KEY FACTORS AFFECTING THE EFFICIENCY OF TRANSPORT INTERCHANGES

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ABSTRACT

This paper provides a meta-analysis of long/short distance passenger interconnectivity within the European context. The analysis is based on the results of the European project HERMES of the 7th EU R&D Programme. The study collected