (EC Commission, communication dated December 9, 1997 concerning the definition of the relevant market within the meaning of the Community competition law, Official Journal of the European Union 1997 No. C372/5, margin number 7; from the jurisdiction of e.g. the European Court of First Instance dated 7/5/2001, case T-J002/99, Reports of Cases before the Court of Justice and the Court of First Instance 2001, II-1881, marginal number 26 ff.). With regard to the transport market, judicial practice differentiates between the markets for leisure and business travellers (EC Commission, dated 9/21/1994, Official Journal of the European Union 1994, L 259/20, 22 "Night Services"; dated 1/28/1999, Official Journal of the European Union 1999, No. L 163/61, 63 ff). Furthermore, the individual means of transport are generally assigned to one market respectively, i.e. there is accordingly a separate market for air travel, rail travel, coach trips, etc. (EC Commission, 7/5/2002, Official Journal of the European Union 2002, No. L 242/25, 29 ff., 8/27/2003, Official Journal of the European Union 2004, No. L 11/17, 26 f. Case of Georg Verkehrsorganisation GmbH (GVG) versus Ferrovie dello Stato S.p.A. (FS). In addition every route forms a relevant market in rail and air transport (EC Commission dated 7/18/2001, Official Journal of the European Union 2001, No. L 265/15, 22; dated 4/7/ 2004, Official Journal of the European Union 2004, No. L 362/17, 19).

These market conditions could be changed by the multimodal travel offer because the offer of combined travel deals could promote the exchangeability of the modes of transport and thus result in a competitive relationship between the modes of transport. Route monopolies could be increased in this case by cooperation agreements, for example by a rail undertaking cooperating with a specific airline, in which the prices and connections are arranged exclusively. Such an agreement could bring combination customers to the airline and thus promote the tendency toward route monopolization through an undivided increase in customers.

If a nationally dominant airline A operates on a certain O&D in competition with another (foreign) airline B, airline A could achieve additional competitive advantage over airline B by arranging exclusive feeder connections and prices for combined travel deals with a nationally dominant railway.

There is therefore a certain risk of agreements with a distorting effect on competition. This risk is however quite controllable. Today the Commission monitors competition primarily on air traffic routes with the objective of preventing route monopolies. The regulatory burden will probably not increase in this scenario. It would only be necessary to provide for an obligation to ensure non-discriminatory access to the connection data and prices within the scope of a preliminary regulation, where existing regulations are found to be insufficient.

7.2.2.2 Collaboration

Collaboration Structures

The purpose of collaboration is to enable the coordination of multimodal journeys. To this end, an integrated ticket portal should be created to enable smooth transfer to and from trains and flights. This system requires not only a central database but also synchronization of traveling times. Another variable is the question that will operate the database. The competitive risks depend on this.

Risks for Competition

The synchronization of traveling times necessarily results in arrangements and agreements between the companies so that an antitrust review is basically required. According to the market demarcations named above in Section 1.2., rail journeys and air trips must basically be allocated to different markets. To assess competitive risks due to multimodal transport cooperation, it is first required to determine whether the market demarcations are changing.

New Market Demarcations?

With regard to market demarcation, the commission regularly examines qualitative and price factors. Airplanes, high-speed trains, long-distance buses, and cars have been regarded up to now as exchangeable means of transport under certain circumstances. This depends on the specific features of the offer, e.g. the traveling time. This exchangeability is always determined for the individual route in question (EC Commission dated 8/27/2003, Official Journal of the European Union 2004, No. L 11/17, margin number 59, 60. Case of Georg Verkehrsorganisation GmbH (GVG) versus Ferrovie dello Stato S.p.A. (FS)). The qualitative differences between the means of transport are so great that exchangeability cannot usually be assumed even with comparable traveling times. Qualitative criteria for demarcation include price differences, routes to and from the train station compared to the airport, check-in times, etc. (instructively: EC Commission dated 8/27/2003, Official Journal of the European Union 2004, No. L 11/17, margin number 59 ff. Case of Georg Verkehrsorganisation GmbH (GVG) versus Ferrovie dello Stato S.p.A. (FS)).

These qualitative differences basically persist in multimodal transport offers even if the various transport carriers are still offered on specific routes. That might change within the scope of a cooperation of transport carriers in connection with multimodal transport offers. This would however require the removal of qualitative obstacles e.g. by offering passenger check-in and luggage check-in services at the train station which would transport the luggage to the destination. Since this would require additional facilities in the train station, such a shift of the market is currently not foreseeable. Therefore it can still be assumed that the markets are basically separated.

Competition-Relevant Changes

In other respects, these cooperations could cause changes in the market which might become relevant with regard to the prohibition of cartels because cooperation entails the possible development of monopolization strategies.

There is also an issue relevant for European competition policy concerning the potential bias of a MMITS' display run by a single transport operator. If one carrier, e.g. a train operator or an airline is running a MMITS which includes possible travel offers from other operators there is the problem that the system should provide information on fares and availability in a neutral manner without bias. It has to be ensured that services offered by competing transport operators are displayed in a non-discriminatory way by a MMITS provider. To ensure a non-biased provision of information transport operators offering MMITS services should be subject to specific rules similar to Regulation 80/2009 (the Code of Conduct for CRS) in the Airline industry.

Furthermore, this is consistent with the recommendations made in the Fitness Check of Regulation 80/2009 and 1008/2008 (DG MOVE 2012), that, inter alia, discusses the need to expand the scope of regulation to include meta-searches to ensure neutrality and price transparency and avoid anti-competitive outcomes, whether this is by the meta-search operator (as in the case of Google) or other, dominant travel providers.

Monopolization of Feeder Routes

As indicated above, one result of cooperation might be the division of the transport service between the railroad and airlines. For example it might be agreed within the scope of cooperation that an airline discontinues a feeder flight in favour of the railroad. The cooperation between Lufthansa and Deutsche Bahn on the Frankfurt Cologne route is an example of this type of cooperation. Lufthansa does not offer any flights from Cologne Bonn Airport to Frankfurt. The feeder services to the Lufthansa main hub are handled solely by Deutsche Bahn.

This type of cooperation would be possible primarily for routes where multimodal competition is feasible because traveling times are comparable. This could pay off both for the railway and the airline because it results in a higher load factor for the railway, and the reduction of production capacity for the airline, which can then use this capacity elsewhere. The lapse of multimodal competition could entail e.g. for the railroad monopolization primarily in the business travel segment because business people may prefer the railroad as a means of transport because they can more easily work while travelling. History shows that high-speed rail is capable of capturing large chunks of the air travel volume. In the face of increasing competition from a rail undertaking on a given route, such agreements may be lucrative for an airline. Primarily cooperation between national railroad companies and national airlines would be conceivable, i.e. in Germany for example between DB AG and Lufthansa or in France between SNCF and Air France. If these national companies synchronized their transport plans exclusively, it could limit not only cross-border competition, but also effectively limit new market entrants.

It is questionable whether an exemption can be made. An exemption would be conceivable as a specialization agreement pursuant to EU Regulation 1218/2010. Thus the discontinuation of flight operation on a specific (feeder) route by the airline in favour of the railroad would be classified as a unilateral specialization agreement pursuant to Art. 1 Par. 1 lit. b) of EU Regulation 1218/2010 if the rail undertaking and airline can be assigned to the same relevant market. This could be assumed if the total point-to-point travelling times are comparable or even shorter by rail. However, this does not need to be determined because even if it were the same market an exemption would not be possible. This type of cooperation would be associated with market segmentation and allocation of customers as defined by Art. 4 lit. c) of EU Regulation 1218/2010, which as a so-called hard-core restriction basically does not qualify for an exemption. This means that such cooperation can be regarded as admissible under antitrust law only if different markets can be assumed on the respective route. However, even in this case the markets have connections which could lead to a distortion of competition. Therefore, these cooperations would have to be reviewed by the commission in individual cases.

Market Segmentations and Price-Fixing Agreements

The purpose of cooperation is to create seamless multimodal travel offers. This requires a central database and synchronization of timetables. However, this type of cooperation also enables indirect price-fixing agreements and market segmentations, which are regarded as violations of antitrust law pursuant to Art. 101 Par. 1 lit a), c) of the Treaty on the Functioning of the European Union. This is a consequence of the basic nature of these offers, namely their time dependence. Flight connections depend on assigned times of departure called slots. Rail connections also depend on a route being free at a specific point in time. Therefore the railroad is not able to offer exactly synchronized shuttles for all flights. Nor can airlines change their slots arbitrarily because this particularly affects the destination airports as well. So it is not possible from the first to coordinate all connections so that they are always exactly synchronized. Airlines and railroad companies could exploit this in order to divide transport offers because synchronization is required not only at the point of departure but also at the destination in order to transport travellers to their further destinations.

So, a cooperation scenario might look like this. Lufthansa flies from Frankfurt to Barcelona as its central airport in Spain and conveys its travellers from there to rural destinations using high-speed trains. Iberia flies from Madrid to Düsseldorf and conveys its customers from there using the railroad. Since Frankfurt and Madrid are hubs for overseas flights, market segmentation also takes place that way.

Furthermore, price-fixing agreements are not only possible but required because a standard ticket should have a standard price. Synchronization is accompanied by standard prices which can be fixed jointly.

Increased Anticompetitive Conditions due to Database Operation

This tendency toward anticompetitive practices can be further increased if transport carriers operate a central database for ticket sales via a joint venture. This increase results primarily from the possibility of price manipulation according to the respective demand situation, enabling selective direction to specific offers. The competing combination deals would then be offered for exactly the same price as a mere flight. That way Lufthansa could still offer a single flight from Düsseldorf to Madrid, however for the exact same price as for the combination deal. The flight is more expensive than the combination deal; however market segmentation takes place to the extent to which travellers whose destination is further away from the respective place of destination opt for the combination deal instead.

A further increase is given by the possibility of controlling the distribution channels, for example by withholding specific low-priced deals from independent distribution channels or passing them on only after a time delay, thereby challenging their claim to market shares.

Countermeasures

The depicted scenarios require a high regulatory burden. Since this model requires the cooperation of transport carriers, the risk of market segmentation and price-fixing agreements is inevitable[27]. Taking action within the scope of an ex-post audit will not suffice to prevent this because it is not easy to prohibit and reorganize timetables that have been synchronized. An ex-ante regulation would have to be implemented. Timetable agreements would have to be approved in advance and only for a time in order to prevent route monopolies and to maintain a balanced competition structure. Legal prerequisites would also have to be created. It would have to be provided for by statute that the operators of the central database are not directly or indirectly controlled by the transport companies. This scenario would also require a high regulatory burden.

[27] This refers to the intermodal approach of the POCs.

7.2.2.3 Licensing Models

Structures

A licensing model could be conceivable as an alternative to the above-mentioned model. In this case several competing databases would be created which calculate combination options and standard ticket prices based on the data entered by the transport carriers. The databases could be operated by travel agencies, transport carriers, or third parties.

Risks for Competition

This scenario takes existing distribution structures as a basis and does not use a standard database but simulates competition between distribution channels. Since a collaboration of transport carriers on the one hand and of distribution partners on the other hand is not provided for, many opportunities for anticompetitive agreements do not exist. In any case the system is not more vulnerable than any other market. One reason for this is that there is not a central starting point where the transport offers are coordinated and distributed at the same time. Because the risk of agreements between transport carriers is comparable to the situation in scenario 1, the currently applicable antitrust provisions are sufficient. It only must be ensured that all databases obtain access to the transport carriers' ticket data in a non-discriminatory manner, a requirement which was named as a basic prerequisite in scenario 1. The risks for competition are negligible.[28]

7.2.2.4 Results

The analysis of the risks of competition showed that collaboration of transport carriers to ensure exact synchronization of transport offers and their collection in a central database (collaboration model) carries substantial risks for competition which can be eliminated, if at all, by means of a considerable regulatory burden. This is due particularly to the structure of the transport offers which cannot be arbitrarily combined time-wise and therefore promote the formation of market segmentations and route monopolies. This risk will not occur if the transport carriers make their offers according to their own logics and let the market offer combination deals. This might not always lead to apposite results; however, this seems possible as a rule, especially considering that the multimodal transport offers supplement the single routes. Non-discriminatory access to the transport carriers' connection and price data alone is worth mentioning as a regulatory prerequisite for such an offer.

[28] This refers to the co-modal approach of the POCs.

7.2.3 Consumer Protection

The true multimodal offers will only be acceptable to customers if the journey is treated as a single journey. This means specifically that in case of railroad delays, the traveller is entitled to be rebooked free of charge on the next flight and vice versa. In addition claims for compensation must be clarified in this case. However, this raises the question of who will bear the costs for such delays. In this context, the question whether the previous regulations for passenger rights provide a sound basis for this must be answered first before considering to which extent contractual agreements or legal regulations are required and sufficient in order to achieve this goal.

7.2.3.1 Applicable Community Law

Multimodal Regulations

Multimodal regulations for passenger rights do not exist. The goal of promoting multimodal transport through corresponding liability regulations is formulated in the Transport White Paper of the Commission dated 3/28/2011, Roadmap to a single European Transport Area – Towards a competitive and resource efficient transport system, COM(2011) 144 final, page 23. Up to now this concept has been taken into account only in the Commission's amendment proposal for Regulation 261/2004 on common rules on compensation and assistance to air passengers in the event of denied boarding and of cancellation or long delay of flights and in the Regulation (EC) No. 2027/97 on air carrier liability in respect of the carriage of passengers and their baggage by air (COM/2013/0130 final). According to this, Art. 2 Par. 4 of the Regulation shall be amended to the effect that the Regulation shall apply to the entire journey in a multimodal contract of carriage, namely in a manner so that the other means of transport is treated like a connecting flight.

Regulation 261/2004 (Passenger Rights Regulation)

Pursuant to Art. 3 Par. 2, the Passenger Rights Regulation applies only if the air passenger is present for check-in on time. In the first place, the airport is meant by this. The customer is responsible for any delays during the journey to the airport. The other possibility is that the air passenger is transferred by an air carrier or travel organization from a flight which he/she booked to another flight. The latter condition applies only in the event of a previous flight. It is questionable whether the term check-in can be interpreted for a multimodal journey so that it refers to the beginning of the journey regardless of the means of transport. Since the Regulation only applies to air passengers who are transported by "motorized fixed wing aircraft" pursuant to Art. 3 Par. 4, such an interpretation cannot lead to an extension of the scope of the passenger rights regulation. This is not applicable to multimodal journeys if the

Regulation is not amended. In the event of a delay of the feeder train, the airline is not legally obligated to rebook the flight or take similar compensating measures.

Regulation 1371/2007 (Passenger Rights Regulation For Rail Transport)

A regulation for rail transport comparable to the Air Passenger Rights Regulation is included in Regulation (EC) No. 1371/2007 of the European Parliament and of the Council dated October 23, 2007 on the passenger rights and obligations in rail transport. These regulations originate from the Contract of International Carriage of Passengers and Luggage by Rail (CIV) and provide for a liability of the carrier if the journey cannot be continued on the same day or is unreasonable. The liability basically includes the accommodation expenses (Appendix I Art. 32 of the Passenger Rights Regulation for Rail Transport). Further compensation can be provided for by the individual states. Furthermore, Art. 16 of the Passenger Rights Regulation for Rail Transport provides for the obligation to offer alternative carriage in case of delays, comparably to the air passenger regulation. Onward carriage with another means of transport is provided for only if the transport service cannot be provided any more.

Alternative carriage pursuant to Art. 16 refers only to trains, not to other means of transport. This arises from the phrase that the customer should be offered onward carriage "with re-routing under comparable conditions". Air trips are however not possible with re-routing, but rather the traveller will usually request carriage on a later flight. Therefore the rules also of this regulation do not justify any obligation for multimodal carriage and are only effective for train rides on multimodal journeys.

Regulation 181/2011 (Passenger Rights Regulation for Bus Transport)

Regulation (EU) No. 181/2011 of the European Parliament and of the Council dated February 16, 2011 on passenger rights in bus transport and regarding the amendment of Regulation (EC) No. 2006/2004, (Passenger Rights Regulation for Bus Transport), Official Journal of the European Union 2011, No. L 55/1) is modeled on the two previously named regulations. In case of delays alternative carriage with re-routing must be offered (Art.19 of the Passenger Rights Regulation For Bus Transport). Multimodal carriage is not provided for in this regulation, either.

7.2.3.2 Possible solutions for multimodal transport

Basic Problems

In order to find a solution commensurate with consumer interests, a regulation is required which ensures for an multimodal journey that a delay, no matter when it occurs during the journey, has the same consequences with regard to liability, compensation and alternative carriage if required. Since different companies are usually involved in an multimodal travel service, the question of who will bear the costs for this also arises. These problems could initially be solved on the companies' own authority, by a contract between the transport carriers involved. If this solution is sufficient, a regulation could be dispensed with. If it is not sufficient, legislative measures would be required.

Contractual Agreements

Contractual agreements between transport carriers regarding multimodal carriage exist nowadays wherever it is offered on single routes. For example, Deutsche Lufthansa guarantees carriage on the next flight in its Rail&Fly program, if the actual flight was missed due to railroad delays. However, this applies because Lufthansa sells the ticket as a package and treats the train route like a flight. This guarantee applies to a ticket which is booked via a tour operator only if it is a package tour as defined by Directive 90/314/EEC and the tour operator offers the service provided by a third party as its own service (from the national jurisdiction of the Federal Supreme Court of Germany dated 10/28/2010, Xa ZR 46/10, NJW 2011, 371).

This obligation does not exist for tour operators or travel agents beyond the scope of Directive 90/314/EEC. That means onward carriage despite delays with an alternative connection is possible on multimodal journeys only if the transport companies involved have previously agreed on this. In other respects the traveller is limited to liability regulations provided for the respective means of transport, which however do not help him/her to reach the destination of the journey. This can be explained using an example:

A traveller books a journey from Alba in Italy to Dehli. The journey is offered by his/her tour operator as follows: train journey to Milan Malpensa, proceeding from there with Lufthansa via Frankfurt to Dehli.

Onward carriage despite delays would be guaranteed to the traveller if there was an agreement with Lufthansa and the railroad. However, not even this agreement would give the traveller the full rights he/she would have for only one flight because additional claims for compensation, such as travel cancellation, and other types of compensation would also have to be regulated by contract. In other respects, the traveller would only be entitled to compensation for the part of the journey taken on the railroad according to Regulation

1371/2007. Contractual agreements would not apply to all routes and all companies, either. Therefore, if contractual agreements were the only basis, there would still be considerable legal uncertainty for the consumers. Random multimodal combination of journeys would not be possible, either.

Regulation Requirements

In view of the poor results which can be achieved with contractual agreements, a passenger rights regulation must be defined for multimodal transport. As mentioned above, the amendment of Regulation 261/2004 in Art. 3 Par. 4 provides for an extension of the scope of the regulation to multimodal journeys. The scope of the regulation is extended to journeys which are conducted with another transport carrier or by helicopter pursuant to the contract of carriage. However, this extension requires a contract of carriage with the airline which provides for this multimodal carriage. In other words, the prerequisite is that the airline itself offers such a multimodal journey, which will usually only be the case if it reaches a corresponding agreement with the other transport company. This means that the airline itself offered this journey.

However, the aim of the models described above in Section 1 is to make random combinations possible. This cannot be ensured in accordance with the proposed amendment because the airline is only obligated if carriage by the other transport carrier is an integral part of its own contract of carriage. That means for example: if Air France offers a flight connection from Marseille to Paris CDG airport and from there a connecting flight, it will not accept a train transfer on a TGV (French high-speed train) at the same time. Under this condition multimodal travel depends on the agreements of the transport carriers.

If multimodal travel should be possible regardless of this, a liability rule must be implemented which functions across or independently of all modes. The consumers are given the same rights, no matter which transport carrier is affected and the party responsible for the delay bears the costs. This could be laid down in a standardized passenger rights regulation which replaces the individual transport carrier-related regulations. The functional principle of such a regulation can be explained using an example:

The traveller wants to travel from Kiel to Segovia in Spain. The standard booked journey comprises a train ride from Kiel to Hamburg, a flight from Hamburg to Madrid and then continuation of the journey on a bus to Segovia. The train between Kiel and Hamburg is delayed, so the traveller misses the flight to Madrid. The traveller is rebooked on a later flight which does not arrive in Madrid punctually so that the last bus to Segovia has departed. The traveller is rebooked on a train to Valladolid with a connection to Segovia.

According to the principle of causal responsibility, Deutsche Bahn AG would have to bear the costs for the delay, namely for the entire journey. The consumer can request rebookings, board and lodging if required. In addition he/she can demand a price reduction. Everything would be charged to Deutsche Bahn. It is obvious that this is a high cost risk. Against this background, it can be argued that these multimodal journeys will become much more expensive because the transport companies would have to insure themselves against such claims and pay higher liability premiums.

7.2.4 Overall View

Currently multimodal transport deals are sporadically offered – outside the framework of package tours – for specific routes. These routes are usually operated as rail and fly tickets by airlines. They are based on contractual agreements of the respective companies. Consumer rights depend on the contract design.

An expansion of multimodal offers would initially require legislation ensuring that an multimodal journey is also a standard journey from the consumer's point of view. To this end, multimodal passenger rights must be created, for example by a uniform passenger rights regulation. In connection with this, a regulation concerning the allocation of costs would also have to be created. Based on liability according to the principle of causal responsibility, this could be a major risk factor for transport companies which would have to be included in the multimodal ticket prices.

If such a solution were created on the part of the consumers, the possibility of combination would have to be created on the part of the suppliers, i.e. an obligation of the transport companies to ensure non-discriminatory provision of their connection data and prices so that they are generally accessible. Observance of this obligation would have to be monitored and penalties would have to be imposed on corresponding violations.

Furthermore, if an exact offer were to be created, i.e. with timetable synchronization, additional monitoring would be required in order to prevent cartelization and route monopolization. This would only work within the scope of an ex-ante regulation, i.e, based on approved offers for each route. For only in this manner would it be possible to take all competitors into account and prevent collusion with the objective of monopolisation.

7.2.5 Key Findings

The following measures are required in order to realise multimodal transport which goes beyond the scope of single offers:

1. Uniform, multimodal passenger rights regulations, strengthening transparency requirements and carrier obligations

2. The regulation of charges for information provision has to be cost-related according to the principle of causal responsibility

3. An obligation of all transport companies to ensure non-discriminatory provision of their connection and price data to everyone,

4. Increased monitoring of competition to prevent route monopolies

7.3 Technological Challenges

The findings from work package 2 suggest that the demand side of the multiple passenger transport service markets (essentially one per transport sector) would support the emergence of a single multimodal transport services market. The key distinction of such an evolution would be the emergence of travel retailers offering one, or the other, or both of the following:

1. 'inter-modal' Transport products and services i.e. jointly created transport products, based upon commercial agreements between transport service providers, and retailed under a single 'passenger transport contract'; and,
2. the co-modal bundling or concatenation, for retail purposes, of uni-modal products and services sold under separate and multiple 'passenger transport contracts' in a 'one-stop' shop.

There are a number of technology challenges which apply to both scenarios, and a number which are either inter-modal or co-modal specific. The purpose of this section is to identify the principle technology challenges that need to be overcome for such a market to be constituted, and to distinguish the technology efforts which may require facilitating from those which market-place dynamics may naturally allow.

7.3.1 Generic Technology Challenges (Inter-Modal and Co-Modal)

The demand side of the market essentially calls for a wider variety of modal options from which to shop at the retail end of the supply chain, whether presented as single or separate products, which means technology has to achieve a significantly greater aggregation of multi-operator products and services than is found in today's market. The aggregation of multi-operator services puts the emphasis on the technology deployed within the distribution mechanisms of the supply chain, rather than at the up-stream level of each individual transport service provider.

So, however issues relating to the availability and access of travel information (timetables, tariffs, availability) may be resolved (see 7.4 Information Provision) with respect to individual transport operators, the following challenge remains: i.e. whichever entity or combination of entities plays the distribution role, it has to deal with the lack of interoperability between the business applications of different transport operators, both within, and between, transport sectors.

Interoperability Challenge

Interoperability issues are caused primarily by differences in data exchange formats, coding lists (e.g. locations, operators, booking classes and other 'itinerary' related travel objects) and the semantics of operator, or, modally specific business processes. At high level, the principles for resolving these differences, permitting different travel applications to 'talk to each other', to be 'interoperable', fall into two simple categories: either everyone agrees to use the same data exchange formats/coding lists (everyone 'speaks the same language'); or, the industry players each have access to a translation service that will render external messages and semantics into the 'native language' understood by their internal business applications.

To the extent that no common language exists, individual players have to invest in their own set of translation services. Naturally, the greater the absence of common languages, and the greater the number of partners speaking different languages, the greater the cost of internal translation services and hence the cost of developing new and innovative business applications connecting different retailers, distributors and transport service providers.

Interoperability Framework Concept

The concept of an 'Interoperability Framework' focuses on a different strategy. In recognising the improbability of global or at least European homogenisation of standards across transport sectors, it considers that the corresponding costs in translation services are needlessly borne by each and every player in the transport eco-system. From a system perspective there is an enormous redundancy.

The concept of such a framework proposes, therefore, to make available a common set of translation services which can be accessed simply by each and every player in the eco-system, so that, in principle, only a single instance of a translation capability between 'X and Y', for example, is necessary. Features of such a framework could therefore include, for example, services to resolve coding list fragmentation to ensure that a multi-modal shopper application is able to provide the relevant origin-destination 'location' codes or 'address formats', as expected by any specialist journey planning application it may wish to call.

Further services could also deal with the semantic resolution of 'events' or 'vacation types' onto location codes in order to propose associated mobility queries. The concept of an Interoperability Framework is one of the features of Shift2Rail's Innovation Program 4 proposition to the EC, and is intended to be based upon internet technology principles which provide yet further scope for the future. In this respect, it is worth noting that the EC has launched a very ambitious PPP initiative called Future Internet PPP which aims to “accelerate the development and adoption of future Internet technologies in Europe, advance the European market for smart infrastructures, and increase the effectiveness of business processes through the Internet”. This PPP initiative has already generated some very interesting smart transport prototypes such as Instant Mobility or Sofia for the Smart Cities.

Clearly it would be relevant to consider such Internet technologies for the MMITS services as is foreseen by Shift2Rail IP4, which proposes a reference Interoperability Framework for the future use or emulation by European transport stakeholders. Looking to the future, we might surmise that such a framework based upon internet technology could evolve into an ‘Internet of Travel’ with interesting prospects for the dynamic packaging of transport services, the dynamic discovery of and access to new travel applications, from journey planners and travel shoppers to multimodal ticketing applications, establishing a digital shopper-supplier travel market-place supported by digitally brokered commercial agreements, as well as connecting to the ‘Internet of Things’ or the ‘Interworld’ for travel / transport domain related purposes (intelligent vehicles, traffic –lights, parking lots etc.).

7.3.2 Centralised vs. Distributed Search Challenges

Another technological aspect related to the distribution role within the supply chain, and which applies regardless of whether transport products and services are integrated (intermodal) or concatenated (co-modal), concerns the speed with which transport services information can be searched, processed and returned in the form of trip solutions answering to an online query from the end-customer. This becomes a critical issue, in scalability terms, in the context of pan-European multi-operator / multi-vendor MMITS capabilities.

End-customer requirements for a comprehensive search at the ‘touch of a button’ already represent a challenge for uni-modal supply chains which need to search data provided by multiple operators, in order to establish viable routes and connections matching with the origin and destination parameters of the query.

This search challenge increases exponentially when translated for the multi-modal, multi-operator, multi-vendor characteristics of a MMITS market. Intuitively speaking, a search can be far more quickly effected if the objects, amongst which the search must be made, are consolidated and locally accessible, than if the objects are spread out and ‘far away’. Time can be saved, therefore, by gathering all of the objects in advance and keeping them close at hand, in order to respond more quickly when a query is made than waiting for that query to be made and, only then, going out to gather the objects. This is the reasoning behind the application of a centralised search approach.

As we have seen, GDSs distributing ‘full-service airline’ products and services, centralise schedules and fares in advance, in order to respond sufficiently quickly to online queries received from the retail outlets which they feed. They are dependent, in turn, on the consolidation activities of other distributors, such as ATPCO (fares) and OAG (schedules) to whom airlines push their data, and who, in turn distribute to the GDSs according to the commercial distribution agreements of the subscribing Airline operators.

Alternatively, if queries regularly target a smaller set of objects which happen to be relatively ‘near by’, or if indexing and probability algorithms provide reliable intelligence about the smaller subset of objects from which a search would be successful, then the additional cost of systematically gathering all objects in advance might outweigh the costs of retrieving the narrower subset only at time of query, particularly if any gain in speed is barely perceptible. In such circumstances, accessing distributed data sources in real time may provide a higher efficiency: cost ratio than the centralised approach. Such considerations support a distributed search approach.

Additionally, from the perspective of the eco-system as a whole, there is an apparent redundancy in the systematic and regular ‘moving’ / ‘copying’ of data all around the eco-system, characteristic of the centralised approach, when, ultimately, only a smaller portion of it is finally ‘offered’ to the querying customers within any given time-frame.

Complicating the issue is whether or not the data to be accessed are static or ‘real-time’ dynamic. Static data which are updated fairly infrequently (such as timetables) are straightforwardly susceptible to either search approaches; but, dynamic data, such as yield managed fares or dynamic fares (both of which may only be derivable at query time, being based upon latest levels of demand, or customer details captured at query time) are clearly problematic for the centralised approach since there is no data to be ‘gathered in advance’, although sophisticated solutions have been found to address even in these cases.

In reality, distributors may deploy a combination of both approaches, depending on the configuration of the travel supplier market, whilst online travel agencies and meta-search engines may successfully deploy distributed search methods only because their optimisation depends upon the deployment of centralised approaches higher up the supply chain.

Current Distribution Technology Trends

In this regard, it is also particularly relevant to note that trends in distribution architecture, from a travel service provider perspective are currently focusing on concepts of dynamic pricing in both the airline sectors (IATA New Distribution Capability) and the Rail Sector (Full Service Model) which are heavily oriented towards distributed search technology, whilst, traditionally, the larger players in the travel distribution space, whether GDSs, internet general search engines such as Google, or some large online travel agencies which specialise in both Air and Rail, tend to base their operations principally on the centralised approach.

Although it remains to be seen whether the intentions of the transport providers in either the air or rail sectors, will ever be realised in this area, at time of writing we can remark on the potential for a resulting mis-match between the general search technology tendency amongst the larger travel distributors and the direction pursued by the travel service providers, which could pose a barrier to the rapid migration of the transport service markets into a sizeable multimodal market.

Facilitating Aspects for Solving Search Technology Issues

Although, ultimately, the market-place will probably determine to what extent Travel Service Provider ambitions and current distributor / retailer technologies adapt to each other's business, any 'disconnect' in this area risks to distract energy and resources away from development activities linked to MMITS capabilities. Given that an emerging MMITS market evidently requires some time for the players to navigate and negotiate not only the technological but the business strategy dimensions, such distractions clearly exacerbate the situation.

If MMITS technology trends are intuitively counter to Individual Transport Provider technology trends as represented by the IATA NDC initiative and potentially within FSM for the Rail sector, the market-place may not support the speedy emergence of MMITS technology. As such, it could be prudent for EC-funded MMITS initiatives to include requirements to pro-actively evaluate the feasibility of accommodating the new travel provider trends in a multimodal transport service capability context.

7.3.3 Technology Specifics – Intermodal

An inter-modal travel product or service is created on the basis of commercial agreements between two or more transport providers, who see the marketing potential of combining their services for an origin-destination normally served by at least two separate transport services.

The technology required to deliver and maintain the services and commitments to the passenger until the various travel entitlements are consumed, and the transport contract is expired, requires each travel provider partner to be connected to a common horizontal architecture dedicated to the exchange of key information focused on the various processes attached to the usage or consumption of travel entitlements.

From the travel service provider perspective, such a common architecture must deliver access to the passenger entitlements for each implicated and authorised party when they require it:

- For the financially controlling carrier (receiving initial payment) at sales time for evaluation of revenues and potential billing claims from partner providers
- For other marketing provider interline partners at initial sales time in order to forecast revenues, and, at entitlement consumption time, in order to bill the financially controlling carrier and realise those forecast revenues
- For each service operator to 'process' their passengers (boarding, ticket control, etc.) who in turn is responsible to flag the relevant entitlement as consumed when their service has completed; and, also, for these operators to verify their revenue expectations from the marketing carrier.
- For any retailer, or operator customer touch point, to make a request to the financially controlling carrier for a modification of any entitlement, due to voluntary (passenger change of plan) or involuntary (service disruption) changes.
- For the 'financially controlling' carrier to be aware of the status of any entitlement in the trip, in order to allow or deny any post-sale modification request, and so guard against fraud.

Supporting infrastructural arrangements must be in place:

- to enable the financially controlling carrier to settle with an indirect retailer (e.g. travel agency) for the overall sale
- to enable the financially controlling carrier to settle with their partner providers for the fulfilment of the component transport service obligations under the transport contract which ultimately deliver the passenger to his/her final destination.
- which ensure that usage or consumption of entitlements are systematically 'registered' in order to 'close the loop' – meaning that entitlement (or ticket) control on transport vehicles needs to be assured and capable of feeding back to the necessary components within the common architecture

The underscoring commercial agreements, between the financially controlling carrier and each partner implicated in the trip, contain the details of supported post-sale transactions together with details as to how revenues should be split between them, which in turn are required by the settlement infrastructure. It is often be said that Intermodal products are complex to design and negotiate and that, therefore, they are unlikely to represent a significant portion of the ways in which travel services will be made available to the end-customer in the future: and this indeed represents a factor discouraging investment into the supporting technology.

Clearly, however, and in true 'chicken and egg' style, the absence of the supporting technology, in terms of a common architecture, will ensure that no intermodal commercial agreements will ever be made outside of purely bilaterally proprietary arrangements.

The Intermodal Challenge

The architecture deployed in the IATA airline world which enables through-ticketing (interline ticketing) of airline services provides an example of the sort of common architecture which would be required to support Intermodal commercial agreements.

As we have seen in Work Package 3, this has underscored a number of examples of Air-Rail intermodality in the market place today. Nevertheless, the investment required from the Rail sector to participate, is fairly significant since it involves adapting to a host of upstream processes, so that the Rail Provider 'appears' as an Airline in airline Distribution systems. Furthermore, the architecture specifications are clearly managed and regulated under IATA (and ATA in North America) governance, which poses an additional difficulty when contemplating their wider application to additional Rail transport providers or indeed other modes such as Public Transport or Long Distance bus/coach.

The Intermodal challenge therefore resides in the creation of a common but 'thin' architecture which is compatible with the Airline interlining architecture and which presents a low investment bar for Rail and other non-Air sectors, so that Intermodal commercial agreements could flourish.

7.3.4 Technology Specifics – Co-Modal

It could be expected that the natural evolution of the transport service markets will see an increase in the concatenation of unimodal transport products and services, as has been illustrated by a number of examples in Work Package 3, and that in some senses this represents the embryonic state of a new MMITS market-place.

Some phenomena, however, simply represent the cross-selling activities of large or geographically dominant transport providers who 'diversify' by concatenating (or integrating) other modes so as to support their direct distribution sales channel. Such phenomena will not necessarily transform into MMITS capabilities in terms of pan-European multi-modal and multi-operator attributes, although certainly answering to a number of end-customer requirements.

Other phenomena, on the online travel agency side, are certainly embryonic, since they attempt to provide, in the absence of a significant intermodal product range, the one-stop shop concatenation of uni-modal products from different transport sectors.

The co-modal retailing of travel services answers to a number of end-customer requirements overcoming levels of effort and complexity in the shopping process, currently borne by the end-customer, which may therefore increase the conversion of travel wishes into pre-paid travel purchase. Remaining obstacles relate to purchase risk and travel uncertainty:

- The purchase risk: that during the time it takes to select an available 'travel solution' and proceed sequentially through multiple payment / ticketing processes, one of the component segments becomes unavailable (or simply fails for whatever reason) leaving the end-customer with a half purchased travel solution. This may or may not be recoverable depending on the fare conditions attached to the successfully purchased segments.

It should be noted that with the 'Agency Merchant' model, the end customer makes a single payment to the agent (thus avoiding the purchase risk) even though the travel provider services are packaged co-modally, whilst the customer also enjoys a single transport or package contract with the agency itself.

- The travel uncertainty: that, despite a successful purchase of the various travel components during the actual execution of the trip, one or other of the services suffers a disruption leading to a missed connection with a subsequent component. Again, depending on the conditions attached to the missed entitlement, or other circumstances, this can lead both to stranded passengers and the impossibility of claiming compensation, due to the lack of transport provider liability with regards onwardly connecting services.

The Co-modal Technology Challenge

Whilst the travel uncertainty factor appears to have no technological solution, it is a good subject for investigation into a workable and acceptable regulatory framework for extending conditions of carriage and liability to cover cancellation/delays; but possibly, and more likely, it represents a business opportunity for travel insurance products to be bundled more systematically into co-modal retailing.

The purchase risk is, however, a technological challenge: i.e. asynchronous multiple payment and ticketing processes need to be launched in parallel, but managed by a meta-payment/ticketing capability, which, on detection of failure of any of the parallel processes, is able to 'undo' those that succeeded.

Such technology at the distribution and retail ends within any MMITS supply chain may (if not currently existing) require corresponding adaptation further up at travel service provider reservation and inventory levels; but also within the banking world, where, although the technology exists (e.g. credit card reversal capabilities which unblock funds attached to a previously approved credit card payment authorisation request) subscription to it is not universal amongst issuing banks.

7.3.5 Key Findings

- Purely technological barriers in the sense of 'technical impossibility' don't exist.
- Industry-driven sectoral standardisation and interoperability framework initiatives need encouragement and possibly intervention to kick them off
- Search Technology which addresses MMITS in conjunction with trends such as NDC within each transport sector, need to be addressed.
- Industry Association level collaboration across transport sectors is required to enable both Interoperability and Intermodal technologies to emerge and be sustained.

7.4 Information Provision

A Multi Modal Information and Ticketing System (MMITS) basically resides on three pillars. These pillars are information, booking & ticketing and settlement/payment. Due to the fact that a service can only be as good as the quality and comprehensiveness of the information it provides to the user, non-discriminatory access to schedules, prices and availability information for all European transport operators and travel agents is required. Studies, such as “Towards a European Multimodal Journey Planner” (2011), also indicate that access to information is generally the key to a multimodal journey planner.

In a nutshell, this means that whoever provides the traveller with a MMITS, requires access to information on schedules, fares, availability and even punctuality of publicly available transport modes. This information can be provided by its owner (e.g. the transport operators) either in an already usable way or as raw data that has to be processed by the MMITS operator to gain the necessary information, as there is no common data standard encompassing all transport modes:

- Required information can e.g. be provided via API[29] interfaces that work as an extension of the transport operator’s own web-service and may provide complete information to the system. This information may include timetable information, fares, availability and other required details. On the one hand, API-access has the advantage that the providing company keeps control about the quality of information published about the transport capabilities. They would also have the opportunity to offer dynamically calculated fares while keeping the structure and the rules of their yield management confidential. On the other hand, the API-based approach might be complicated in the calculation of multimodal trips because of the number of API requests to be sent rises with every additional leg, which will also have influence on the performance. It may also be costly for the operator to provide the API interface if not already existing. Extending existing APIs is also topic of the FSM[30] discussion and was already valuated feasible by some carriers. The European journey planners’ providers are also looking for the establishment of European open API standards which could facilitate the development of such services.
- Another possibility is provision of raw data, e.g., via GTFS[31] feeds. GTFS is a format for providing raw data about timetables, fares etc. by Google. According to Google, GTFS allows *“public transit agencies to publish their transit data and developers to write applications that consume that data in an interoperable way*”. For the use of raw

29 Application Programming Interface
30 Telematics Applications for Passenger Services – Full Service Model
31 General Transit Feed Specification

data, a MMITS provider needs his own algorithms to transfer it into usable information. This means that the quality of information lays in the hands of the actual MMITS provider who is responsible for the algorithm. Complementary to this issue is the aspect of frequency and rhythm of updates. Furthermore, some carriers might fear that the quality of information given to the traveller might differ from their own quality standards; therefore it might be a risk from the travel operators' point of view. They may also fear that information quality issues corresponding with a certain transport mode may reflect to the carrier and cause a bad image and bad sense of quality to the carrier as such. They might also fear to be liable for low quality information published by third parties. TAP-TSI also defines a raw data format that is obliged for use in the European rail sector.

- There are also alternative initiatives from Open data communities such as Open Street Map which base their approach on the contribution of any citizen with the objective to leave the data free and accessible to any citizen in order to foster creativity and productivity in the development of new services.

Regarding the scope of information relevant for a MMITS, several approaches can be found to separate certain kinds of information. The term "information", in this case, can be separated into timetable information, fare information, availability information and real-time (on-trip) information. Basically, timetable information is the most important information that has to be provided to the customer, to make multimodal journey planning possible and to allow the comparison of different modes. Timetable information enables the MMITS operator to offer certain proposals of combining transport modes. But in the end, such an itinerary proposition does not completely satisfy the traveller because it does not contain the price of the trip that is very often the crucial aspect when it comes to a decision. In case of rail operators, timetable information is already published via the rail-only B2B platform MERITS[32] and most local public transport authorities also already publish this information via several platforms. Timetable delivery is also compulsory for rail operators due to TAP-TSI[33]. It is foreseen now that within TAP-TSI the UIC-MERITS platform will be the central component for all RU's timetable delivery.

To make the timetable information valuable for the traveller, fare and availability information need to be added to enable the traveller to decide which journey proposition suits his interests best. With respect to different pricing systems, publishing fares might become complicated via static raw data. Some carriers use a dynamic yield management to calculate fares. This includes special offers that are only available for a limited time and fares that

32 Multiple European Railways Integrated Timetable Storage
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depend on the occupancy rate (availability) of the means of carriage and the time that is left until the beginning of the journey. The fare management though includes sensitive data that are an important asset for the transport operator and may not be published in any way. Therefore, sharing details about their fare management might not be feasible for the transport operators. To overcome this barrier, a way of data or information transfer needs to be used that keeps sensitive data and information privately by its owner. Owner may be the transport operator or, e.g., local authorities in case of local public transport.

Additionally to the necessary information about timetable, availability and fares, the fourth dimension of information needs to be addressed: real-time-information. This information is only partly important for the pre-trip planning. Real-time-information is mostly important during the journey. It provides the user with valuable information regarding further connections. For travellers it is essential on a multimodal journey to get information whether they will be able to catch the forthcoming connections or if re-accommodation is necessary. Real-time-information includes punctuality as well as current positions of the vehicles. This information is not only important for travellers but might also be seen as highly sensitive with respect to the carriers' interests. Therefore, owners of real-time information about the transport vehicle might not be willing to publish this kind of information.

Information or data transmission may be executed via API-access, GTFS feed or any other possible format. Technically, using data translators to merge different data formats is possible – but data or information provision might prove an issue with some transport operators. The information or data owner in general, might assess access to information and information as such as an asset that needs to be exclusive (e.g. with respect to fare or real time data). For a multimodal journey planner, non-discriminatory access to transport operators' schedules, fares and real-time information is a key factor for obtaining success. If non-discriminatory information provision (or data access) cannot be ensured throughout all European transport operators, the development of a MMITS might not be possible. 'Non-discriminatory' does not intend information should be free of charge. Information may, e.g., be provided free of charge to business partners but charged to non-business partners (for use in their MMITS). Basically, the fee should be intended to cover the costs of data provision. These costs might vary between the carriers due to the number of daily requests (server capacity) and the existing standard. The fee as such must be low to prevent the risk of a prohibitive price.

Comprehensive information is essential for the success of a Multi Modal Information and Ticketing System in Europe. For a MMITS, a common ecosystem might be the best solution to make information interchangeable. This can be realised, e.g., via a centralised platform or preferable via mutual agreements regarding access to special multilateral MMITS interfaces as an extension of each transport operator's web service. Information provision may also be done as a combination of static timetables and API-based price, punctuality and availability requests to address the concerns regarding sensitiveness of fare and real time data. A further important aspect is to distinguish between information provision and retailing. While a MMITS is intended to be a central contact point for booking door-to-door journeys, carriers may not be obliged to accept any MMITS-providers as retail agents because retail is based on bilateral contracts. All European transport operators will have to share their information with other players in the market; otherwise MMITS will most likely never become reality.

Key Findings

1. Three kinds of information have to be availability for planning a journey via a MMITS: Schedule, fare and availability. Real time information is necessary during the journey
2. Comprehensive information is necessary for a usable MMITS
3. Information provision is only feasible for carriers if no sensitive data is published. Therefore, schedule information may be published as raw data while dynamic information, like yield-managed pricing, may be share via API access.
4. It has to be distinguished between information provision and retail.

7.5 The Role of Local Public Transport

In work package 3 it was already outlined that there are huge differences between the value chains in ticket retail of airline and rail operators on the one hand and local public transport operators on the other hand. Not being able to offer location-independent advance ticket sales, as it is provided e.g. by the GDS, is regarded as the main difference amongst others.

The following section will therefore examine the barriers and limitations of the **market specifics in local public transport** when implementing MMITS, taking public transport services into account. Hence, its results will represent an in-depth analysis which particularly arises from the institutional and technological differences between public transport operators as well as airline and rail operators. All findings will furthermore complement the above analyses which are to be regarded within the **overall context of all companies and institutions** involved.

7.5.1 Structure and Relevance of Local Public Transport

7.5.1.1 Structure

Especially in large cities, providing public transport services is the result of a complex system including many companies and institutions. Depending on the city's dimensions and its geographic prerequisites, transport services are offered by predominantly publicly owned or controlled transport companies using:

- buses,
- trams,
- metros,
- suburban and regional trains, as well as
- ferries.

In addition to the above services, car-sharing and bike renting facilities may be added to the system of local public transport, which are sometimes partially funded by advertising revenues. In some Member States, local transport is provided by private operators with or without government subsidies.

Public transport "ticketing" infrastructures are characterised by the use of unmanned sales points, vending machines, and automated validation solutions at a very large number of stations or outlets.

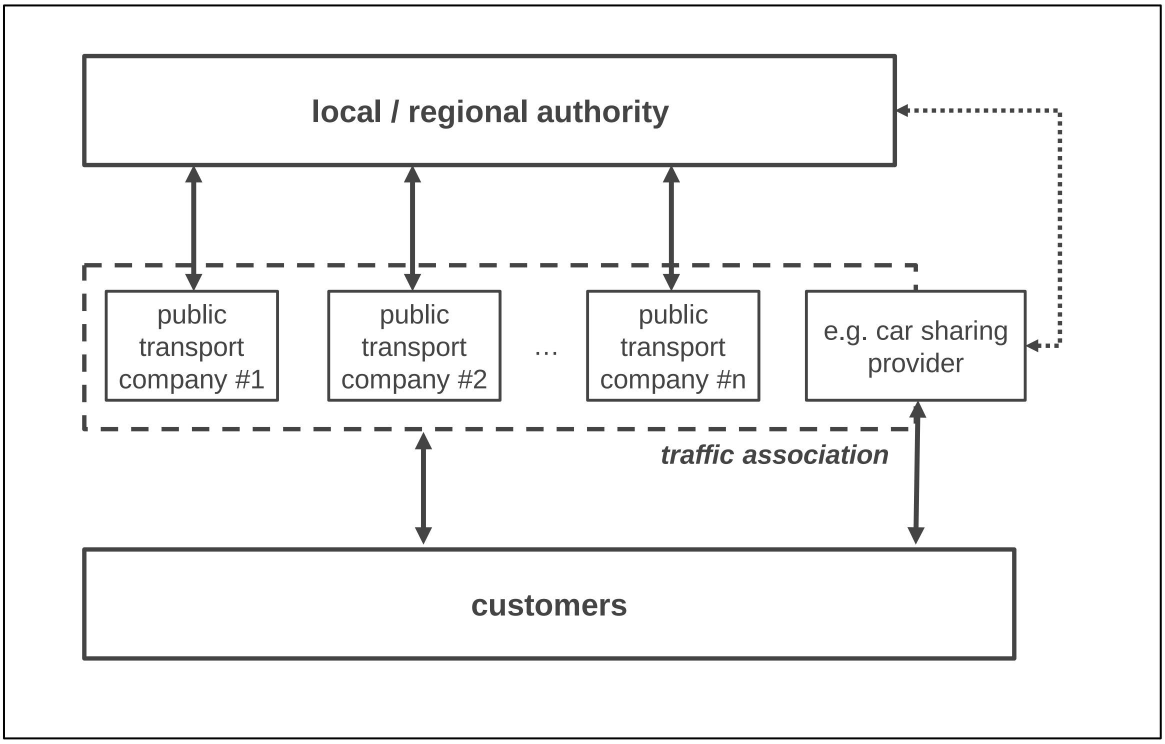

Figure 77: Structure of the Local Public Transport Market
Source: Own figure.

Unlike (commercial) long-distance railway companies and airlines, there are features in the market structure of local public transport which result from a strong link to public administration and politics. This structure is shown schematically in figure 77.

Local public transport companies are commissioned by local administrations or authorities indirectly representing those local administrations to provide transport services. It is possible to commission those services directly if a local public transport company exists. It is also feasible to award a contract by way of a competitive tender involving privately owned transport companies as well. In most cases, the extent of any service provided (timetable, network, etc.) and its financing will be stipulated in public service contracts.

In larger cities it is common to have several transport companies providing local public transport services which are differentiated spatially or by means of transport, for example. In order to offer a largely coherent service concept as well as seamless travel for passengers, operators have, in most cases, under the guidance by public transport authorities, joined forces to establish a governance and collaboration model, often in the form of a “traffic association” The aim is to provide a cross-company pricing and ticketing system which allows for passengers to use all services, which are provided by every operator involved, buying one ticket only. There are such traffic associations e.g. in Brussels, Berlin, Vienna or Zurich. However, due to the number of companies which need to be involved – e.g. more than 40 companies in Berlin – it sometimes takes more time for companies to reach decisions. Furthermore many traffic associations already integrate services provided by several car-sharing and bike renting providers which means that there are multimodal services offered already.

In contrast to long-distance rail and airline operators, public transport companies:

- are dependent on political decisions, because public services policies are defined by public authorities (cities or regional authorities), and there is little harmonisation between cities or member state approaches
- the Public Transport market is currently highly fragmented and heterogeneous; However, many large cities have successfully already implemented urban/regional multimodal interoperable ticketing and journey planners services
- rely heavily on automation a very large number of often unmanned stations, using self- service kiosks and other devices

7.5.1.2 Market Dimensions

Compared to the railway and aviation sector, there are not only differences in the local public transport market regarding its structure, but also in regards to its dimensions. The below figure 77 shows selected indicators and their estimations for local public transport, rail and air traffic. Rather than comparing the exact figures, it is more important to become aware of the differences in the dimensions shown.

When implementing MMITS, complexity and costs will also be driven by all stakeholders required to be involved. Apart from the pure provision of information, this is in particular the case while implementing booking and purchasing processes. If only medium-sized and large cities are taken into consideration for participating in MMITS, it still means more than 1,000 companies must be involved in Europe. Even though this number can be reduced by the ongoing can be reduced by the grouping within traffic associations, local public transport companies will still form by far the biggest group numerically.

The difference of the individual sales processes in local public transport (see section 5.3.4.) can be attributed to its feature as means of mass transport and its resulting restrictions. The number of passengers carried by airlines compared to local public transport operators is times 70, whereas it is only times 7 in contrast to rail companies.

With regard to revenues, the opposite is the case. In local public transport only passenger revenues are included without taking into account revenue from public service obligation. Without taking PSO subsidies into account, revenues of local public transport operators amount to less than a third of the revenues made by rail and airline operators respectively. Revenues of both rail and airline operators are approximately similar.

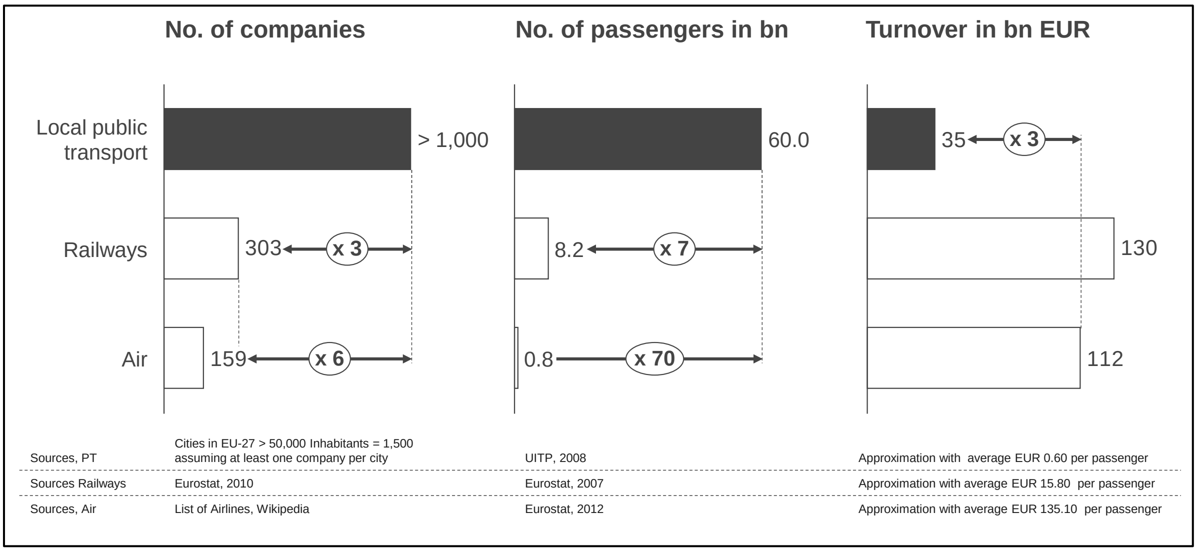

Figure 78: Market Dimensions
Source: Own figure.

Based on the above, several implications result concerning the implementation of MMITS:

- MMITS providers face a considerable complexity integrating local public transport because of the fragmented market and the number of cities to be connected.
- Benefits for local public transport companies, resulting from their implementation of MMITS, are limited compared to airline operators or railways, as potential new customers only make up a very small proportion of all customers, whereas (in theory) all air passengers as well as most rail passengers may profit from this system.
- Due to the low revenue per passenger trip (less than EUR 1), transaction costs must be marginal, .

7.5.1.3 Relevance for Travel Chains

The significance of local public transport should not only be highlighted by comparing figures for each transport sector, but also by analysing the importance of travel chains for passengers.

Three indicators will be used in order to analyse the significance of individual travel chains: distance travelled, journey time and ticket price. In the following, some highly frequented European O&D's that have been identified in section 4.1.4 of this report will be examined in an exemplary manner to assess the relevance of local public transport for the travel chain.

Regarding the different means of transport, various combinations are possible. However, it is most likely, especially in international traffic, that a short distance is being travelled to a hub, followed by the main distance being travelled to another hub, followed by another short distance to the final destination. In order to cover different constellations, two examples have been selected from each of the following exemplary travel chains: "local public transport – flight – local public transport", "local public transport – flight – long-distance train" and "local public transport – long-distance train – local public transport". By this means the key aspects will be covered.

In order to accommodate the different distances between hub and the passenger's final destination, the (largest/ most central) university building was chosen as starting and ending point in this example. Regarding the distance travelled by air, the Euclidean distance was chosen, as this figure comes closest to the actual distance travelled. Distances travelled by rail or local public means of transport were determined by road distance calculations using www.luftlinie.org. This does not exactly match actual rail tracks or public transport routes. However, it is a suitable indicator for the alternative usage of private cars/ taxis. In addition, there are huge differences in public transport relations concerning routes and waiting periods even if the journey time is very similar (e.g. for bus and metro travel).

With regard to journey times, either journey times published by the transport operator or figures determined using www.rome2rio.com have been used. Furthermore the cheapest ticket option has always been selected. This may result e.g. in a single ticket being used at the first leg of a journey and a day pass being used at the last leg of a journey. All prices used were published by the transport companies and/ or traffic associations. As flight fares vary depending on the day and time of booking, capacity utilisation, etc., all sample flights have been booked on the same day using the same day of travel. On 30.10.2013, an economy flight was booked one way departing on 15.01.2014 (Wednesday) at 10 o'clock. The cheapest flight fare for a non-stop flight was chosen. In order to identify the cheapest flight fare available several search engines were used and no extra costs for additional luggage allowances were included. It was often the case that the cheapest ticket shown on www.rome2rio.com was more expensive than those found via search engines.

The following figure shows all parameters used for analysing these travel chains.

	Price EUR	Time hh:mm:ss	Distance km
PT – Air –PT			
King's College, London / Heathrow – Dublin, UCD			
PT	12.42	01:57:00	49.00
Air	57.60	01:20:00	449.11
Rail			
UCM, Madrid / Barajas – Rome / Fiumicino			
PT	3.00	00:36:00	18.00
Air	126.98	03:55:00	1,332.37
Rail	11.00	00:32:00	31.00
PT – Air – Rail (– PT)			
King's College, London / Heathrow – Amsterdam / Schiphol – Utrecht			
PT	7.01	01:02:00	49.00
Air	37.21	01:00:00	371.14
Rail	8.10	00:31:00	48.00
Frankfurt (Main) – London (Heathrow) – Cambridge			
PT	10.75	01:12:00	47.00
Air	73.90	01:45:00	653.89
Rail	26.20	00:45:00	90.00
PT – Rail –PT			
King's College, London – Paris Sorbonne University, Paris			
PT	3.70	00:24:00	7.00
Air			
Rail	48.50	02:16:00	455.00
UCM, Madrid – Universidade de Lisboa, Portugal			
PT	4.40	00:40:30	16.00
Air			
Rail	60.50	10:40:00	638.00

Figure 79: Selected Travel Chains, Absolute Figures
Source: Own figure.

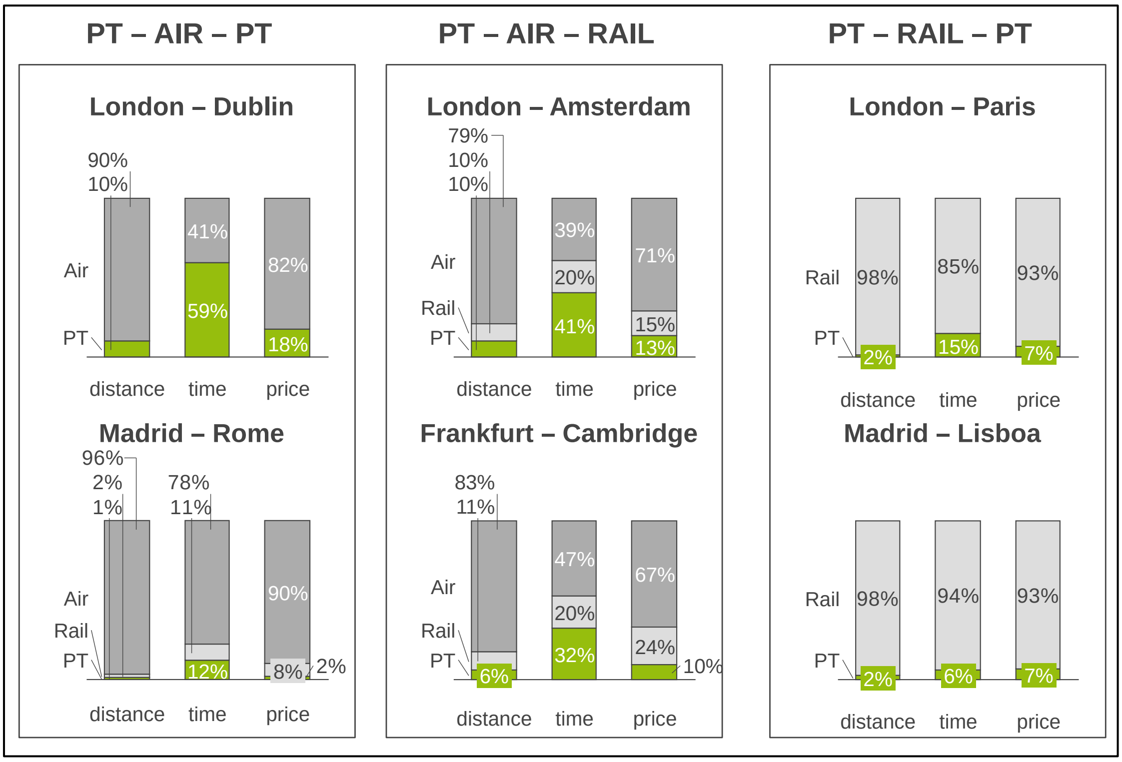

Figure 80: Selected Travel Chains, Relative Figures
Source: Own figure.

The figure above shows the distribution of each indicator for all three means of transport (i.e. public transport, rail and air travel) combined. Compared to the other means of transport, it is quite evident that local public transport is less important with respect to the distance travelled and the price. However, in regards to the journey time, it becomes obvious that for shorter travel chains (e.g. London – Dublin) more than 50 per cent of the overall journey time is spent using public transport. Nevertheless, the share in ticket prices never exceeds 18 per cent.

Based on the above, several implications result concerning the implementation of MMITS:

- Using local public transport may amount to considerable shares in the overall journey time in pan-European travel chains.
- Planning requirements prior to travel increase with a growing share of public transport in the overall journey time and additional necessary transfers.
- Low shares in public transport revenues must be considered when drafting the economic concept of MMITS.

7.5.2 International Examples for Multimodal Links

7.5.2.1 Status Quo

In order to highlight the benefits of MMITS in particular for passengers in public transport, the following section will show how complex multimodal links can be. To illustrate the complexity, we choose airport-city connections from the set of travel chains above (destination: university). This analysis will take the passenger's perspective, who is gathering information regarding his onward journey by public transport on the airport's website.

Traffic Association	Information on PT on Airport Website (in English)	No. of Companies bound to University	Number of Tickets for the Route	Tickets available on Airport Website or in Pre-Sale
London, Heathrow				
Transport for London/ multiple tariff-systems	good	3	3	no
Brussels				
STIB/ MIVB, single tariff-system	good	2	1	no
Paris, Charles de Gaulles				
stif, multiple tariff-systems	good	3	3	no
Frankfurt am Main				
RMV, single tariff-system	good	3	1	no
Madrid, Bavajas				
CTM, single tariff-system	good	2	1	no

Figure 81: Quality of Information Available for Multimodal Travel Chains
Source: Own figure.

In most cases, airport information on websites of airports regarding public transport services are limited to links to the operators' websites or information on the operators. In order to plan a journey, the traveller needs to visit the operator's website. If no tariff association exists, the traveller must also determine which means of transport to use. Depending on the purpose of travelling the decision seems obvious at first: much luggage or time pressure means travelling by taxi, few luggage and price consciousness imply travelling by bus. Transitions are made using metros, suburban and regional trains. This decision, however, becomes considerably complicated, if there are several bus and rail operating companies like e.g. in London or Paris with different ticket types, fares and travel speed. Here only rough pricing information on public transport is available on airports' websites.

From a passenger's perspective, it is desirable to have the possibility to specify travel speed, luggage or price either directly on the airport's website or through a centralised tool. Hence, not only the means of transport is a concern but also journey times, transfer frequencies and prices. While this information is available on the RMV website (see figure 81), it is not possible to book a ticket in advance. However, all information required for this purpose is available at the time the flight is booked. Therefore it is not obvious while the ticket for public transport cannot be booked in advance.

In case there are physical access barriers when validating tickets, it would be an option to provide an on-site collection of tickets. Machines would then e.g. read printed or digital QR-codes and would then provide the purchased ticket. Deutsche Bahn AG is already using a similar technology. Another example is the HVV (Hamburg transport association) where it is possible to book digital tickets online.

From a passenger's perspective, Heathrow Airport currently provides the best navigation regarding available means of transport. A link "Transport and Directions" can be found on the start screen of the airport's website. Here it is possible to choose the appropriate means of transport. However, advantages of each mode of transport only become apparent on closer examination, as both "Underground" as well as "Train" may be selected.

The situation is similar in Paris-Charles de Gaulle. Information on the inbound and outbound journeys can be selected on the start screen of the airport's website. However, the passenger is then required to select bus or train lines, as it is not possible to enter the destination via address. Therefore the passenger needs to know the closest stop to his destination.

Overall, it can be said that especially non-local travellers are required to plan ahead considerably. MMITS would integrate those planning steps, resulting in less information and transaction costs for passengers.

7.5.2.2 Best Practices

From an IT and sales' point of view, the above exemplary examination shows that proficient multimodal links are not always guaranteed, even under today's technical possibilities. However, several examples for proficient links between different modes of transport, covering public transport, will be shown in the following:

PLUSBUS (UK)

One of the most interesting examples regarding multimodal organisation of transport is UK's programme PLUSBUS. Tickets may be purchased optionally against a small extra fee while booking train tickets. PLUSBUS is available for 290 rail-served towns and cities across Britain, with varying prices (e.g. GBP 3 in Birmingham) and can be purchased for the first and/or for the last leg of a journey. Tickets provide unlimited bus and tram travel (on participating operators services) to and from the rail station and around the whole urban area of the rail-served town on the day of travel. In Birmingham e.g. both airport as well as train station are within the area of validity. For commuters, PLUSBUS tickets are available for 7 consecutive days, 1-month, 3-months and a whole year, to match the validity of rail season tickets.

Madridcard (ES)

Madridcards in Madrid are primarily interesting for tourists and are available for purchase in local sales offices, but reservation may also be made in advance due to their limited quantities. Madridcards are season tickets for 1, 2, 3 or 5 consecutive days which are valid for all means of public transport in the greater metropolitan area. In addition, discounts in shops and free admission to museums and other sights are available. For travelling outside the metropolitan area discounts will also be granted for car rentals. Ticket prices offer different levels of benefits depending on duration of validity and scope of use. A Madridcard for one day (EUR 45) costs more than twice as much as a day travel pass (EUR 17) in the greater metropolitan area. However, the price difference between Madridcards and travel passes is for a 5-day stay much less: Madridcard EUR 75 and 5-day travel pass EUR 51. Similar offers exist with different varieties in many other European cities. It is obvious that the barriers regarding the system's complexity were lowered considerably for short-term visitors in order to allow an easier market access.

Transfer to and from Paris' Airports (FR)

Another good practice example is provided by AirFrance for both airports in Paris. For flight transfers between Paris-Charles-de-Gaulle and Paris-Orly, AirFrance ticket holders receive vouchers for free bus shuttle use. Thus, passengers are not required to search for shuttles themselves. On the other hand, it may also be argued that transfers are a necessary part of the travel chains of AirFrance and should therefore be included in flight tickets anyway.

Ride and Fly (GER)

Ride and fly is offered by several travel companies in Germany. The optional ticket for public transport can be purchased while a flight is being booked and provides unlimited travel in the departure and/or destination city on the day of travel. However, this is limited to participating travel companies and traffic associations. Similar to the example above, ride and fly offers enable passengers to travel to and from the airport while minimising the traveller's effort to obtain information on the local public transport possibilities.

Train to Plane / Rail & Fly (GER)

Very similar to ride and fly, rail & fly is offered in many towns and cities across Germany. Long-distance rail tickets are being booked with travel companies from any town to the departure airport. Its comparatively low price of EUR 29 per ticket is the same as for limited available promotional offers by Deutsche Bahn AG. In regards to validity of those tickets in local public transport, however, no specific statement can be made. Here the passenger is also not required to search for trains to and from the airports. For holidays in the USA, the train journey from Hamburg to Frankfurt airport can definitely compete against domestic flights, as long-distance flights are often only offered from the largest airports.

City-Ticket (GER, CH, AT)

For journeys that focus on rail as the main mode of transport, several European long-distance railway companies (like ÖBB, SBB, DB) offer free single public transport tickets along with the long-distance rail tickets purchased. Depending on the offer, those tickets are valid for public transport only at the final destination (ÖBB, SBB) or at the first and last leg of a journey (DB). Additionally, further restrictions like an obligatory minimum distance of travel of 100 km or being a BahnCard holder (DB's rail card) can be applicable. The validity is automatically included in the offer. Therefore spontaneous travelling is possible without much planning required beforehand.

All of the above examples have one thing in common: the connection in sales and price between the different modes of transport is being made by a lump-sum surcharge for the local public transport. The actual price for the particular public transport ticket is not added on top. From the public transport operator's point of view, there is a risk of the ticket being "overused" which would result in a "imputed loss in revenues". However, the system is simple and reduces the pricing system's complexity in public transport for both cooperation partners and passengers.

7.5.3 Barriers and Limitations

The following examines to the obstacles to the successful establishment of a functioning market for MMITS, with particular focus on local public transport services. This section will also review which problems are to be expected during the MMITS development and which regulatory options should be considered in this case to support the development of MMITS. Furthermore expected technological problems will be identified relating to the particularities in local public transport and pragmatic approaches will be shown.

7.5.3.1 Corporate strategy aspects

Based on the approaches for MMITS business models presented in detail in work package 3, this section will analyse which incentives exist for participating companies to establish MMITS, incorporating public transport. The examination focuses on the willingness of the players rather than the technological capabilities of all participants. Firstly, benefits and opportunities as well as costs and risks involved when participating in MMITS will be examined from the public transport companies' points of view. Following this, the positions will be compared and assessed to what extent both sides' interests can be harmonised.

Public transport companies

For public transport companies the following **benefits** of a MMITS seem to be relevant:

- Increased visibility and broader marketing opportunities for their services
- Improvement in customer satisfaction through the provision of real-time information and in advance booking facilities (→ passengers save time, as no information gathering and ticket purchasing is required at the station)
- An incremental volume of new customers will be acquired which could possibly lead to attractive multiplier effects (→ international travellers) Perhaps there will be extra travellers when airline feeders are replaced by rail.
- New customers (e.g. business travellers) are acquired which tend to have a higher average revenue than regular customers due to single tickets and day passes being purchased (in contrast to season tickets)
- Improvement of the company's perception through the participation in innovative information and communication channels

The attraction of new (international) passengers and the improvement of the transport operator's perception as a leader in innovation are linked to an increased attractiveness of cities because of the integration in a MMITS. Therefore, local public transport authorities should have an interest in providing incentives to public transport operators to participate in a MMITS.

On the other hand, there are several risks associated with MMITS:

- Interdependency between public transport companies and MMITS and its providers with regard to data standards as well as business relationships
- The perceived effort needed to achieve standardisation, as well as for data transmission and data interfaces

- Fear that ticket retail via MMITS reduces verifiability and increases potential risk of abuse
- The loss of data quality or misinformation by MMITS regarding public transport services, creating negative repercussions for public transport companies (e.g. customer complaints)
- Fairly high transaction costs for ticket retail

MMITS providers

MMITS providers will benefit from the cooperation with local public transport operators:

- Increased attractiveness of the MMITS system due to door-to-door-connections being offered
- Higher customer potential when establishing a tightly-knit network with many public transport companies participating
- Potentially increased unit revenue, as information quality improves and transaction costs are reduced by using MMITS, thus increasing the willingness to pay
- Positive brand perception impact due to the involvement of ecological means of transport
- Possibility to claim subsidies in order to further develop MMITS in connection with public transport companies being involved

But there are also relevant concerns when integrating public transport operators:

- The complexity in achieving standardisation and to aggregate public transport data
- High complexity to realise contractual and commercial agreements with public transport companies due to its clustered structures and partially complex decision-making structures (see above)
- Prohibitive transaction costs compared to average revenues per passenger trip

The interaction of the above aspects should ultimately be examined in a microeconomic cost-benefit analysis which is however beyond the scope of this study. Therefore in the following, the relative distribution of cooperation benefits and costs will be assessed qualitatively in order to derive a statement regarding the willingness to collaborate of public transport companies and MMITS providers nonetheless.

In contrast to public transport companies, increasing revenues are very important to MMITS providers, as the latter benefit directly from ticket retail as well as indirectly by a higher attractiveness of their platform due to additional revenues from increased ticket sales for air and rail travel as well as from advertising. Public transport companies, on the other hand, do not profit from these indirect effects initially. Furthermore, these additional ticket sales revenues realised by the cooperation are only of little importance to public transport companies, as they result in only marginal increases in passenger numbers. Both sides could equally benefit from the effects of acquired subsidies and a positive perception, if public transport companies participate in MMITS.

Even though public transport companies also benefit from ticket retail via MMITS, it is necessary to critically ask whether the overall majority of public transport companies is prepared to enable ticket retail for third party providers. Industry representatives claim that public transport companies will be reluctant to do so, as they are concerned about a loss in control as well as higher retail costs from "parallel structures".

With regards to costs, expenses to comply with standards for interoperability will be highest. Therefore costs of standardisation are equally important to both public transport companies as well as to MMITS providers. There will be additional costs for MMITS providers to coordinate the various participants which are just as important to them. It can be assumed that there will be also switching costs for both sides due to the interdependency between public transport companies and MMITS providers.

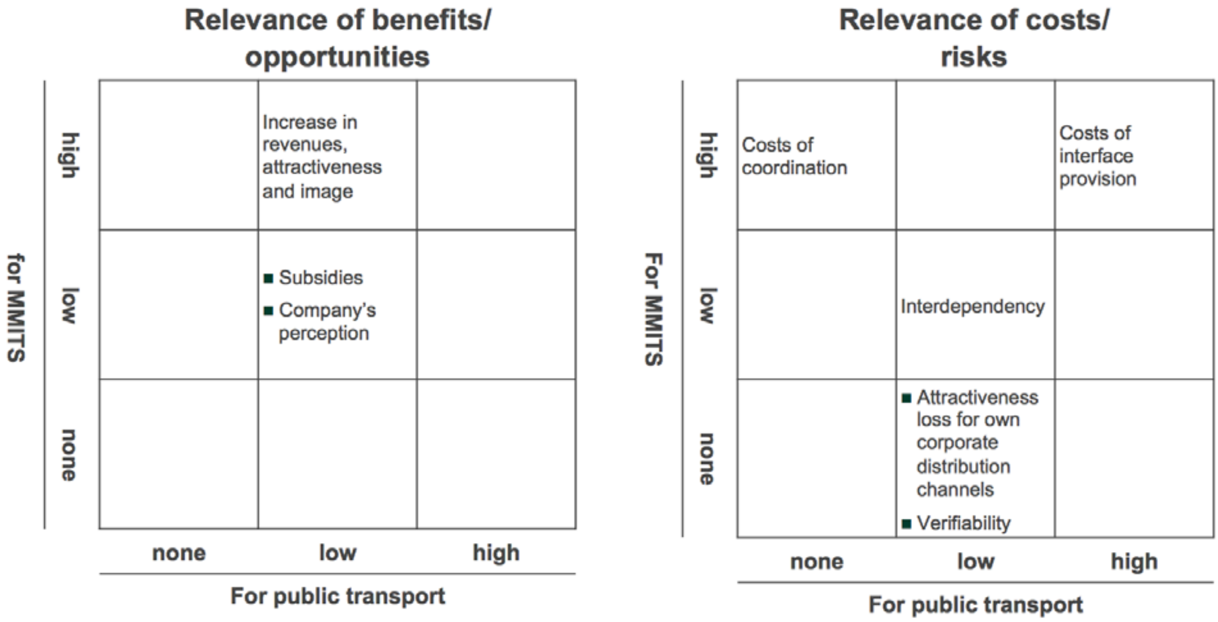

Figure 82: Costs-Benefits-Distribution
Source: Own figure.

The figure above shows the asymmetric distribution of costs and benefits between MMITS providers and public transport operators at a glance. In summary, benefits and costs are not equally distributed, as MMITS providers gain more from a cooperation than public transport companies. In principle, however, there are no conflicting interests between these parties.

From the MMITS providers' strategic point of view, involving public transport companies appears sensible. From the public transport companies' points of view, participating in MMITS is likely. However, in each case it must be checked to what extent MMITS providers can become involved in sharing the costs of standardisation and to what extent public transport companies can receive a greater share of indirect revenues induced by them.

7.5.3.2 Technological Aspects

The development of a European-wide MMITS with participating public transport operators means economic as well as technological challenges. On the one hand, this can be traced back to the requirements arising from the functionalities like real-time information. On the other hand, it is necessary to standardise and coordinate information flows of more than 1,000 different public transport companies. In contrast to airlines, which have been operating with standardised data interfaces for their worldwide ticketing systems for decades, no binding European-wide standards regarding timetable information and ticketing systems are yet in place.

In the following, it will be examined to what extent technological barriers exist regarding the implementation of MMITS. This will be based on MMITS' three pillars introduced in section 5.1 of work package 3:

- Information,
- Booking & Ticketing, and
- Settlement

Information regarding timetables and potentially real-time traffic data, which need to be provided by public transport companies, do not impose insurmountable barriers for them. For instance more and more public transport companies provide their GTFS (General Transit Feed Specification) data for Google Transit or others. Partially even real-time data is provided, e.g. in London. An overview of all participating cities can be found under https://www.google.com/landing/transit/cities/index.html. Additionally, further raw data formats aim to establish a European standard for exchange transport data, such as IFOPT (Identification of Fixed Objects in Public Transport) and NeTEx.

This shows that this aspect is a corporate strategic one rather than a technological one. Current journey planner providers, as well as open data communities are currently considering alternative data formats that will facilitate such data exchange and avoid the conversion into proprietary formats.

There may be implementation barriers in the area of **booking & ticketing** also, while booking trips is normally not applicable to public transport, the use of a “ticket” or trip entitlement token normally is. The key challenges are therefore typically related to how access is granted to public transport, and the extent to which a trip entitlement mechanism is required. In general there are two different systems in public transport:

- Closed systems, e.g. Underground in London with access barriers
- Open systems, e.g. Metro in Frankfurt am Main without access barriers

To be able to use a **closed public transport system**, validation is required at the access barriers in order to gain access to the system. Depending on the city and public transport system, different devices are in use, e.g. smartcards using RFID or NFC technology, tickets with magnetic strips or in some areas even QR codes which use a scanner function.

Providing passengers with “tickets” or trip entitlements that are transversally accepted in multiple systems currently imposes a great challenge in the location-independent multimodal ticketing process. The challenge is to make relevant electronic information accessible for the applicable device regardless of the public transport system used. Smartphones could be used as ubiquitous ticket devices which would provide access via NFC or QR code depending on the system, so could application emulation embedded in a SIM or a universally accepted chip enabled payment card.

Just like any existing options (e.g. smartcards), those new possibilities of access (e.g. via smartphone) must also prevent abuse due to tickets being forwarded to other users, at least at the level of current solutions in place.

Unlike in the airline and rail industry, trip entitlement in public transport and urban transit is not stored as a central travel record, and therefore access validation normally does not involve central systems communicating with remote devices.

Open public transport systems employ a variety of validation requirements, sometimes combining different policies in parallel, depending on the type of trip entitlement of the passenger. MMITS providers could therefore provide public transport trip entitlements as QR code, ticket2print or on a mobile device. These options do not prevent abuse of multiple print-outs or the like, and may therefore require that some form of verification process is implemented. This verification procedure is already in place for numerous online ticket sales, e.g. the online ticket of Deutsche Bahn AG or mobile tickets of various traffic associations, while the majority of public transport systems are based on random spot checks and controls

From a technological point of view, the integration of public transport into the MMITS perspective needs to be considered in terms of:

- Information provision to enable construction of timetable and trip options
- Offers for and the purchase/payments of trip entitlements, singular or plural
- Issue of the medium for trip entitlement or “ticket”
- Validation mechanisms
- Settlement

Overall, the conception and implementation of **payment and booking processes** does not impose major implementation difficulties. In case that ticket retail is for traffic associations rather than individual public transport companies, the question of revenue shares between the companies involved is concerning the respective traffic association.

7.5.4 Key Findings

In connection with public transport services, the following implementation obstacles can be found during the MMITS development:

- Asymmetrical distribution of costs and benefits between MMITS providers and public transport companies, so it is likely that urban public transport providers will require incentives to participate
- Significant costs to achieve standardisation for both MMITS providers as well as for public transport companies
- Low interest of public transport companies to enable ticket retail for third party providers – local public transport operators or public transport authorities would’nt afford to pay distribution fees to MMITS service providers
- The technical approach has to take into consideration the necessity of validation, security and control of the rights to travel especially in a closed network with gates.

7.6 Market Failure

7.6.1 Theoretical Approach

Goods are allocated efficiently within a market if there is no solution to improve a market actor's situation without degrading another actor's situation. This situation is called pareto-optimal equilibrium. In turn, a market failure exists if the pursuit of the individual interests of each market actor results in a situation in which at least one market actor's situation could be improved without degrading another actor's position. For the further discussion it has to be kept in mind that market failure is not connoted negatively. It only describes the state in which market mechanisms are not sufficient to generate the theoretical optimum. Market failure is not a result of a market actor's failure. It usually results from imperfections in the market conditions or the characteristics of the good. Therefore, four causes of market failure are generally distinguished:

1. Market power
2. Information failure
3. Externalities
4. Public goods

Market Power

Under perfect competition no single market actor (neither supplier nor consumer) is able to influence the market mechanisms as they have no market power. The situation changes if the market is characterized by a monopoly or cartel. In this case, the monopolist can dominate the market, i.e. the actor has market power which results in imperfect competition.

Market power implies that one company or a little group of enterprises has the power to block beneficial gains for others (e.g. customers). The monopolists can use their market power to limit the output level and in consequence, to increase the price to a level higher than under perfect competition. Assuming that in the optimal state the equilibrium price is equal to the cost, this means that the monopoly price exceeds the equilibrium price. In consequence, the optimal equilibrium as defined in literature is not reached.

Causes for monopolies can be diverse: If fixed production costs are high relative to the variable costs it is the most efficient to have one single supplier (scale effects). This state is called subadditivity of costs. The result is a so called natural monopoly. In this case the production costs constitute a barrier to entry for further suppliers. The monopoly maintains itself. Additionally, monopolies can develop due to regulatory interventions that impede the entrance of further suppliers.

Information Failure

Information failure or information asymmetries refer to a situation in which a lack of information characterises the decision process of market actors. I.e. the contractual partners do not have the same information about a product or service, e.g. about the quality. The result is a suboptimal allocation of resources and adverse selection. The most famous illustration of market failure due to information asymmetries is the example of the lemons problem on the market for used cars: As badly informed car buyers are afraid of being deceived, the maximum willingness to pay (reservation price) is set low. In consequence, only the used cars of the lowest quality are sold as they are the only ones corresponding to the reservation price. The unequal distribution of information again leads to power imbalances within the market as one party has more information or better one than the other parties.

In the example described the information asymmetry results from a lack of information on the customer side that is not willingly created. However, market failure may also develop if there is no incentive for one or more parties to provide full information.

Nevertheless, it has to be taken into account that complete information (in the sense of all producible information) might not be desirable because the production of information is costly. It can be assumed that the utility per added amount of information decreases after having reached the optimum whereas the extra costs per added amount of information increase. The more information the user has the more decreases the utility. This can be explained by the fact that too much information leads to an information overload. On the contrary, for the information supply side it becomes more and more difficult to create new information after having picked the low hanging fruits. In consequence, information becomes more expensive. Therefore, it can be said that complete information *rather* refers to the optimal amount information than the maximum.

Externalities

This paragraph shows that also the characteristics of goods can generate market failure

In the optimal state, the market actors pay for the costs (e.g. production environmental or social costs) they cause. In turn, if market actors create value or an advantage, they receive compensation. In the case of market failure because of externalities, costs or benefits of an activity that affect an uninvolved party are not internalised.

An illustrative example is noise caused by traffic. Although noise is said to cause health issues, these costs are not included in the price structure, for example for car driving. The affected person does not receive compensation nor does the causer have to pay any compensation.

The fact that the interests of uninvolved parties (they are not involved in the transaction) remain unconsidered leads to an economically inefficient resource allocation. As the impact on other parties is not considered, a market failure can be assumed.

An example for positive externalities is network effects that occur if the utility of a product or service increases with the number of users. A typical example is the telephone that is only useful if at least two, better more persons have one.

Public Goods

Up to now all assumptions were based on private goods. Only those consumers that are willing to pay the market price can purchase the product. Those that are not willing or able to pay the market price are excluded. Additionally, there is rivalry in consumption, i.e. one's consumption of a good limits someone else's consumption. In the case of public goods, consumers can neither be excluded nor is the consumption marked by rivalry (e.g. national security). Especially the characteristic of non-excludability can cause market failure: If providers cannot exclude non-payers, this means that the product or service can be spread freely. In consequence, two effects can be derived: Either, the problem of non-excludability can lead to an underinvestment in the development of the good because the provider cannot generate sufficient benefits from the development as a significant number of consumers use the product or service without having to pay (free-riders). This can mean in consequence, that the product or service is not provided although there would be a demand. Or – if the good is characterised by non-excludability but also by rivalry (e.g. natural supply of fish) – non-excludability can lead to a depletion of resources as there is no mechanism (as the price) that expresses scarcity. This problem is discussed as the the "tragedy of the commons" in the economic literature.

Further Causes of Market Failure

There is a variety of further issues that can induce market failure. For instance, it can be observed that markets are usually characterised by **adjustment lags**. I.e. when framework conditions change the market does not adjust immediately but in a later period. This is especially the case for durable goods as property. Assuming that the demand for property suddenly rises due to a migration trend, for example, the supply side cannot immediately adapt but has to build new property. This can lead to economic welfare losses.

Another aspect that can cause market failure is **market turmoil**. Market turmoils are oscillations in the market that cause a changing environment. The more turbulent a market is the quicker the market conditions change. Assuming that the market framework changes very quickly the market has to adapt with the same rate. However, it can be assumed that the adjustment lags still remain. This, in turn, means that the gap between the moment of change and the moment of adaption increases. Again this can lead to economic welfare losses which are expression of market failure.

Finally, the factor of **bounded rationality** has to be taken into account. Under perfect competition it is assumed that all market actors act rationally and figure out all available information and compare it to finally make the optimal choice. Bounded rationality, in turn, assumes that the information overload and the complexity of situations impede a rational choice. Therefore, market actors rather make a satisfying decision than an optimising one.

Market Failure in Real Markets

Economic theory assumes that market failure exists as soon as one of the previously named causes occurs. However, for real markets this perspective has to be relativized: Real markets are characterized by dynamic equilibriums rather than static equilibriums as stated in economic theory. Additionally, almost no market is marked by complete and symmetrically distributed information among all actors. Therefore, it can be said that in reality not each market imperfection automatically leads to a market failure.

In consequence, on real markets it underlies a subjective intuition if the market imperfection is already severe enough to cause significant efficiency losses. These losses can be compensated by state intervention.

7.6.2 Market Failure: An Applied Investigation of the a Market for Multi Modal Information and Ticketing Systems

The foregoing chapter provided the necessary theoretical background on market failure. It defined the conditions of a perfect market and described possible causes of imperfections on the market that can, in turn, lead to market failure. The forthcoming chapter analyses the market for Multi Modal Information and Ticketing Systems with regard to possible imperfections. This chapter is based on the market insights generated in work packages 2 and 3.

Market power: In the first step the market’s tendency to result in a natural monopoly has to be discussed. A natural monopoly occurs if it is more efficient to produce a product only in one enterprise instead of two or more. This is especially the case if fixed costs (operational and one-time) are high whereas marginal costs are low.

The largest cost pool is the development of a Multi Modal Information and Ticket System, i.e. the respective software. According to expert interviews the development costs (or first-copy costs) lie between 75 and 100 million euros. It has to be taken into account that these costs only refer to the development of a MMITS. They do not include possible additional costs for the adaption of the existing transport information systems. This pool is assumed to be largest cost pool and can be a significant market entry barrier for potential suppliers. These development costs are independent of the later production output.

Furthermore, a certain amount of initial integration costs has to be considered which vary with the level of standardisation. The lower the level of standardisation between the operators is the more initial costs are necessary to integrate them into the system standard.

Operational costs exist but are less significant compared to the first-copy costs. Some fixed costs can be assumed for maintenance, protection or actualisation of the software for a Multi Modal Information and Ticketing System. Variable operational costs are relatively small compared to the investment. It can rather be assumed that a MMITS is characterised by step costs especially regarding the server capacity. Capacity does not have to be increased per additional user but per group of new users, i.e. as soon as the server capacity reached its limits.

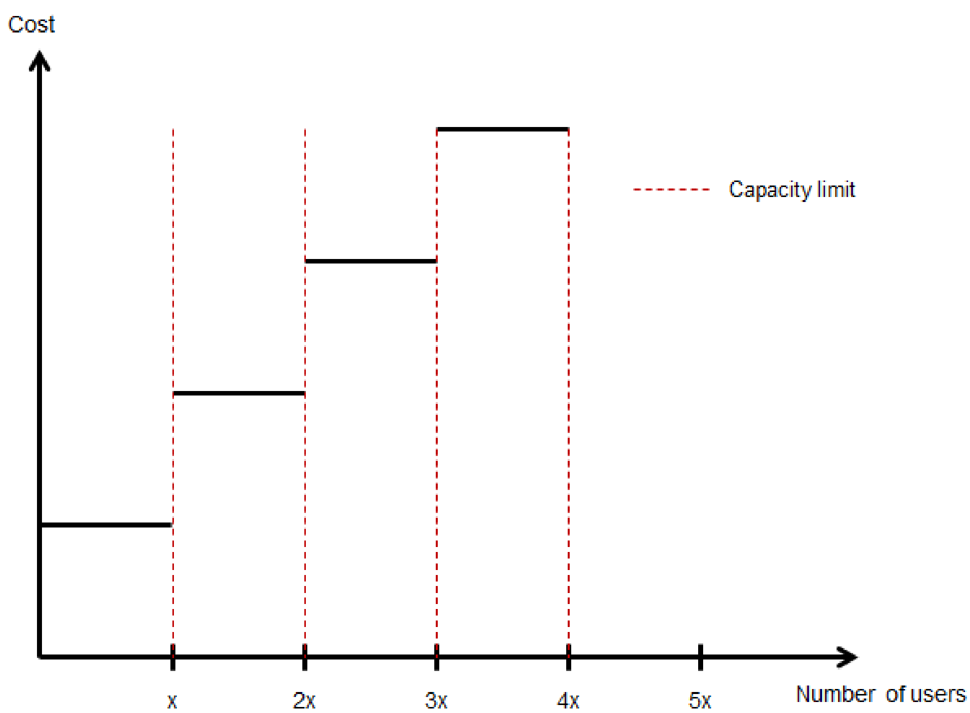

Figure 83: Cost Structure of the MMITS Capacity
Source: Own figure.

However, it has to be mentioned that opportunity costs per additional user can rise the closer the capacity limits are because the speed of data processing might decrease. Nevertheless, it can be assumed that the reduction in data processing speed is minimal.

In general, a MMITS can benefit from scale effects as the fixed costs per unit decline per additional user. The central question is how strong these scale effects finally mark the cost structure to actually favour monopolistic or oligopolistic structures. Research provides indications that software production in general does have scale effects but not to such a significant extent that market power imbalances could actually be the consequence.

Concluding, it can be said that there is only little potential for market power imbalances due to the cost structure of a MMITS. Market imbalances can, however, be favoured by network effects that are a kind of positive externalities. Therefore this aspect is discussed in the paragraph about externalities.

Information failure: Information failure on the Multi Modal Information and Ticketing System market has to be analysed from two perspectives: the demand side and the supply side.

Assuming that a MMITS provides optimal **route information** according to preselected criteria the customer has to simply trust that actually the optimal information is provided. Nevertheless, only the provider can know if the presented information is the best information possible. Also **price information** can come along with trust issues due to information asymmetry: The customers cannot be sure if they receive the cheapest option or if there is maybe a hidden fee included in the price for the usage of the MMITS. This can lead to certain scepticism towards the MMITS. Finally, **real-time information/on-trip information** (e.g. disruption management, information about delays, the possibility of re-accommodation during the trip, etc.) can come along with information asymmetry. This type of information is especially marked by uncertainty about the availability during the trip. Real-time information is usually based on online access. However, this access cannot be guaranteed in all cases. Additionally, a low smartphone battery, for instance, can complicate the access to on-trip information.

Furthermore, it can be argued that MMITS-customers are unsure about what happens with personal data. Data safety could become an issue of information asymmetry and is an important topic that has constantly to be addressed. However, our study has shown that at the moment data safety is not perceived as a critical issue for users.

Although it can be concluded that information asymmetry occurs in the market that can cause trust issues, it has to be mentioned that information asymmetries occur in almost all real markets. Trust issues can be one factor that helps to explain the low willingness to pay as indicated in the customer study. It clearly has to be said that the low willingness to pay also derives from the fact that customers are used to information for free on the internet. Therefore, it might be overacted to name all markets with information asymmetries as failed markets. In conclusion, it can be said that information asymmetry not necessarily causes market failure but generally hinders market penetration.

Furthermore, information failure on the supply side can be found as the MMITS provider cannot be sure having received full information about all route options. As discussed in the chapter about limitations from a business policy and strategic perspective, there are incentives for transport operators not to provide full information but only the most basic one. The issue occurs if the MMITS providers cannot be sure to receive full information, e.g. about price or availability. This asymmetry between operators and carriers complicates the implementation of a MMITS.

In this case the MMITS providers cannot guarantee to their customers to offer the optimal options. This can, in turn, increase the feeling of uncertainty on customer side and in consequence lead to a low usage rate.

Externalities: Externalities occur if there are effects on a third party which is not part of the market mechanism.

It can be assumed that a MMITS is a two-sided market business model as discussed in the section on business models. A MMITS provider on the one hand gathers information of the carriers and on the other hand provides the service of information, route planning and ticketing to the customers. These models are characterised by network effects: The more carriers provide their information to the MMITS the better is the offer for customers. In turn, the more users a MMITS has the more attractive it is for carriers to provide their information to a MMITS and possibly sell more tickets. These effects are positive externalities as there is a gain in utility with an increase in the number of users and information providers..

However, network effects can also have negative effects as they can cause the emergence of market power: If the MMITS with the largest user base has the best information pool and in turn the MMITS with the best information pool attracts the most users, the consequence is that the majority of users is bound to one MMITS provider. The so called lock-in effect occurs. The result is that market power imbalances can emerge. These have again negative effects on the allocation. An earlier paragraph already concluded that market power due to the cost structure of a MMITS is unlikely to occur. This evaluation differs for market power due to network effects. These externalities are rated in research as likely to cause monopolistic or oligopolistic structures on software markets. However, a specific analysis of the travel market indicates that the market does not have a strong tendency for the development of monopolistic structures. This can be explained by the example of OTA's that generally show similar network effects as a MMITS with mainly balanced market power.

Public goods: To fulfil the criteria of a public good a MMITS has to be characterised by non-rivalry in consumption and non-excludability of consumption.

To discuss the question of rivalry in consumption several components of the usage of MMITS have to be distinguished. On the one hand, there is hardware needed to operate a MMITS. This hardware can be either data carriers or probably even more relevant: devices that are needed to actually use a MMITS (e.g. smartphone). Hardware is typically scarce and therefore, marked by rivalry. Consumption is limited by material/resources. On the other hand, there is the central good itself – the MMITS. From a technological point of view MMITSs are mainly made of software applications. Software is often characterized by non-rivalry in consumption. However, the argument has to be critically discussed for any MMITS solution. In general, the main service of a MMITS consists of sampling and presenting information in a clear way, providing a comfortable way of booking and increasing the travel comfort via real-time information. The usage of such services requires the access to a platform and the activation of data processing via a platform. This, in turn, means if too many users access a MMITS at the same time the processing power can be considerably affected. Therefore, non-rivalry is only true under the condition that a certain number of users at the same time is not exceeded.

It remains the question of non-excludability. Whether excludability is practiced strongly, depends on the business model of the MMITS. The question, however, is if excludability can be implemented without much effort. Usually excludability is generated by setting a price, in this case some kind of user fee. This user fee guarantees that only those that pay can use the MMITS. Free-riders are excluded. This means, non-excludability is a given character. Given the fact that only after having exceeded a certain number of users, rivalry in consumption occurs, it makes sense to characterise the MMITS as club good (i.e. non-rivalry and excludability). The mechanism works as follows: By introducing a usage fee for the MMITS it can be ensured that users do not obstruct each other by overusing a MMITS within the server capacity limits.

However, it has to be considered that a MMITS is an experience good. Just by experiencing, i.e. using the MMITS, the user can be fully convinced by the usefulness of such a tool. Without ever having used a MMITS and experienced the advantages the users might not be able to fully estimate their willingness to pay. This means it can be assumed that the willingness to pay without having experienced a MMITS is lower than after having used and experienced the MMITS. This means that excluding users by setting a price would only attract lead users regarding technology but not the normal user. This can impede that a MMITS actually reaches the critical mass. Therefore, it seems to be reasonable not to exclude users but find another business model that helps to finance a MMITS. The chapter on business models offered a variety of possible financing options that could avoid the exclusion of users (i.e. the preservation of the characteristics of a public good from the user perspective) and still provide a lucrative business model for enterprises. Possible business models are collaboration, horizontal licencing or a commission based business model (see work package 3, chapter on business models). As soon as the critical mass has been reached it can be considered to set a user fee. I.e. a stepwise exclusion might be the solution for impeding rivalry in consumption.

Another positive side effect of letting users experience the good free of charging is the fact that the lack of trust because of information asymmetry could be reduced. It has to be clear that experiencing a MMITS is not able to actually reduce the asymmetry but might help to build the trust in a MMITS by providing positive experience. Especially those users that have certain scepticism against a MMITS because of uncertainty might rather be willing to experience a MMITS if it is free of charging. This can be explained by the fact that the potential costs of making a bad experience are lower if they did not have to pay for it.

In conclusion, the analysis has shown that the MMITS market would be a generally well working market. Market power because of cost structural effects is unlikely to happen. The same is true for market power because of network effects. Although software markets are mostly susceptible monopolistic structures due to network effects, the analogy to the OTA market showed that the travel market behaves differently. Information asymmetries occur in almost all real markets. They may hinder market penetration but do not necessarily cause a failure. Finally, the characteristics of a public could not be proven for a MMITS.

8 Scenario Analysis (WP4)

Based on the previous work, the scenario analysis tries to give an outlook on the future. To elaborate potential scenarios, the institutional role model is used and certain levels of collaboration and regulation are derived. The institutional role model identifies roles that are to be filled for the successful implementation of a MMITS.

Firstly, the institutional role model is introduced in theoretical way. This is followed by the definition of meta-roles and institutions that are required for implementing MMITS. At last, the scenarios are built and described according to different levels of collaboration and regulation.

8.1 Institutional Role Model

8.1.1 Institutional Role Model: An Introduction

This chapter gives a theoretical introduction to the institutional role model which will be the basis for the following scenario analysis. The institutional role model is a systemic and actor-based approach. To fully understand the dynamics of a defined ecosystem the institutional role model has to be explained in contrast to traditional operator based models.

Operator based models assume that there is a number of operators within a system. These operators are clearly profit-oriented, and are driven by strong self-interest. I.e. when the implementation a new service is discussed the expected gain is the decisive factor. However, there will be difficulties if information asymmetries impede that all operators can estimate their benefits resulting from the introduction of a service correctly. This is especially difficult for experience goods that are marked by hidden characteristics. This fact can start a mechanism that enormously hinders the implementation of a service. Such a mechanism is illustrated in the following figure.

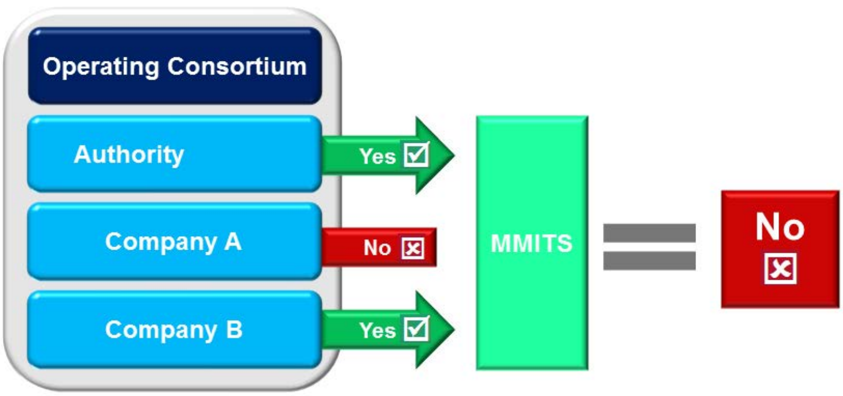

Figure 84: System Implementation via Operator-Based Models
Source: Slightly changed according to Converge (2013).

The figure shows an operating consortium that includes exemplarily three participants. Two out of three decide to participate in the implementation of a respective service. One, however, does not foresee sufficient benefits for himself to take the financial risk of failure. To reduce the financial risk of company A, public funding could be possible such that company A decides to participate. The usage of public funding could send a signal to the market that a private business investment is not rational. However, the issue is not the high financial risk but information asymmetries regarding the benefits of the good/service. The missing definition of clear tasks within the system complicates the identification of alternative entities which, in turn, reduces the flexibility of reactions onto changes.

This is exactly the leverage where the institutional role model interferes. Instead of defining a system by operators the institutional role model approach defines a system via roles, i.e. activities that have to be fulfilled.

Roles describe a set of actions that have to be fulfilled. I.e. a role defines how an institution behaves within a system. To determine a role it is not sufficient to define the actions but also the conditions under which they are executed. Additionally, when defining the set actions it has to be taken into account that these actions are either complementary or at least neutral. Consequently, there cannot be conflicting actions within one role. The defined set of action, i.e. the defined role is conducted by actors.

Actors are defined as the acting entity that takes a certain role. It has to be considered that that one actor can take several roles and vice versa a role can be split between several actors. In general, actors have the obligation to act as social subsystems. They can be firms, public authorities, federations, courts, universities, etc. Nevertheless, institutions, i.e. actors do not only act under given rules but also create rules (e.g. rules for communication, decision making, control). Therefore, it has to be taken into account that actors have internal as well as external impacts on the system as summarized in the following figure.

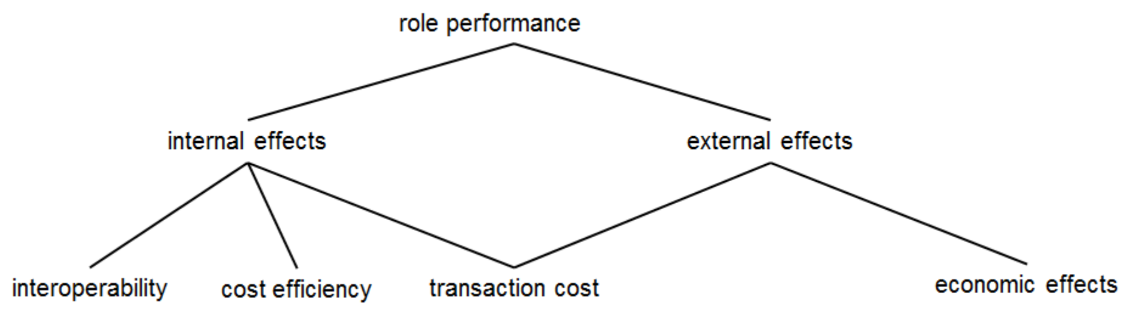

Figure 85: Examples of Effects of Role Performances
Source: Own figure.

The definition of roles and the identification of the respective actors are subsequent steps. Actors voluntarily decide to overtake one or more roles. Roles act in cooperative structures with a common goal. According to the institutional role model systems are not only driven by self-interest but also by the role perception. This increases stability for the ecosystem and certainty for the participants themselves. The following figure illustrates the advantage of an institutional role model:

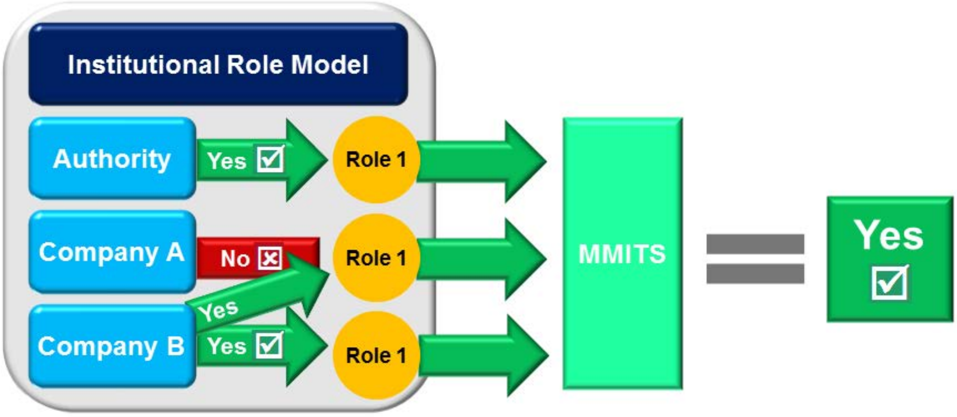

Figure 86: System Implementation via Institutional Role Model
Source: Slightly changed according to Converge (2013).

In a first step, the needed roles are defined. In a second step, actors decide if and which role they want to overtake. It results that company A again does not want to participate. In contrast to the operator based model this does not necessarily complicate the system building process. As there is a clear definition of actions, company B decides to overtake also role 2. It could also be that a company unexpectedly decides to leave the role and another actor has to spontaneously decide whether to overtake role 2. In any case, the clear definition of actions beforehand allows flexible reactions to changes. This, in turn, creates stability for the system as it does not necessarily depend on one actor. It simply has to be ensured that all roles are fulfilled.

The figure below gives a schematic illustration of such an ecosystem. The figure clearly shows that there are no hierarchical structures but all participants form part of a system with a common goal. This cooperative structure also allows reducing uncertainty for the single participant.

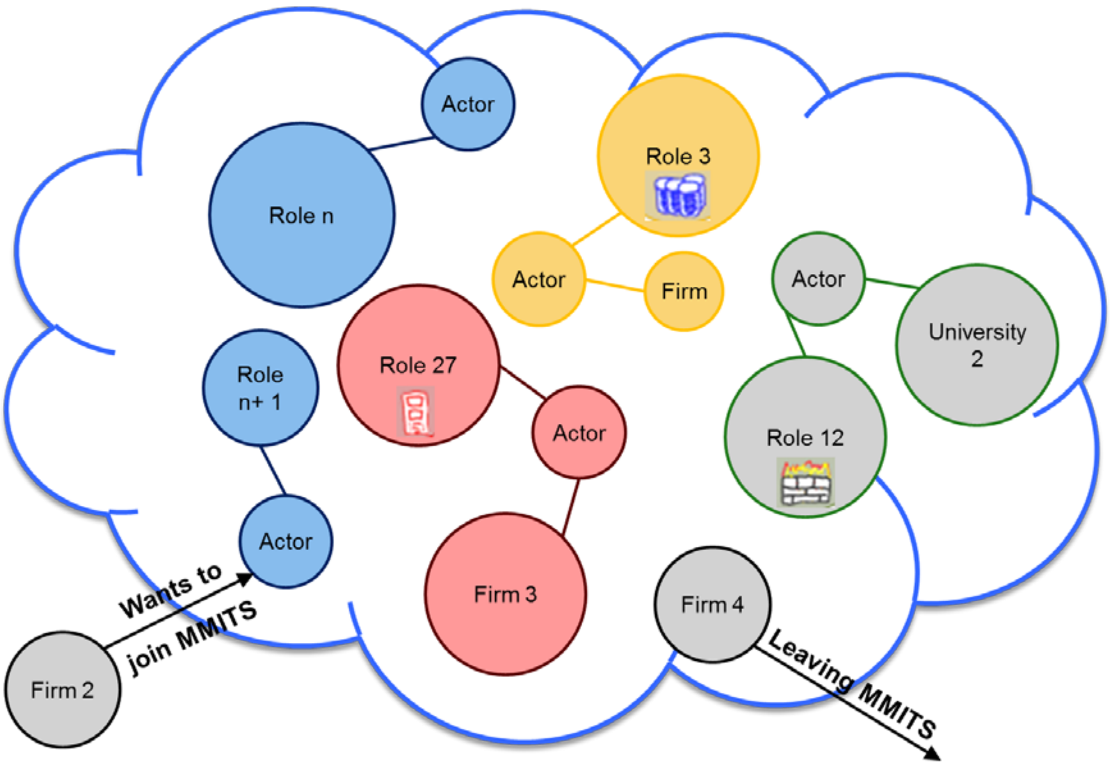

Figure 87: The Ecosystem MMITS from the Perspective of the Institutional Role Model
Source: Slightly changed according to Converge (2013).

Furthermore, the figure shows that it is a permeable system, i.e. institutions can constantly decide to leave or join the system. However, to fully take advantage of the institutional role model approach it requires a systematic illustration of the roles and the actors. Therefore, the following four-dimensional matrix has been developed. On the left, the meta-roles are presented. The bottom line lists the several actors that are part of the ecosystem. The top line can vary according to the needs of the analysis. This can be the market phases (development & research, growth, maturity and stagnation/decline). In our case, the scenarios are the relevant category. On the right, the level of involvement for each actor with reference to the assigned role in each scenario can be anticipated.

		Scenarios										
		Scenario 1			Scenario 2			Scenario 3				
Meta roles	Role1										High	Involvement
											Medium	
											Low	
	Role 2										High	
											Medium	
											Low	
	Role 3										High	
											Medium	
											Low	
		1	2	3	1	2	3	1	2	3		
		Actors										

Table 20: IRM-matrix for the identification of potential actors
Source: Own illustration.

This illustration allows identifying the relevant actors within the ecosystem. Additionally, it can be distinguished under which conditions (scenarios) the respective actors are involved to which degree. However, this illustration may not be seen as a given fact: Once the actors have voluntarily chosen their roles, it has to be reviewed if the actors are actually able to fulfil their chosen role. Furthermore, the matrix helps to identify empty cells, i.e. roles that are not sufficiently fulfilled, which would imply a call for action. At the same time, crowded cells can be identified. This can be an indicator that too many resources are spent for a certain role. A selection procedure can be the result. If many actors are involved in one activity and all that a high level, it has to be checked if a splitting of the action might be efficient, i.e. making two actions out of one.

8.1.2 Meta-Roles and Institutions in the Institutional Role Model

To use the institutional role model, firstly, the roles need to be clearly defined. In this chapter every role is defined with respect to the related set of actions, the general conditions and whether the role in complementary or conflicting to other roles in the institutional role model. Subsequently, the institutions are defined referring to the abbreviations in the matrix.

System Development:

System Development is the task of initial software development. Additionally, it consists of the task of the further evolutionary development of the service to keep up with the demand of the market as well as the increasing customer expectations. This task though is mostly limited to the technological part of the development. This includes the following components: Middleware Interoperability Services, Travel Shopping functionalities, ticketing functionalities, trip tracker and travel companion. The system development needs to be conducted in strong collaboration with the transport operator(s) to ensure a high grade of functionality. The role of software development is complementary to the role of system provision.

System Provision:

The system provider is responsible for running the service and providing it to whoever is contracted to use it in the role of a reseller, agent or transport operator. This includes providing the server infrastructure and regular maintenance of the service. The system provider is responsible for the system to be accessible by all participating players and for it to be in working order at all times. The role of the system provider is strongly dependent on the role of the system development.

Settlement / Clearing:

The settlement and clearing is the task of providing and issuing traffic documents and of accounting and settling accounts between carriers and distributors, including MMITS providers and Travel Agents. It includes handling of the processing of tickets, payments, and the disbursement of commissions to travel agencies. The role is complementary to the distribution.

Distribution (B2B):

B2B-Distribution contains the role of distributing the MMITS solutions to players in the market and / or players in further markets, even worldwide, e.g. CRSs. The B2B distribution as such only affects the solution as a software/eco-system, and can function in accordance with established rules and business models.

Distribution (B2C):

The distribution role consists of the task to organise the distribution-process of transport products to travellers (B2C). This includes sales promotion, advertising, operation of ticket selling machines and any other customer related action that is not part of the actual process of transport. In a nutshell, any kind of selling a ticket to a traveller is part of the distribution role. The distributor is also the one that collects the fares. He may be an operator, a travel agent or any other institution.

Transport Operating:

The Transport Operator basically is the entity that processes the transport as such. The Transport Operator is thereby responsible for the vehicles, timetables, fare policy, availability, reliability and other topics related to the transport service. The provision of vehicles includes the maintenance of on-board solutions that are necessary to communicate with the MMITS-environment, such as the real-time vehicle disposition. This does not include the provision of online-booking tools, which is a complementary part of the role of the distributor.

Information Supply:

The role of information supply obliges to every carrier being part of the MMITS eco-system. To make the system usable, passengers need comprehensive information about timetables, fares, delays etc. This information needs to be provided to the eco-system. The role of the provider of data access points, API interfaces or any other kind of information provision though does not only apply to the carriers. A third party that provides the carriers with the necessary technology may also handle it. The role of information supply is also strongly connected to the transport operator with respect to the actual owner of information or data.

Standardisation (Interoperability framework):

To make the information usable in the MMITS eco-system, certain standards need to be set. Standardisation includes for example data formats and information provision.

Customer Service:

The Customer Service relates to services like re-accommodation, rebooking, cancellation etc. It includes all kinds of customer care. The customer service provider is also responsible to provide the customer with a point of contact. It is complementary to transport operating.

Promoting/Support:

Promoting and Support relates to supportive actions to realise the implementation of MMITS. This includes financial help for involved players as well as the provision of incentives of collaboration and joining the Eco-System. It is complementary to all other roles related to the implementation of MMITS.

Regulation:

The role of regulation applies to the institutions that set the regulatory framework for collaboration within the MMITS Eco-System. Setting up the regulatory framework is a very complicated task may vary between self-determination by the industry and full regulation by the EC, including the appropriate application or development of existing regulatory obligations on the institutions/players in the market. For the regulator, it is essential to take into account interests of all players involved to set up a successful framework.

Institutions:

AO: Airline Operator, e.g. Lufthansa, Air France, etc.

RO: Rail Operator, e.g. SNCF, Deutsche Bahn, Trenitalia, BeneRail

LPT: Local Public Transport Operator, e.g. TransDev etc.

LPA: Local Public Transport Authorities

Asoc.: Associations, e.g. UNIFE, IATA, etc.

OTA: Online Travel Agencies, e.g. Opodo, etc.

MSE: Mesta Search Engines, e.g. Waymate, Swoodoo, etc

Sw-P.: Software provider, e.g. AMADEUS, etc.

EC: European Commission

8.2 Scenario Building

Based on work packages 2 and 3, we can now provide a framework concerning possible scenarios that will be further analysed in this work package. The starting point of all scenarios is the status quo of today. Different scenarios incorporate different possible future developments of the MMITS ecosystem. The scenarios result from different levels of regulation and intervention by the European Commission. Therefore, the changing variable is the intensity of intervention, because the goal of the study is to develop policy and regulatory recommendations for the EC. In addition, the intensity of intervention is strongly connected to the degree of collaboration in the market. In a first assessment a hypothesis is that a higher intensity of collaboration on a voluntary basis reduces the necessity of intervention by the European Commission. The outcome of the scenarios, in any case, is a working MMITS solution based on different levels of the apportioning of collaboration and intervention.

In general, different possible patterns of regulatory intervention with different characteristics are in use on the EU-level that will be used in our scenario building. First of all we address the level of recommendations/guidelines. Recommendations and/or guidelines are not binding for the EU-member countries or any other legal entity in the EU. A guideline allows the EC to suggest a line of action e.g. for the development of a MMITS market without imposing any legal obligation on those to whom it is addressed.

Guidelines have to be distinguished from stricter forms of intervention like directives or regulations. When the EU adopts a legislative act in the form of a directive, a specific goal is set that all EU-countries have to achieve. However, it is up to each individual member country how to reach this goal (certainly within a specified period of time). Apart from this, the aims of the EU can be enforced by intervention and regulations. A “regulation” in this specific sense means a binding legislative act that must be applied across the EU and is directly putting obligations on the entities addressed without additional legislative procedures on the national level.

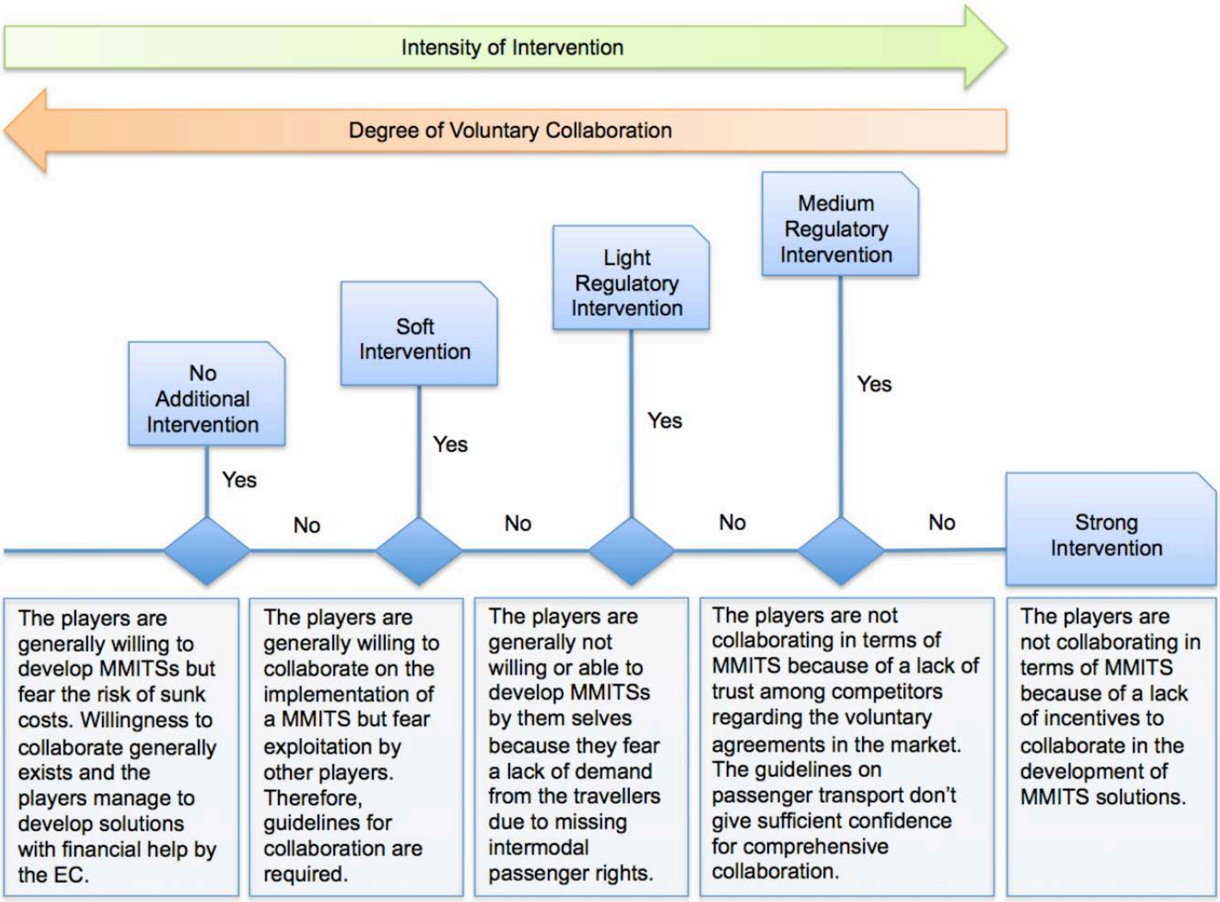

Figure 88: Stepwise Scenario Development
Source: Own figure.

Firstly, we describe framework scenarios, which show extreme potential developments - a lower baseline scenario and an upper baseline scenario. These scenarios are supposed to draw up a framework for the development of further, more realistic scenarios. The upper baseline scenario describes a future where the market is not able to develop MMITS systems on its own and strong intervention by the EC is necessary, whereas the lower baseline scenario describes a future where the market is able to develop MMITS solutions mostly on their own on the basis of currently existing and recently launched regulation. Based on those scenarios, three moderate scenarios that show possible forms of intervention by the EC within the range of the two framework scenarios are derived. It has to be mentioned that the scenarios are built consecutively. That means a scenario with additional regulatory measures (e.g. the medium regulatory intervention scenario) contains the interventions already incorporated in all scenarios with a lower intervention intensity (e.g. the light regulatory intervention scenario). In all scenarios, the combination of intervention/regulation by the EC and collaboration by the players leads to the realisation of a MMITS.

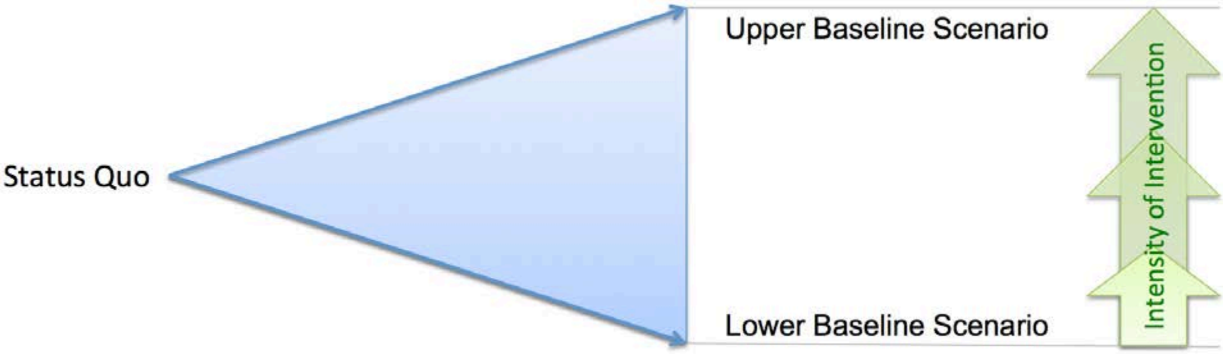

Figure 89: General Scenario Funnel for MMITS Development
Source: Own figure.

8.3 Framework Scenarios

8.3.1 Lower Baseline (No Additional Intervention) Scenario

The basic scenario is the 'No Additional Intervention Scenario'. It assumes that no further intervention by the EC is necessary compared to the regulatory framework of today and the regulatory measures already planned and introduced by now. This includes that regulation such as TAP-TSI are fully implemented and running successful. On the one hand, the market actors behave freely without additional specific restrictions in this scenario, and are only constrained by national and European competition law. On the other hand, a high intensity of industry collaboration will lead to market-based MMITS solutions. Initiatives such as the Full Service Modell (FSM)[34] and Shift2Rail[35] are completed and proved to be successful. The scenario only assumes supportive action by the European Commission. Financial support for research and development of possible standards and solutions by the EC supports the development of MMITSs. This is supposed to promote research and development in Europe and to help the players involved in finding common solutions for the implementation of MMITSs without forcing them.

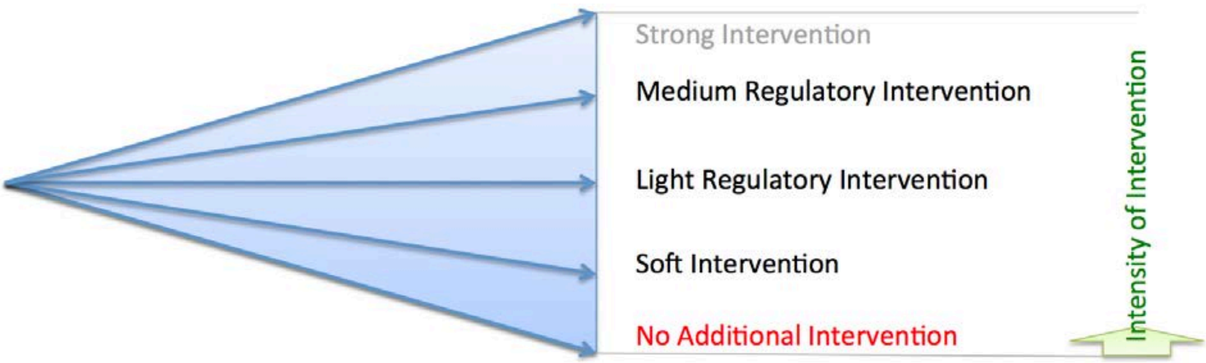

Figure 90: No Additional Intervention Scenario
Source: Own figure.

[34] For a further description of FSM see chapter 5.3.2.4
[35] For a further description of Shift2Rail see chapter 5.3.2.3

Strategic Dimension

In this scenario, collaboration with reference to a MMITS ecosystem is characterised by an atmosphere of mutual trust among the players.

Due to the confidence that players being involved in the ecosystem do not exploit each other, they are able to set up rules for their collaboration all by themselves (self-regulation). Each of the players takes on a specific role in the MMITS ecosystem, which is characterised by non-discriminatory access and the possibility to join or to leave at any time. Access to the ecosystem is free of discrimination but follows a certain set of rules building a governance framework for the collaboration.

Every player taking part in the development of the MMITS ecosystem is interested in certain assets developed within the system. This aligns the commercial interests of the players involved and thereby supports future collaboration of the industry. Due to the fact the ecosystem as such is open source, several solutions from different providers may exist on the market that make use of the non-discriminatorily accessible framework, enabling several MMITSs to become reality. Thereby, several players are able to use this framework and compete on the market for multimodal travelling. This leads to a situation where the players are aiming to better suit the traveller's needs and improve their product in order to gain a larger market share. This market is only based on the mutual open source MMITS ecosystem. This collaborative open innovation process strengthens the relation between the players. Every single player relies on the collaboration with the other players in order to optimise their businesses. As one player did the first step into collaboration and mutual trust, the other players follow. If one player defects, he is punished directly but, according to the 'tit-for-tat' strategy, subsequently integrated in the collaboration again.

This collaborative open innovation process strengthens the relationship between the players. Every single player relies on the collaboration of the other players in order to optimise their business. As one player did the first step into collaboration and mutual trust, the other players follow. If one player defects, he is punished directly but, according to the 'tit-for-tat' strategy, subsequently integrated in the collaboration again.

Despite the fact that local public transport and rail carriers are facing additional players in their distribution value chain and thereby the share of indirect distribution in their field might rise, they realised that they have certain advantages by using the MMITS ecosystem.

If there were no common European standard on passenger rights, the willingness to switch to multimodal travelling would be limited due to reliability issues. In this scenario, transport operators decide to provide a connection guarantee and to improve re-accommodation possibilities in case connections are missed due to delays by the previous carrier to solve this problem.

Role Allocation

In this scenario, the roles are allocated to achieve the best possible results with reference to the MMITS. The allocation is made according to the meta-interests of the industry players, the European Commission and the travellers.

The system development is executed in a collaborative innovation process by an alliance of the European transport operators, associations, online travel agencies and software providers. They all have a high acting intensity as they are developing the MMTS ecosystem in a collaborative manner. Complementary to this, the system provision is mainly executed by online travel agencies and/or software providers because they have core competencies in online solutions. In this role, the transport operators and associations are only involved with a low acting intensity on a consulting basis. Associations fill the role of settlement/clearing. As they are the sole actor in this role, the associations act in a high intensity as well.

Regarding the topic of distribution, on the B2C level, the transport operators and the online travel agents show a high acting intensity. The transport operators and travel agencies are responsible for the complete distribution to the end user and / or traveller. Because the MMITS ecosystem is based on a non-discriminatorily accessible open source approach the role of B2B distribution is not required.

The operation of transport as such is done by the transport operators / carriers in a high acting intensity. As those are in charge of the vehicles, they may also be able to provide information about timetables, fares and any other relevant information and thereby fill the role of information supply. Additionally to the transport operators, also associations are involved, e.g., in case of small operators that are not able to handle this all by themselves.

The task of standardisation is crucial in this scenario. As the industry is implementing the MMITS ecosystem, they do also develop certain standards to fulfil the needs of the traveller with respect to the MMITS. Therefore, transport operators and associations, as well as software providers, are acting highly intensive in the development of standards. These standards contain data transfer / information access, passenger rights and interoperable ticketing.

The customer service (on-board as well as pre- and post-trip) is a role that is taken on by transport operators and online travel agents. Depending on the terms and conditions the travel agencies or the transport operators are liable for customer care.

Promotion and support of the MMITS ecosystem, in this scenario, lies mostly in the hands of the transport operators as they implement MMITS all by themselves. The EC is only acting with a low intensity. In this more or less autonomous approach, the players in the market are also responsible for the self-regulation regarding the MMITS.

Summary

The allocation of roles and the willingness of collaboration are complementary in this scenario. This is mainly based on the fact that players in the market trust each other regarding the development of MMITS. Referring to the game theory, the players collaborate to realise the highest possible overall pay-off. The ECs efforts to intervene and to regulate the market can be held rather low while the cartel authority will be in charge to make sure that collaboration is limited to the implementation of the ecosystem. In a collaborative open innovation process, existing MSEs and OTAs, as well as transport operators (carriers) develop multimodal solutions by themselves. Services and corresponding business models evolve. In addition to bilateral contracts, transport operators set industry standards for multimodal ticketing and settlement by themselves. In this scenario multimodal travel information will soon be available throughout Europe on a market basis. External standards and regulations like TAP-TSI are successfully implemented and running. Self-regulation by the market players exceed existing regulations and bring MMITS to success.

8.3.2 Upper Baseline (Strong Intervention) Scenario

This framework scenario assumes that the market players are not willing or able to implement MMITS systems on their own. Industry collaboration only exists on an occasional bilateral basis and the players are not cooperating for the implementation of MMITS. Therefore, the European Commission has to intervene heavily to successfully realise a MMITS for Europe.

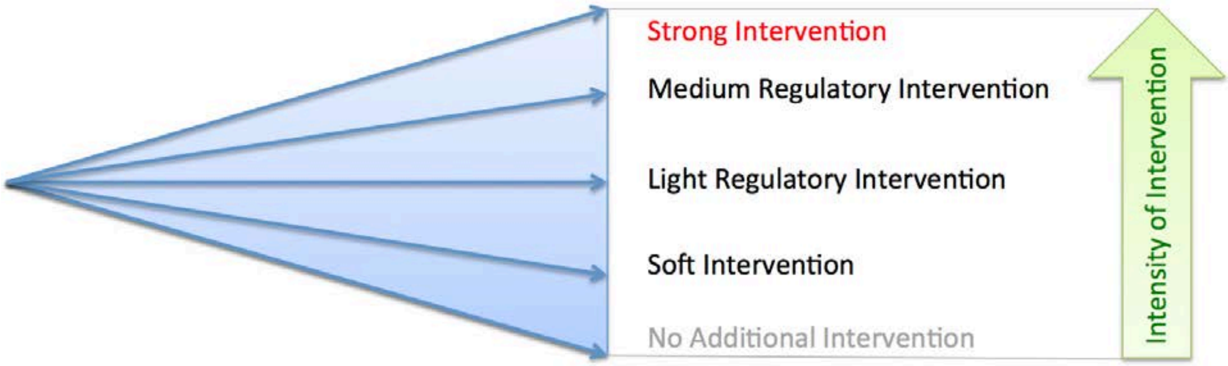

Figure 91: Strong Intervention Scenario
Source: Own figure.

Strategic Dimension

Regarding collaboration with reference to a MMITS ecosystem, the players in the market act in an atmosphere of mutual suspect. Due to the prejudices that players involved in the development of a common ecosystem would exploit each other and act selfishly, the willingness to collaborate is very low. When each of the players takes on a role in the MMITS ecosystem environment, the commitment is also very low. This leads to only limited provision of information access and a bad success of MMITS ecosystem.

Several standards have to be developed within the ecosystem on a collaborative basis to make a MMITS working. Unfortunately, and due to a lack of willingness to collaborate, only a limited number of services are available on the market. This is also based on the fact that there is not any kind of aligned interest among the players. According to game theory, the competitive players choose the dominant strategy of defection. They also do not realize possible commercial benefits from providing a MMITS. As travel information and ticketing services are not running with high quality data, usefulness for the traveller is very limited.

Under these presumptions, a MMITS will only be realised under strong influence and supervision by the EC. The EC is interested in making a MMITS running because of the expected benefits for the society as a whole. In this scenario it would be necessary to put a strict obligation on transport operators, OTA's and other players in the market to build MMITSs. They will be forced to participate in all MMITS solutions that are built according to the specifications of the EC, to share information and to offer a pre-defined set of services to the customers.

Because the industry does only reluctantly participate in the implementation process, transport operators and service providers will have to live with the circumstances that evolve from a centralised solution. It is quite clear that the innovatory strength of this solution is quite low. Therefore, customer needs are not sufficiently matched by MMITS ecosystem.

Role Allocation

In the strong intervention scenario, the roles are allocated with the goal to realise MMITS solutions for the benefit of the European traveller on a centralised basis, supervised by the EC.

Solely software providers working under the supervision of the European Commission execute the system development. Therefore, both are under a high acting intensity while associations are only involved in an advisory function with a mostly low acting intensity.

Complementary to this, the software provider that is in charge of the development is also responsible for the system provision. Again, this is done under the supervision of the EC as they are, at least partially, the principal of the MMITS solution.

Associations fill the role of settlement/clearing. As they are the sole actor in this role, the associations act in a high intensity as well.

Regarding the topic of distribution on the B2C level, the transport operators, online travel agents and meta-search engines show a high acting intensity. These players are responsible for the complete distribution to the user and / or traveller. The B2B distribution though is done by the software provider on behalf of the European Commission, who is, at least partly, owner of the solution.

Transport operation as such is done by the transport operators / carriers in a high acting intensity. As those are in charge of the vehicles, they may also be able to provide information about timetables, fares and any other relevant information and thereby fill the role of information supply. In addition to the transport operators, also associations are involved, e.g., in the case of small operators that are not able to handle this all by themselves. In this case, this is complementary to the role of regulation as the scope of information supplied relies on EC intervention.

The task of standardisation obliges mainly to the EC because the industry is not willing or able to implement the MMITS ecosystem and to collaborate in the implementation of the MMITS.

The customer service (on-board as well as pre- and post-trip) is a role that is filled by transport operators and online travel agents. Depending on the terms and conditions the liability for customer care is on the travel agencies side or the transport operator's side.

Promotion and support of the MMITS ecosystem, in this scenario, lies mostly in the hands of the European Commission as they managed the implementation of MMITS. Although there is a certain participation of the industry players in the process of implementation, the EC is the driving force, supported by software providers. This leads to the role of regulation, which is also filled by the EC.

Summary

Due to a lack of collaboration in the industry, the EC was required to realise the MMITS solution under their own steam. Transport operators, online travel agents and other players in the industry are forced to join the MMITS and to behave according to the strict regulations set by the EC. These regulations are, for example, the obligation for European Transport Operators to offer multimodal journey planning and ticketing to a wide group of passengers by 2020. To achieve this goal, players that do not take part in the implementation of MMITS and are not ready by 2020 are penalized by the EC. As the MMITS works as a centralised platform that is not under control of the transport operators in any way, the innovatory strength is quite low.

As an alternative to the obligation of implementing MMITS, the EC may call for tender for the development of a MMITS solution. Players in the market may apply to the call for tender to develop a central MMITS platform. The development is then funded by the EC. As a result, the EC is the owner of the MMITS ecosystem and imposes all carriers to take part in MMITS and to provide all required information to the platform. While the EC is the owner, the platform is still run by the company/consortium that won the call for tender for MMITS implementation. They are also responsible for maintenance and further development of the platform.

8.4 Moderate Scenarios

The moderate scenarios are positioned within the funnel drawn up by the mostly unrealistically created upper and lower baseline scenarios. These scenarios serve as a basis for feasible options of regulation and intervention by the EC, and for potential initiatives taken by the transport operators to implement a market based solution. Collaborative action by the market players and potential regulatory intervention by the EC add up to a working MMITS.

8.4.1 Soft Intervention Scenario

The players in the market for multimodal journey planning and ticketing are generally willing to set up a MMITS solution for Europe and tend to collaborate. Collaboration may become disappointing because at first there is no common approach on how to implement a MMITS ecosystem in the industry. The players take financial help by the European Commission to launch research projects and to develop a concept for a MMITS. Although the players are highly motivated and willing to collaborate, a sense of risks remains with respect to the level of collaboration. They might fear that other players take advantage of their openness and therefore share only basic information. Because the players are also not sure whether collaboration would be fruitful, some support from outside the market would help to overcome the obstacles.

As pointed out in earlier work packages, local public transport is marked by a special framework regarding structure and financial circumstances as they are mainly owned by public transport authorities. To be able to successfully participate in a MMITS, local public transport has to dedicate a high effort to the adaption and standardisation of its systems. The financial disadvantages resulting from these efforts can have negative effects on the local public transport's ability to participate in MMITSs and to serve the citizen. Therefore, the EC decides to allocate compensations to the LPT to avoid financial disadvantages.

The EC therefore decides to develop recommendations in order to set a framework for collaboration among the players in the market for passenger transport. These guidelines are meant to facilitate the collaboration among transport operators, OTAs and any other players participating in the market. The EC also provides recommendations how information should be shared in a MMITS, e.g. that schedule information should to be published as raw data while fare and availability information has to be shared on request via API access, but such recommendations are not mandatory. A voluntary set of rules for charges for information provision is also parte the MMITS guidelines. The guidelines are thereby meant to protect players from exploitation by other players and to ensure comprehensive information provision as well as non-discriminatory access.

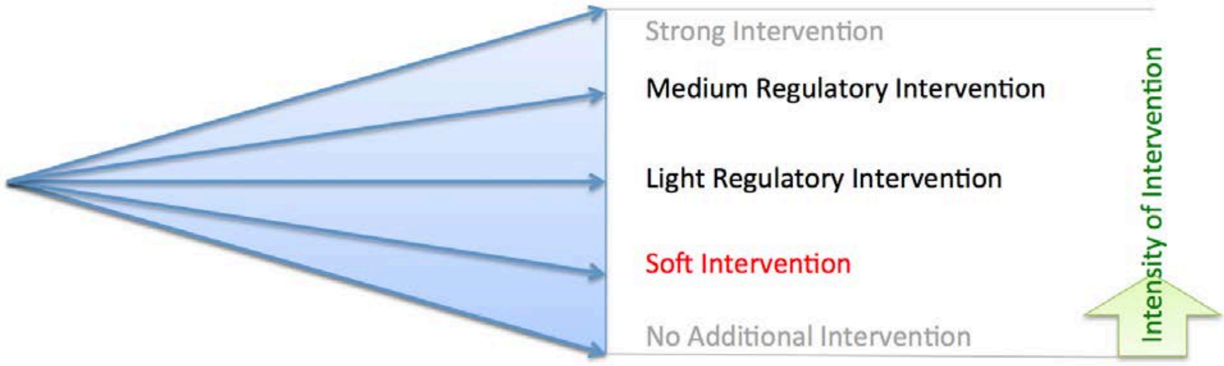

Figure 92: Soft Intervention Scenario
Source: Own figure.

Strategic Dimension

In this scenario, collaboration with reference to a MMITS ecosystem is voluntarily intended by the players in the market, but there is the problem to set up an institutional framework for this collaboration and to make collaboration starting.

Although it might be a chance to optimize their business, competitors in the market struggle to collaborate with each other due to the fear of losing a competitive advantage. Additionally, they don`t assess the advantages they could gain (additional passengers, better information on passenger profiles) high enough to enter the risk of coopetition in the market.

The players being involved in the ecosystem do not have sufficient confidence in the quality of collaboration at first, but this obstacle can be broken through by EC guidelines for collaboration that make sure that information or data provision is made under secure circumstances, because the industry players want to collaborate generally. Within the institutional framework of the EC-guidelines, the players in the market voluntarily commit to a common standard for sharing timetables and to provide API access to each other. API access though is only given free of charge to each carrier’s business partners. Other players in the market are charged a reasonable fee, which is also calculated according to the guidelines. The access to API is non-discriminatory, meaning no request may be refused and fees always have to be reasonable. It is important to mention that information provision and retailing need to be distinguished. Carriers are encouraged to open their retailing to third parties, but it is still based on business agreements.

Role Allocation

In the soft intervention scenario, the roles are allocated with the goal to establish a MMITS solution within the borders of the passenger transport guidelines established by the EC. The allocation is made according to the meta-interests of the industry players, the European Commission and the travellers.

The system development is executed in a collaborative innovation process by an alliance of the European transport operators, associations and online travel agencies. This alliance is driven by software/systems providers that take on the leading role in the development of standards and suitable software. The latter have a high acting intensity as they are mainly developing the MMITS ecosystem. The other players act with a medium intensity. They fulfil dominantly a consulting role. Complementary to this, the system provision is mainly executed by online travel agencies and/or software providers because they have core competencies in online solutions. In this role, the transport operators and associations are only involved with a low acting intensity on a consulting basis.

Associations fill the role of settlement/clearing. As they are the sole actor in this role, the associations act in a high intensity as well.

Regarding the topic of distribution, on the B2C level, the transport operators and the online travel agents have a high acting intensity. The transport operators and travel agencies are responsible for the complete distribution to the user and / or traveller.

While the MMITS standard as such is open source, the software is not. Therefore carriers might use/implement their own solutions based on the common standard or used licensed software from other players, e.g. software providers.

The operation of the transport as such is done by the transport operators/carriers in a high acting intensity. As those are in charge of the vehicles, they may also be able to provide information about timetables, fares and any other relevant information and thereby fill the role of information supply. Additionally to the transport operators, also associations are involved, e.g., in case of small operators that are not able to handle this all by themselves.

The existing market players mainly do standardisation on their own. While the industry is implementing the MMITS ecosystem as such, the EC provides the players with a set of voluntary rules. These rules cover information provision, passenger rights and interoperable ticketing. The software providers are acting highly intensive while carriers and other players mainly act with a medium intensity. LPT, in turn, has a lower acting intensity as they depend to a certain extent on the financial support of the EC to successfully participate in the standardisation process.

The customer service (on-board as well as pre- and post-trip) is a role that is filled by transport operators and online travel agents. Depending on the terms and conditions the liability for customer care is on the travel agencies side or the transport operators' side.

Promotion and support of the MMITS ecosystem, in this scenario, lies in the hands of the transport operators, software providers and the EC.

The task of regulation is partly filled by the EC through the establishment of the passenger transport guidelines. Although there is a certain promotion by the EC in terms of basic regulations, the EC is only acting with a medium intensity as the guidelines are not a regulation as such but a set of voluntary rules.

Summary

Although collaboration with reference to a MMITS ecosystem is voluntarily intended by the players in the market, there is the problem of making collaboration feasible within a suitable institutional framework. Therefore EC offers a framework for collaboration by defining guidelines for collaboration in the MMITS ecosystem. The guidelines by the EC provide a voluntarily accepted regulatory approach that contains information provision, retailing agreements, passenger rights and reaccommodation agreements as well as the necessary data standards. These (non-mandatory) recommendations apply to all players in the European market for passenger transport

8.4.2 Light Regulatory Intervention Scenario

This scenario assumes that the players involved in the market are generally willing to implement MMITSs by themselves supported by applicable guidelines and recommendations developed by the EC. The implementation is hindered, however, by a lack of common EU-wide passenger rights regarding the case of re-accommodation in case of delays and missed connections and covering all modes. The players fear that a MMITS will not be used by the traveller due to the uncertainty of multimodal travelling terms and conditions.

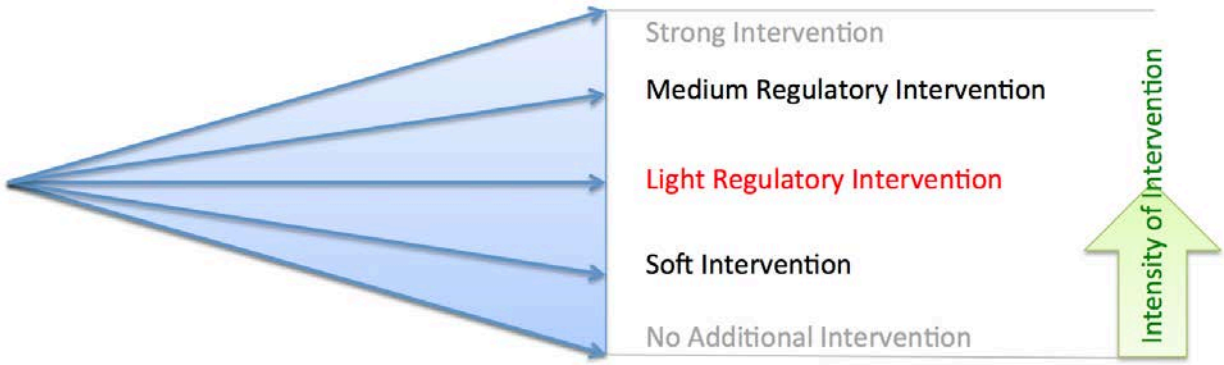

Figure 93: Light Regulatory Intervention Scenario
Source: Own figure.

While several service providers offer multimodal journey planning, travellers always bear the risks of missing connections. This is counterproductive to the idea of multimodal travelling in general and with respect to the idea of modal shift as intended by the EC. Therefore, the reinforcement of passenger rights, particularly in case of incidents and delays for which passengers are not responsible, may motivate more travellers to shift to multimodal travelling as reliability increases. This implies a harmonisation of European passenger rights across all travel modes to a high customer oriented level. In detail, it must be guaranteed that travellers can continue their multimodal journey, without additional costs for re-accommodation in case of missing connections. Therefore, the EU provides a regulation on passenger rights in European multimodal travelling.

Strategic Dimension

Despite the existence of MMITS guidelines by the EC, an atmosphere of rudimentary mistrust can be observed in The MMITS ecosystem. Mistrust is mainly caused by the issue of missing regulation of terms and conditions regarding multimodal travelling. The conditions, e.g. for re-accommodation in case of missing connections, are only stated as a voluntary guideline in the passenger transport guidelines. Due to the fact that re-accommodation may mostly be 'last minute', official fares might be extremely high with respect to yield management based pricing. Carriers and OTAs fear those extremely high additional costs and therefore struggle to implement a working MMITS solution. This may additionally raise prices for multimodal travel products as merchants face the risks of re-accommodation that will have to be insured. These insurance premiums will most likely be added to the retail price. Therefore, a regulation for the last-minute re-accommodation is also required for the supply side.

Role Allocation

In the light regulatory intervention scenario, the roles are allocated with the goal to establish a MMITS solution within the framework of the passenger transport guidelines established by the EC and based on an additional regulation on passenger rights and re-accommodation. The allocation is made according to the meta-interests of the industry players, the European Commission and the travellers.

The system development is executed in a collaborative innovation process by an alliance of the European transport operators, associations and online travel agencies. The process is supported by the EC with a low acting intensity, making sure the solution does not provide any advantages to single carriers or players. This alliance is led by software providers that take on the leading role in the development of standards and suitable software. They have a high acting intensity as they are mainly developing the MMTS ecosystem. The other players act with a medium intensity (mainly consulting activities). Complementary to this, the system provision is mainly executed by online travel agencies and/or software providers because they have core competencies in online solutions. In this role, the transport operators and associations are only involved with a low acting intensity on a consulting basis.

The role of settlement/clearing is filled by associations. As they are the sole actor in this role, the associations act in a high intensity as well.

Regarding the topic of distribution, on the B2C level, the transport operators and the online travel agents have a high acting intensity. The transport operators and travel agencies are responsible for the complete distribution to the user and / or traveller.

While the MMITS standard as such is open source, the software is not. Therefore carriers might use/implement their own solutions based on the common standard or used licensed software from other players, e.g. software providers.

The operation of the transport as such is done by the transport operators / carriers in a high acting intensity. As those are in charge of the vehicles, they may also be able to provide information about timetables, fares and any other relevant information and thereby fill the role of information supply. Additionally to the transport operators, also associations are involved, e.g., in case of small operators that are not able to handle this all by themselves.

The task of standardisation is mainly filled by the EC through the establishment of the basic passenger transport guidelines. While the industry is developing the MMITS ecosystem as such, the EC provides the players with a set of rules. These rules contain data transfer / information access and interoperable ticketing. Additionally, a regulation for Europe-wide passenger rights is established by the EC, which means a high acting intensity.

The customer service (on-board as well as pre- and post-tri) is a role that is filled by transport operators and online travel agents. Depending on the terms and conditions the liability for customer care is on the travel agencies side or the transport operators side.

Promotion and support of the MMITS ecosystem, in this scenario, lies in the hands of the transport operators, software providers and the EC.

While the players in the market act within the regulatory framework given by the general MMITS guidelines, the definition and enforcement of passenger rights affords a high acting intensity of the EC.

Summary

The players involved in the MMITS market are generally willing to offer adequate MMITS services, but the implementation is hindered by a lack of common EU-wide passenger rights regarding the case of re-accommodation in case of delays and missed connections.

The EU sets up new passenger rights regulations that protect the traveller and provides equal risks and opportunities to the players in market. The regulation does not only contain passenger rights but also regulates the conditions on the supply side. To tackle the issue of mistrust, this regulation defines a directive on how carriers interact among each other in settling re-accommodation for travellers.

Based on the passenger transport guidelines and the Europe-wide passenger rights regulation for multimodal travelling, the players in the market are able to implement a working MMITS ecosystem that is accepted and used by all European passenger transport operators and (online) travel agencies. Due to common passenger rights across boarders and across travel modes, multimodal travelling is also well accepted among European travellers.

8.4.3 Medium Regulatory Intervention Scenario

The next level of intervention leads to the medium regulatory intervention scenario. Again, the market players are not able to implement MMITSs by themselves. Industry collaboration only exists on an occasional bilateral basis and the players are not cooperating for the implementation of MMITS. Therefore, the European Commission has to intervene with higher intensity. In addition to the abovementioned regulation of passenger rights and the passenger transport guidelines, the EC now sets an obligation for carriers to publish schedule, fare and availability information and to develop an industry standard for data exchange and provision by an EU directive or regulation.

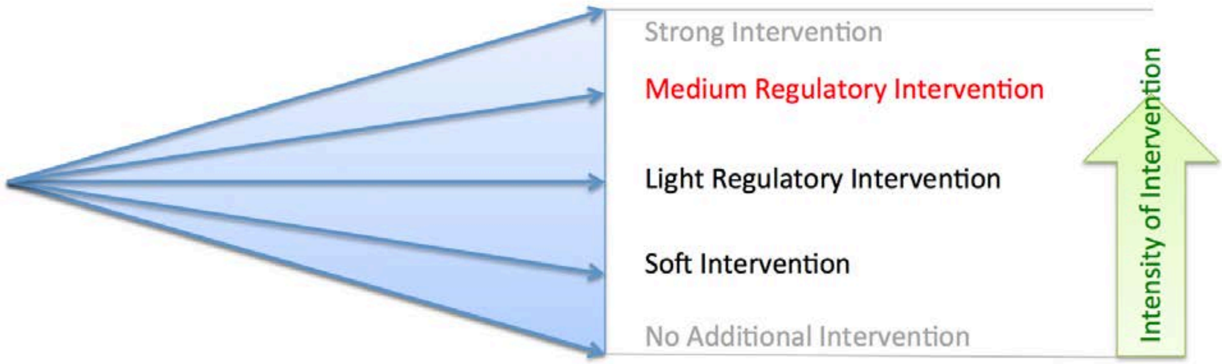

Figure 94: Medium Regulation Scenario
Source: Own figure.

Strategic Dimension

Regarding collaboration with reference to a MMITS ecosystem, the players in the market act in an atmosphere of mutual suspect. When each of the players takes on a role in the MMITS ecosystem environment, the commitment is also very low. This leads to only limited provision of information access and a bad success of MMITS ecosystem. Willingness for collaboration may generally be found, but the implementation of MMITS is not successful because players in the market do not trust in each other's commitments, e.g. to the passenger transport guidelines. Players still fear exploitation by the competitors in the case of collaboration. This fear is mainly based on a lack of trust and control. Therefore, players in the market only collaborate on a very limited basis.

Thus, collaboration is fostered by a directive for multimodal travelling that is based on the multimodal passenger transport guidelines, making them mandatory. Such a directive regulates the provision of information about schedule, fares and availability with regard to a MMITS. The necessary condition for implementing a MMITS is that transport operators publish high-quality rich data to create equal opportunities on the market for MMITSs. This may evolve, for example, in the form of an API deployment obligation. This means that transport operators are obliged to give access to their web service API to third parties and other carriers in Europe. Schedule information may also be published as raw data while dynamic information like availability and fares may only be published via API requests. Information on availability, however, does not mean the transport operator has to report the overall number of seats available, but to confirm at least a number of e.g. 9 seats is still available.

Role Allocation

In the medium regulatory intervention scenario, the roles are allocated with the goal to establish MMITS solutions based on additional regulation on passenger rights and re-accommodation and a regulatory approach in order to change the European passenger transport guidelines into a mandatory regulation. The allocation is made according to the meta-interests of the industry players, the European Commission and the travellers.

The European transport operators, associations and online travel agencies, execute the system development in a collaborative innovation process. The process is supported by the EC with a medium acting intensity, making sure the solution does not provide any advantages to single carriers or players. This alliance is led by software providers that take on the leading role in the development of standards and suitable software. They have a high acting intensity as they are mainly developing the MMTS ecosystem. The other players act with a medium intensity. Complementary to this, the system provision is mainly executed by online travel agencies and/or software providers because they have core competencies in online solutions. In this role, the transport operators and associations are only involved with a low acting intensity on a consulting basis.

The role of settlement/clearing is filled by associations. As they are the sole actor in this role, the associations act in a high intensity as well.

Regarding the topic of distribution, on the B2C level, the transport operators and the online travel agents have a high acting intensity. The transport operators and travel agencies are responsible for the complete distribution to the user and / or traveller.

While the MMITS standard as such is open source, the software is not. Therefore carriers might use/implement their own solutions based on the common standard or used licensed software from other players, e.g. software providers.

The operation of the transport as such is done by the transport operators / carriers in a high acting intensity. As those are in charge of the vehicles, they may also be able to provide information about timetables, fares and any other relevant information and thereby fill the role of information supply. Additionally to the transport operators, also associations are involved, e.g., in case of small operators that are not able to handle this all by themselves.

In this scenario, the task of standardisation is mainly filled by the EC through the establishment of the passenger transport guidelines. While the industry is implementing the MMITS ecosystem as such, the EC provides the players with a set of mandatory rules. These rules contain data transfer / information access, passenger rights and interoperable ticketing. In this case, the EC , as the EC is the initiator of the regulation is acting highly intensive while carriers and other players mainly act with a medium intensity.

The customer service (on-board as well as pre- and post-trip) is a role that is filled by transport operators and online travel agents. Depending on the terms and conditions the liability for customer care is on the travel agencies side or the transport operators side.

Promotion and support of the MMITS ecosystem, in this scenario, lies mostly in the hands of the EC. As there is a strong promotion by the EC in terms of regulation, the EC is acting with a high intensity. The guidelines evolve to a regulation and are no longer a set of voluntary rules.

Summary

Because collaboration between the players in the transport and travel industry in order to develop a pan-European information and ticketing system does not work successfully, the EC replaces their non-binding recommendations for the development of a MMITS by a legislative approach (EU-directive or regulation). Transport operators are forced to establish a common data access standard. This standard is used for multimodal ticketing via open ticketing interfaces and information provision within the MMITS ecosystem. In consequence, seamless booking and ticketing is possible. Carriers and (online) travel agents can process booking and ticketing via direct access to the operators' booking interface.

8.5 Overview of Scenarios

When considering the different scenarios, it appears that a certain relation between the intensity of intervention and the degree of collaboration exists (see Fig. 7). Intervention by the EC might compensate for the absence of collaboration, in particular among competitors in the market. While the intensity of intervention can never be put back to zero, it can be minimised if the degree of collaboration rises. This is particularly true for the implementation of MMITSs on a large scale.

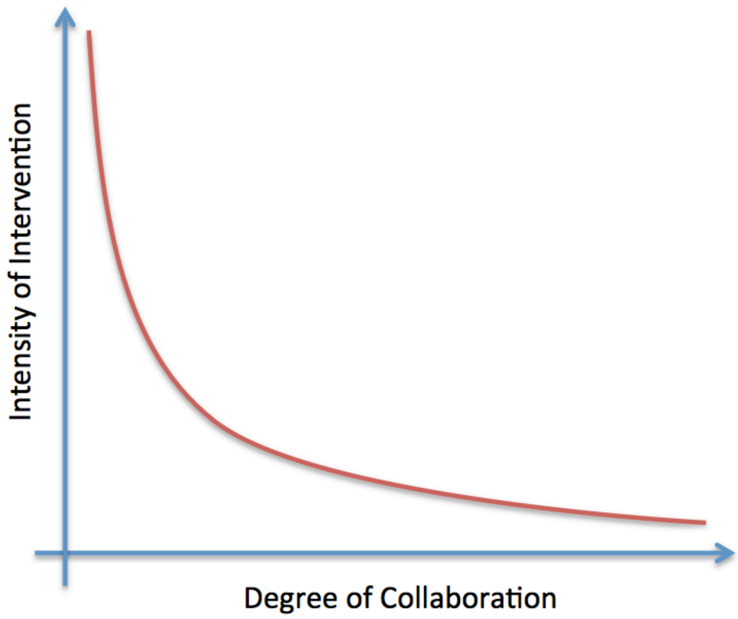

Figure 95: Cohesion of Intervention and Collaboration for MMITSs.
Source: Own figure.

As the EC has set the goal of making MMITS widely publicly available, they might be willing to accelerate the implementation of multimodal journey planning and ticketing through interventions and regulations if the industry is not able or willing to do it by themselves. Therefore, the European Commission supports the market with research funds and subsidies and will offer guidelines and recommendation to the industry. If this does not come to fruition, further regulations might be necessary to reach the EC's goal of a Multi Modal Information and Ticketing System. It is important to make clear that the EC's goal is not a central platform, but the opportunity for travellers to book a pan-European journey with a one-stop-shop solution.

The table below shows a comprehensive overview of the individual scenarios and possible intervention and regulation.

Scenarios	Intensity of Intervention / Regulation
No Additional Intervention (Lower Baseline Scenario)	No additional intervention/regulation necessary. Current regulations are successfully applied and no further regulations by the EC are necessary as the players decide to set up rules on the implementation of a MMITS on their own. Research and development funding continues. FSM and Shift2Rail are implemented successfully. LPT and PSO operators receive compensation for standardisation efforts.
Soft Intervention	Establishment of "European Passenger Transport Guidelines". These guidelines give a voluntary framework to all European transport operators on the implementation of a MMITS. There are recommendations on topics such as information provision, re-accommodation and multimodal passenger rights. The EC and the European transport operators develop the guidelines in a collaborative way.
Light Regulatory Intervention	Establishment of European passenger rights in order to guarantee that travellers can proceed their multimodal journey without additional costs for re-accommodation in case of missing connections. This regulation does not only include rights of passengers but also obligations of carriers, e.g., by defining rules to set fees for multimodal re-accommodation.
Medium Regulatory Intervention	Obligation to provide information for all transport operators. Based on the "European Passenger Transport Guidelines", the EC sets an obligation on carriers regarding aspects such as information provision and booking interfaces for multimodal travelling. In addition, LPT operators have to accept MMITSs as distribution channels.
Strong Intervention (Upper Baseline Scenario)	Obligation on carriers to offer multimodal journey planning across Europe to all travellers. Players in the market are forced to participate in MMITS on a non-discriminatory basis, to facilitate multimodal travelling across Europe.

Table 21: Overview of Scenarios and Possible Intervention and Regulation
Source: Own table.

9 Conclusions and Recommendations (WP7)

9.1 Conclusions

After having conducted an in-depth analysis, this chapter now presents conclusions that can be drawn on the basis of the previous work packages. These conclusions serve as the basis for recommendations that are derived afterwards. Conclusions can be drawn from the perspective of different players in the MMITS ecosystem, always taking into account that actions, efforts and challenges of certain players are usually linked to the needs and challenges of other players.

9.1.1 Consumer perspective

A MMITS is able to improve the customers' multimodality experience.

Work package 2 has provided an in-depth analysis of the customers' expectations when travelling and especially when travelling multimodally. Special issues could be found regarding the topic of complexity when travelling by several modes within one trip (during the shopping and ticketing process as well as on-trip). By providing one single point of information and ticketing access in the language of choice, complexity can be reduced for the consumers, and add visibility of better travel options than are currently available in one place today. This comes along with the idea of a mobility provider in contrast to a transport operator. A mobility provider is not focused on a certain mode or a limited number of operators but allows access to all different transport modes. In sum, the whole complexity behind billing and ticketing between different transport operators as well as regulatory and technical systems, should not burden the end-user. Different ticket-vending machines, price categories and fares currently are frustrating even for experienced travellers.

From the customer perspective a system of common multimodal passenger rights including re-imbursement and re-accommodation is necessary for the acceptance of a MMITS.
Switching between modes comes along with the uncertainty whether the connecting mode can be reached (e.g. in the case of unfortunate weather conditions). This has been shown in work package 2. If re-imbursement, passenger rights and re-accommodation do not underlie clear rules, complexity for the customer again increases in case of unforeseen occurrences. Consumers need to have transparency and a single point of contact, with regard to complaint-handling, re-imbursement and re-accommodation. Otherwise, dealing with several different transport operators, in different European countries and languages can make it impossible for consumers to exercise their rights. Also, consumers within Europe have to have the same legal claims regardless of the country, carrier or the mode of travelling. This means that every multimodal journey has to have one responsible actor. For example

consumers need to know where to turn to, if a missed connection leads to an over-night stay and they need to know who pays the additional costs.

Additional liability issues for the operators can lead to higher ticket prices when using a single multimodal ticket instead of several ones.
Work packages 2, 3 and 6 have pointed out the necessity of clear conditions for liabilities in case of delays, missed connections, etc. It has to be strictly defined who is in charge if the connection cannot be reached. For operators this can lead to additional liability claims. This additional risk can lead to higher ticket prices when booking a single multimodal ticket instead of separate ones due to the necessity of insuring this risk. This can especially be important with regard to price sensitive customers who might not be willing to pay an extra fee but would always prefer the cheaper offer – even if it implies more effort.

MMITS services should be provided free of charge to the customer in its initial phase.
In work package 6 was shown that potential MMITSs are marked by the characteristics of an experience good. This means that the full usefulness of the service usually is not recognized in advance but relies on the fact that users actually experience the service. This, in turn, can be one explaining factor why such a low willingness to pay on the customer side was shown in work package 2. The low willingness to pay can also be linked to the problem of information asymmetries as analysed in the chapter on market failure. Customers cannot be sure to receive correct and optimal information nor that information is available when needed in the case of on-trip information. Therefore, it is useful not to charge the customers in its initial phase but letting them experience the MMITS and building trust in the system. With the increased trust the willingness to pay might increase and a later charging of the customers becomes possible as soon as a critical mass of users has been reached. This is a common approach for experience goods. By providing a reliable regulatory framework to the customer, information lacks can be reduced and trust in a MMITS may be improved to increase market penetration.

Data privacy risks may not be a problem in advance but can cause severe and long-term issues once they have occurred.
Although the customer survey has revealed that customers currently do not see grave risks of data privacy, the topic may not be underestimated and has to be considered from the very beginning. For consumers the generation and systematic accumulation of individual movement patterns is already an issue. Data privacy should be integrated in the design of new services and the default options should always be the ones, submitting the least personal data as possible. General data protection principles regarding the: (1) manner and purpose of collection, (2) collection of information directly from individuals, (3) collection of

information generally, (4) storage and security, (5) access and amendment, (6) information use and (7) disclosure have to be respected and thought through.

9.1.2 Business perspective

In a competitive environment trust is required to make the actors collaborate on a voluntary basis.

Throughout the foregoing analysis it has been shown that collaboration is a core element to build a pan-European Multi Modal Information and Ticketing System. In work package 6 it was shown that collaboration requires mutual trust among the actors. To build up trust seems to be especially difficult among (potential) competitors. The problem was illustrated by the example of the provision of information using a game theoretic approach. If collaboration, however, is the necessary condition for the successful implementation of a MMITS, this problem has to be overcome. Scenario analysis provided a possible solution with the introduction of MMITS governance guidelines that serve as voluntary regulatory framework to enable the players to collaborate in an atmosphere of mutual trust and confidence. Trust can also be reinforced by promoting the fact that the operators have strongly complementary interests: Airlines strongly operate on long distances; rail is dominant on medium distances, local public transport on short distances.

The trust issue is important for established players as well as for new entrants. Additionally, new entrants often do not have enough incentives to enter the market if it is occupied by a group of strong incumbents. Therefore we need specific incentives for newcomers entering the MMITS market.

Carriers fear losing competitive advantages when providing information.

The forgoing work packages have shown that the provision of information is a core element. However, carriers assess information to be valuable. Therefore, having information someone else does not have, means having a competitive advantage. Therefore, the general attitude of “those who generate information are the owners of the information” dominates the market. The consequence is that the provision of information to a competitor equals the revelation of this competitive advantage. This general position towards information provision, however, complicates the necessary collaboration. However, this fear of competitive advantage loss can be compensated in an environment of mutual trust where the actors can be sure not to be the only ones providing information.

Carriers fear losing control over their distribution channels when participating in a MMITS.

In the previous analysis the general structure of a MMTIS was presented. It could be concluded that the participation in MMITS creates new distribution channels. However, carriers fear losing control over their distribution channels if their tickets can be sold by every MMITS provider. If MMITS systems are widely adopted, however, they become more attractive as distribution channels, and the use of MMITS as indirect distribution channels should increase.

A missing alignment of the actors' interests hinders the establishment of a successful MMITS.

Another factor that can make the establishment of a MMITS difficult is the fact that the players pursue individual interests. The individual interests of one actor are often in conflict with the individual interests of a competitor, such as gaining market share, maximising profit. This has been explained in work package 6 on the basis of the institutional role model approach. Traditionally, these goals are seen as achievable if someone else loses passengers, profit, etc. Therefore, the focus on the common goal – the successful implementation of MMITSs – has to be promoted. A helpful leverage can be the assumption that MMITSs can increase the number of passengers for all transport modes (incremental business). I.e. the operators will be able to serve a larger number of travellers. This can also result from a potential shift from car to other modes. However, the common goal does not necessarily have to be altruistically motivated. It goes along with the individual interests: The more operators participate in a MMITS, the better is the offer for customers which in turn leads to a better occupancy rate. Additionally, a travel companion can help to generate important customer insights into movement patterns, connections, etc. This information creates additional benefits for all participants which can help to align interest.

The fear of losing market share due to increased transparency dominates the players' actions.

Work packages 2 and 3 have shown that a MMITS can be able to increase transparency on the travel information and ticketing market by bundling information and presenting it clearly to the user. In the ideal case, it allows the customer to choose the subjectively optimal combination of modes which is far more difficult without MMITS because information is harder to find and compare. However, it has to be clarified that each transport operator has its core competencies, such that increased transparency rather helps to optimise the offer because the modes and competencies can complement each other. Additionally, valuable input can be generated by collecting real-time information, e.g. regarding connecting transport modes, which provides important customer insights as mentioned in the chapter on big data.

Local public transport operators need additional incentives to participate in a MMITS because of an asymmetrical distribution of costs and benefits.

While public transport authorities may see several benefits from MMITS, the analysis of the distribution of costs and benefits between MMITS providers and local public transport operators shows that MMITS providers gain more from collaboration than public transport companies. For both partners there are high costs to achieve standardisation, but there is no or low interest of public transport companies to enable ticket retail for third party providers.

In principle, however, there are no conflicting aims between these parties. From the MMITS providers' strategic point of view, involving public transport companies appears sensible. From the public transport companies' points of view, participating in MMITS causes additional costs and may lead to a loss of attractiveness of their own distribution and sales channels and occasional problems with the verifiability of tickets. However, in each case it must be checked to what extent MMITS providers can become more involved in the costs of standardisation or to what extent public transport companies can receive a greater share of indirect revenues.

In any case, if publicly funded, public transport companies should be obliged to enable ticket retail for third party providers. As most, if not all, public transport companies are publicly owned, or otherwise operate under PSO, it should be in the interest of their owners not to hinder the implementation of functioning MMITS platforms.

There are technological challenges but no general limitations for the implementation of a MMITS.

The analysis of work package 6 has shown that there are barriers regarding, e.g., the standardisation of data formats. This is because many regional or national operators use their individual technological solutions. However, there are no limitations or barriers that cannot be overcome. Different data formats, e.g., can be translated to a common standard by a suitable middleware. Only financial investments can be severe barriers or limitations.

The cost-benefit analysis shows that there is a relevant socio-economic benefit from offering a MMITS.

The use of a MMITS may lead to a modal shift from car to train, bus or aeroplane. Calculating the potential for modal shift a certain vehicle kilometre reduction potential can be identified. The reduced vehicle kilometres are leading to emission reductions. Due to reduced pollutant and CO2 emissions we calculate a net social benefit of at least 650 mn Euros p.a. from the MMITS on the EU28 level. To achieve a positive benefit-cost ratio, yearly costs to offer the MMITS services should not exceed this amount of money. Further efficiency gains for the transport network can be assumed, however, beyond the emissions reduction potential, . These gains, in turn, should have positive effects on the competitiveness of the European transportation network. However, these are intangible effects that cannot be quantified without further research.

9.1.3 Legal and Market Perspective

Legally, non-discriminatory access to schedule and fare data/information is the basis for a market-based development of a MMITS.

Work package 3 and 6 have pointed out that data access is a necessary condition to foster the development of a MMITS. Furthermore, it was pointed out that there is an intrinsic motivation for each player not to be the first to provide access to data. It has to be clear that non-discriminatory does not mean access free of charge. It only means that the fees have to be reasonable and all actors in the market are allowed to use the information once they have paid the fee. The baseline information for all further MMITS solutions is information about schedules. Without providing schedule information within the MMITS ecosystem, all further information about prices, availability, etc. are useless. Nevertheless, information about schedules, fares and availability together serve foundation for the MMITS ecosystem as a whole. As discussed, information provision hardly takes place on a voluntary basis without providing additional incentives to the actors. An adequate regulatory framework would allow the access to the necessary data on the one hand and make sure on the other hand that any undesirable exploitation by the participants is avoided. In any case, a possible regulatory framework has to take into account that there are also sensitive data, e.g. fares. Therefore, a one-size-fits-all solution for all kinds of information might not meet the transport providers' concerns when having to provide access to their information. In consequence, information provision as a combination of static timetables and API-based price, punctuality and availability information might offer a solution.

Additional effort on the EU-side is needed to prevent the emergence of anticompetitive behaviour due to collaboration of transport operators realising a MMITS.

The fostering of collaboration discussed in work package 6 can also have negative effects. These effects can be that operators no longer act competitively but start colluding with respect to their transport and travel offering. The consequence is that single routes could be monopolised. This monopolisation, in turn, would in turn lead to economic welfare losses and could have especially negative effects on consumers. Therefore, it is necessary to prevent this development in advance by considering regulatory interventions, following general competition law or expanding existing regulation to include the MMITS scope.

The fact that, according to economic theory, no market failure was identified, does not imply that regulatory intervention is not necessary.

An analysis in work package 6 showed that according to economic theory, market failure is unlikely to occur on the MMITS market. It was also shown that information asymmetries occur but they are very common to occur on almost all markets. However, it is not reasonable to attribute the term market failure in this case as the information asymmetries are likely to occur to a normal extent. Apart from that regulatory intervention might be helpful to establish a MMITS market on a pan-European scale.

9.2 Recommendations

Work package 6 of this study dealt with the barriers and limitations that may prevent a MMITS from becoming reality on a pan-European scale. Apart from technological challenges which seem ambitious but will not form a general barrier to the development of a MMITS, we identified collaboration issues as the most relevant topic to determine the success or failure of a MMITS. Cooperation and collaboration of all relevant players in the EU-travel and transport industry, possibly by the establishment of a new industry governance organisation among industry associations, seems to be the key for a successful development of a MMITS ecosystem on a pan-European-level. As it was shown by the development of the five scenarios, the necessary volume and intensity of intervention by the EC is strongly linked to the degree of voluntary collaboration. It results: The more collaboration occurs, the less regulatory intervention is required in order to develop a working MMITS and vice versa.

Putting together the scenario building and the assessment of barriers and limitations we are now able to develop recommendations based on the conclusions stated above. The assessment of barriers and limitations leads to the conclusion that the “medium regulatory intervention scenario” is the reference scenario, because genuine incentives for collaboration in the transport and travel industry are too weak and not equally distributed between the participants in order to build a pan-European MMITS on a voluntary basis. According to the baseline scenario (and therefore in any of our scenarios) the EC will provide additional incentives for the players in the market by **supporting initiatives like Shift2Rail or the Full Service Model (FSM)** in order to stimulate the development of a MMITS. However, such soft measures alone coming into action within the next 2 or 3 years may not be sufficient to ensure the development of a MMITS ecosystem on a pan-European scale as desired by the European Commission. We assume that single solutions will be available on the market based on national travel information systems, e.g. information systems provided by the big national rail operators like Deutsche Bahn or SNCF, but do not expect the emergence of multimodal information and ticketing services with the requested functionalities and geographical coverage within the next five years. This appraisal is strongly encouraged by our analysis of the barriers caused by business policy and corporate strategy from the industry's perspective and also by the evaluation of the role of public transport operators for the feasibility of a MMITS. It is also unrealistic that an industry-wide agreement concerning the implementation of a multimodal passenger rights regime will take place on a voluntary basis without additional incentives. Taking into account the various limitations and challenges discussed in WP 6, non-mandatory recommendations and guidelines by the EC will also not be able to close the presumable gap.

To overcome these pessimistic conclusions the European Commission needs at least the possibility to maintain a credible, regulatory alternative, with the preparation of regulatory initiatives for the MMITS market. According to the concept of "light-handed regulation" or "threat of regulation" the EC should prepare regulatory measures according to the catalogue laid down in the medium regulator intervention scenario to be ready for action. If soft policy measures do not prove to be successful within the next two or three years, a regulatory process would have to start in 2017 to come into effect by the end of the decade. Such measures include an obligation on all transport operators (commercial carriers and PSO) to offer non-discriminatory information provision and a multimodal passenger rights regime; In addition transport operators offering public services should be obliged to enable third party providers to sell their tickets.

This approach suggested to the European Commission is consistent with the general European transport policy as laid down in the White paper on transport policy from 2011 ("*By 2020, establish the framework for a European multimodal transport information, management and payment system*"). It forms also an important step to reach the goals of the currently discussed 4th railway package regarding multimodal travel information and booking. Setting incentives for the development of a MMITS can also be assessed as an essential part of the European ITS strategy according to the ITS Directive in July 2010 that is supposed to accelerate the deployment of ITS across Europe. Its time horizon covers seven years with the aim to address interoperable and seamless ITS services.

Assuming that seamless travel is fostered by multimodal information and integrated ticketing, it becomes clear that these aspects play a crucial role when making transport more efficient, clean and safe. In consequence, the European Commission started fostering research on multimodal journey planning and booking as these systems are supposed to allow seamless door-to-door travelling. If comfortable door-to-door travelling becomes possible and the travellers are able to compare several mode options (and combinations) according their preferences (e.g. price), the European roads might be less congested. However, Multi Modal Information and Ticketing Systems do not only serve the customer but are assumed to heighten the use of public transport and in consequence to reduce congestion and make European transport more efficient and sustainable.

Against this background, the following recommendations are derived:

1. **Non-discriminatory information provision containing schedule, fares and availability has to be guaranteed to all players in the market for multimodal travelling.**
   Schedule information has to be made accessible for MMITS providers in a suitable format, e.g. as raw data, whereas price and availability information are recommended to be provided on request, e.g. via an API, subject to terms and conditions for use. This arrangement allows taking into account the concerns of players not to provide business sensitive data. At the moment, the market does not sufficiently fulfil the requirements of this recommendation. Therefore, in addition to the on-going soft policy measures a credible regulatory threat by the European Commission has to be established by preparing corresponding regulatory activities: If the market fails to provide a sufficient solution, the European Commission will be able start appropriate regulatory activities.
2. **EC intervention has to distinguish between commercial carriers and public transport operators working under public service contracts (PSO)**
   Whereas information provision is a necessary prerequisite for a MMITS addressing all transport operators, commercial carriers should not be forced by EC intervention to make use of MMITS as a distribution channel for their tickets. Such an obligation seems to be an inappropriate restriction of their business strategy. Local public transport operators, however, could be obliged to enable third party providers to sell their tickets through a MMITS because they usually fulfil publicly funded service contracts.
3. **There should be no EC regulation regarding a specific technological solution for non-discriminatory information provision.**
   Possible technological solutions shall be developed by the market players on their own, always taking into account that the previously defined recommendations, such as information provision, are met.
4. **Multimodal, pan-European passenger rights have to be defined.**
   It is important that passenger rights will be defined transparently within MMITSs. The terms and conditions of carriage must provide a clear definition of the re-accommodation process, assuring that the travellers are not charged with higher prices if they have to be re-accommodated in case of delays or other incidents during their journey. Liabilities on multimodal travel products need to be clearly defined. To offer incentives to the market for the provision of an adequate solution for the passenger rights problem, European Commission has to establish a credible regulatory threat by preparing a legislative action to

develop a system of multimodal, pan-European passenger rights within the next years, in the case the market fails to provide a satisfying solution.

5. **Clear interfaces have to be defined and a regulatory framework has to be set to stimulate LPT operators participating in the MMITS without disadvantages.**

   Local public transport operators mostly provide services to fulfil public service obligations (PSO) which are funded by local authorities. Furthermore, most public transport companies are publicly owned. Under these special circumstances it should be reasonable to place them under the condition to join the MMITS ecosystem and to give access to the necessary information. To avoid possible disadvantages, LPT should be compensated to a certain extent for visible standardisation efforts.

6. **The competitive behaviour of transport operators participating in a MMITS has to be supervised strictly.**

   It is essential to protect the market against bias, collusion, or monopolisation within the MMITS market that could lead to welfare losses for customers by strengthening the oversight of this market by the EU Commission, with regard to competition. The Commission may need to consider establishing a "Code of Conduct" to regulate market behaviour..

7. **Further analysis of Europe-wide mobility data has to be conducted to provide a comprehensive picture of the mobility landscape in Europe.**

   These insights are necessary to better understand how European travellers move and to explain the specific requirements of multimodal travelling. Today the statistical picture is incomplete and rather vague. Necessary data to be collected may include movement patterns, numbers of passenger and further aspects of multimodality (e.g. the role of long distance busses). Demonstration projects and proofs of concept for MMITS solutions should be used to collect data that enriches the insight into the subject.

8. **Deeper research regarding the customer needs is necessary**.

   Customer surveys representing the European population should be performed to fully understand the expectations towards multimodal travelling. This is especially important to develop enhanced MMITSs that truly fulfil traveller requirements.

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11 Appendix

11.1 Glossary

TERM	Abbr.	DEFINITION
Accounting		The process of recording financial transactions as well as reporting on the financial status of a business.
Ancillaries / Additional Services		Additional services resulting from unbundling transport products, for example: more legroom, WiFi access, special meals, special drinks, lounge access, insurances, etc.
Allotment		A number of seats, cabins, berths, etc. available for sale by a supplier or agent.
Bar Coded Boarding Passes	BCBP	With BCBPs, boarding passes can be printed at home, or paperless boarding passes can be accessed from a mobile phone for faster and more convenient web check-in.
Billing and Settlement Plan	BSP	Method of providing and issuing traffic documents and of accounting and settling accounts between airlines and travel agents.
(Direct) Billing		System in which a corporation's travel agency bills employees for their business travel. The employee must then submit expense accounting and be reimbursed by the corporation.
Booking		Action of reserving space on a transport mode for a passenger, e.g. an inventory space or physical seat. This term is also applied to hotel, car and other types of travel services.
Cost-per-Click	CPC	With cost-per-click bidding, the customer is charged when someone clicks the ad.
Cost-per-Lead	CPL	An affiliate partner integrates the advert into their homepage. When the advertisement generates a lead - a customer contact, e.g. in form of an email address, or a registration for a newsletter - the affiliate is paid.

Computer Reservations System	CRS	A computerized system containing information about schedules, availability, fares and related services, and through which reservations can be made and/or tickets issued, and which makes some or all of these facilities available to subscribers.
Global Distribution System	GDS	A computerized system containing information about schedules, availability, fares and related services, and through which reservations can be made and/or tickets issued, and which makes some or all of these facilities available to subscribers, e.g. a travel agency.
Mobile Business		Mobile business can be seen as part of e-commerce, where communication, information, interaction and transaction take place via mobile devices (for at least one of the transaction partners).
Modal Split		Describes the relative proportion of each mode of transport, for example by road, rail or sea.
Multimodality		Transportation making use of at least two different transportation modes regarding a door-to-door trip.
Online Travel Agency	OTA	Online travel companies help to plan business or leisure trips. On their sites, one can usually discover destination ideas, obtain information about flights, hotels, car rentals, cruises and more, and then book and purchase a trip.
Open Data		Open data is the idea that certain data should be freely available for everyone to use and republish as they wish, without restrictions from copyright, patents or other mechanisms of control.
Passenger Kilometres	pkm	The unit of measurement representing the transport of one passenger by a defined mode of transport over one kilometre.
Pay As You Go	PAYG	Used to describe a contractual system of payment in which bills are paid when they are due or goods and services are paid for when they are bought.

Payment		Payment is defined as the transaction of a pecuniary claim (money) from the party obliged to pay to an institution that is accepted by the receiving party.
Proration		The division of a joint fare, rate or charge between the carriers concerned on an agreed basis.
QR-Code (Quick Response)		QR-Codes are 2D codes, usually printed in a small square, into which can be embedded a web link, a telephone number, a sms or free text, and which can be scanned and read by mobile phones/smartphones and tablets.
Real-time Information		Information which is given by a computer system that processes the input and provides a response immediately or within seconds. In particular, this can be used to obtain information on the current position of vehicles.
Reservation		Equivalent to the term "booking", reservation means the allotment in advance of seating or sleeping accommodation for a passenger or of space or weight capacity for baggage, cargo or mail.
Settlement		See Billing and Settlement Plan
Billing and Settlement Plan	BSP	Method of providing and issuing traffic documents and of accounting and settling accounts between airlines and Travel Agents.
Ticket		A formal travel document representing a contract between the traveller and the supplier. It is issued by or on behalf of the carrier and includes Notice of Contract Terms. The document may be paper or electronic.
Ticketing		Any or all of the processes involved in collecting fares and issuing tickets for any form of transportation.
Ticketing Information Exchange Standard (TIES)	TIES	The ATA/IATA standard which defines specifications for the computer to computer exchange of airline industry ticketing information.

Ticketing System		The system which imprints on paper or stores electronically (electronic ticket) the automated accountable document.
Ticketing Time Limit		A time by which the passenger must secure their ticket for a confirmed reservation as required by the carrier.
(Transport) Mode		Transport mode refers to the way in which passengers and/or goods can be transported.
Travel Agency		A point of sale where the customer can directly interact with a service, the travel agency.
Travel Intermediary		Any person or entity that assists in the distribution of travel products to travellers.
(Travel) Meta Search Engine		A meta search engine is a system that crawls other search engines in order to provide the user with better search results

11.2 Customer Survey – Questionnaire

Please tell us your age.

How old are you? __________years old

If under 18: Thank you, this is the end of the questionnaire as you do not fall into the group of people we are looking for.

Have you planned a journey of over 60 miles for yourself or others in the last 12 months? (Multiple answers possible)

☐ Yes, I am planning a private journey

☐ Yes, I am planning business trips

☐ Yes, I commute more than 60 miles (one way) a day to work

☐ No, I haven't planned any journeys of over 60 miles (one way) in the last 12 months

If 3 or 4: Many thanks for your participation.

Because the following questions relate to journey planning, this is unfortunately a prerequisite for further participation.

How often per year do you plan journeys of over 60 miles for yourself or others with one of the following modes of transport: aeroplane, train, car, bus, ferry?

(Both private and business travel can be included, although each journey must fulfill the aforementioned minimum distance. Overnight breaks or other stops are not included)

__________ times in the last 12 months. ☐ not at all

How often do you plan international/cross-border journeys?

__________ times in the last 12 months. ☐ not at all

Whom do you plan journeys for?

☐ For myself ☐ For others

If no trip planning during the last 12 months: Many thanks for your participation.

Because the following questions relate to journey planning, this is unfortunately a prerequisite for further participation.

	☹ **1= I disagree completely**			**4 = I partially agree**			☺ **7 = I agree completel y**
Have you ever not travelled in the past because you found planning the journey too complicated?	☐	☐	☐	☐	☐	☐	☐

Please order these modes of transport according to their average usage on your planned journeys. Please be sure to focus on your main journey routes in the last 12 months. Your total should not exceed 100%.

On your main journey routes...

...how much is a car (personal, company) used in %? _______

...how much is a car-sharing car or hire car used in %? _______

...how much is a train used in %? _______

…how much is an aeroplane used in %? _______

…how much is a bus used in %? _______

...how much is a ferry used in %? _______

For the following questions, please refer only to these modes of transport: aeroplane, train, bus, car-sharing, hire car and ferry.

How high are the average costs for the entire journey – not only the main journey route?

Average expenditure in Euro (GBP) approx. _______________

In choosing mode of transport for your last journey, what criteria were important for you or the other person?	☹ 1= not at all important			4 = partially important			☺ 7 = very important
flexibility	☐	☐	☐	☐	☐	☐	☐
journey duration	☐	☐	☐	☐	☐	☐	☐
reliability	☐	☐	☐	☐	☐	☐	☐
comfort	☐	☐	☐	☐	☐	☐	☐
availability	☐	☐	☐	☐	☐	☐	☐
environmental / climate protection	☐	☐	☐	☐	☐	☐	☐
freedom to move around	☐	☐	☐	☐	☐	☐	☐
price	☐	☐	☐	☐	☐	☐	☐
safety	☐	☐	☐	☐	☐	☐	☐
quality of the experience	☐	☐	☐	☐	☐	☐	☐
opportunities for taking luggage	☐	☐	☐	☐	☐	☐	☐
privacy	☐	☐	☐	☐	☐	☐	☐
opportunities to work	☐	☐	☐	☐	☐	☐	☐

Could you envisage changing from the mode of transport used to date to one of the following?	☹ 1= I can't envisage it at all		3 = I can partially envisage it		☺ 5 = I can well envisage it
Change to car sharing, rental car	☐	☐	☐	☐	☐
Change to aeroplane	☐	☐	☐	☐	☐
Change to train	☐	☐	☐	☐	☐
Change to bus	☐	☐	☐	☐	☐

Which of the following modes of transport can you <u>least</u> envisage changing to?

☐ Change to car sharing, rental car

☐ Change to aeroplane

☐ Change to train

☐ Change to bus

Why have you not booked car-sharing/ eroplane/train/bus until now?	☹ **1= I disagree completely**			**4 = I partially agree**			☺ **7 = I agree completely**
because of the lack of flexibility	☐	☐	☐	☐	☐	☐	☐
because of the long journey time	☐	☐	☐	☐	☐	☐	☐
because of the lack of reliability	☐	☐	☐	☐	☐	☐	☐
because of the lack of comfort	☐	☐	☐	☐	☐	☐	☐
because of the lack of availability	☐	☐	☐	☐	☐	☐	☐
because of environmental/climate protection considerations	☐	☐	☐	☐	☐	☐	☐
because of the lack of freedom to move around	☐	☐	☐	☐	☐	☐	☐
because of the high price	☐	☐	☐	☐	☐	☐	☐
because of the lack of safety	☐	☐	☐	☐	☐	☐	☐
because of the poor quality of the experience	☐	☐	☐	☐	☐	☐	☐
because of the lack of opportunities for taking luggage	☐	☐	☐	☐	☐	☐	☐
because of the lack of privacy	☐	☐	☐	☐	☐	☐	☐
because of the lack of opportunities to work	☐	☐	☐	☐	☐	☐	☐

What methods do you use for booking your journeys?	☹ 1 = I don't use this at all		3 = I use this partially		☺ 5 = I use this frequently
Personally, at the ticket counter	☐	☐	☐	☐	☐
Online booking via PC	☐	☐	☐	☐	☐
Online booking via smartphone	☐	☐	☐	☐	☐
Online booking via tablet computer	☐	☐	☐	☐	☐
Telephone	☐	☐	☐	☐	☐
Letter or fax	☐	☐	☐	☐	☐

Which of the following booking methods do you use <u>most frequently</u>?

☐ Online booking via tablet computer

☐ Online booking via PC

☐ Online booking via smartphone

Why do you use *Tablet/PC/ Smartphone?*	☹ **1= I disagree completely**			**4 = I partially agree**			☺ **7 = I agree complet ely**
Booking is quick and easy.	☐	☐	☐	☐	☐	☐	☐
Availability of the mode of transport is instantly visible.	☐	☐	☐	☐	☐	☐	☐
I can make a comparison without pressure	☐	☐	☐	☐	☐	☐	☐
I can book from the comfort of my home.	☐	☐	☐	☐	☐	☐	☐
I can book from anywhere.	☐	☐	☐	☐	☐	☐	☐
The choice is largest on the internet.	☐	☐	☐	☐	☐	☐	☐
I can pay by credit card.	☐	☐	☐	☐	☐	☐	☐
The choice on the internet is normally cheap.	☐	☐	☐	☐	☐	☐	☐
Internet bookings are secure.	☐	☐	☐	☐	☐	☐	☐

What sources of information in particular do you use when planning journeys? *Multiple answers possible.*

- ☐ General purpose search engines (google, yahoo, etc.)
- ☐ Online travel agencies
- ☐ Websites with travel reports
- ☐ Transportation company websites (e.g. trains, airlines)
- ☐ Travel search engines
- ☐ Tour operator websites
- ☐ Travel destination websites (e.g. city webpages, tourist information for a destination)

The following scenario illustrates the features of a Multi Modal Information and Ticketing System:

Imagine you are planning an international trip from your hometown to *Madrid/Moscow/ Athens/Copenhagen/Zurich (randomised)* for the next day. The journey starts at home. To find out about the best way to travel to the destination, you now use the multimodal information and ticketing system via your laptop. You type in the home-address and the address of the destination and browse through the results.

Doing so, the multimodal information and ticketing system provides you with any possible and practical/worthwhile itineraries combining all possible travel modes in Europe. It gives you information about travel-time, costs, CO2-emission, travel mode etc. Based on this information you can decide which option you prefer. Finally, you decide to book public transport from the home-address to the main station of the hometown. Then you plan to take the train to the Airport and to switch to a flight to Madrid. For the last mile you want to use again public transport from the airport to the final destination.

After booking the trip with just one click, you pay one single amount for the whole journey to the multimodal-information-and- ticketing-system-provider and receive one single ticket that is valid for the whole trip.

During the whole journey, with the help of the multimodal-information-and- ticketing-system-provider it is possible to keep control of the schedules via smartphone and get alarmed automatically in case of incidents or delays that may affect the travel plan. If connections will not be caught, the system provides the traveller with possible alternatives to process with the journey via push-notifications. Booking and ticketing for alternative itineraries are made automatically via smartphone.

Please evaluate this scenario within the following questions.	☹ **1= I disagree completely**			**4 = I partially agree**			☺ **7 = I agree completely**
Using the multimodal journey planner improves my performance in journey planning.	☐	☐	☐	☐	☐	☐	☐
Using the multimodal journey planner in journey planning increases my productivity.	☐	☐	☐	☐	☐	☐	☐
Using the multimodal journey planner enhances my effectiveness in journey planning.	☐	☐	☐	☐	☐	☐	☐
I find the multimodal journey planner to be useful in journey planning.	☐	☐	☐	☐	☐	☐	☐
My interaction with the multimodal journey planner is clear and understandable.	☐	☐	☐	☐	☐	☐	☐
Interacting with the multimodal journey planner does not require a lot of my mental effort.	☐	☐	☐	☐	☐	☐	☐
I find the multimodal journey planner to be easy to use.	☐	☐	☐	☐	☐	☐	☐
I find it easy to get the multimodal journey planner to do what I want to do.	☐	☐	☐	☐	☐	☐	☐
Working with multimodal journey planner makes me nervous.	☐	☐	☐	☐	☐	☐	☐
I'm not sure that my data would be safe.	☐	☐	☐	☐	☐	☐	☐
Assuming I had access to the multimodal journey planner, I intend to use it.	☐	☐	☐	☐	☐	☐	☐
Given that I had access to the multimodal journey planner, I predict that I would use it.	☐	☐	☐	☐	☐	☐	☐

Please note now:

The multimodal information and ticketing system provides you the possible itineraries with different means of transport, allows you to book and pay a valid ticket for all means of transport and provides you information about possible changes in time table and routing during your travel via your smart phone.

Could you envisage your mode of transport choice changing due to the use of the multimodal travel information and booking system?	☹ 1= I can't envisage it at all		3 = I can partially envisage it		☺ 5 = I can well envisage it
Change to car sharing, rental car	☐	☐	☐	☐	☐
Change to aeroplane	☐	☐	☐	☐	☐
Change to train	☐	☐	☐	☐	☐
Change to bus	☐	☐	☐	☐	☐
Change to ferry	☐	☐	☐	☐	☐

☐ **How much more would you be prepared to pay for the multimodal travel information and booking system compared to the average cost of your bookings until now?**

__________________%

☐ **How much would you be prepared to pay for the service as described? (The fee would grant you use of the multimodal travel information and booking system for 12 months)**

__________________Euro (GBP)

Are you aware of a particularly good multimodal journey planning and booking system?

☐ yes ☐ no

What multimodal journey planning and booking system from what provider is that?

____

What do find particularly good about this multimodal journey planning and booking system?	☹ **1= I disagree completely**			**4 = I partially agree**			☺ **7 = I agree completely**
Clear layout of the choices	☐	☐	☐	☐	☐	☐	☐
Cheap pricing of the choices	☐	☐	☐	☐	☐	☐	☐
Very wide range of choice	☐	☐	☐	☐	☐	☐	☐
Easy to use search function	☐	☐	☐	☐	☐	☐	☐
Easy to use booking function	☐	☐	☐	☐	☐	☐	☐
Trustworthy payment process	☐	☐	☐	☐	☐	☐	☐
Certified trustworthiness	☐	☐	☐	☐	☐	☐	☐
Qualified staff on the customer service phone line	☐	☐	☐	☐	☐	☐	☐

Finally, some questions about you:

a) **What is your marital status?**

❍ single ❍ married
❍ cohabiting ❍ divorced / widowed

e) **What job do you do?**

❍ self-employed ❍ homemaker
❍ employed ❍ trainee / student
❍ civil servant ❍ retired
❍ manual worker ❍ unemployed

f) **What is your net monthly household income?** _____________ Euro (GBP)

i) **What is your gender?** ❍ male ❍ female

Thank you for your participation.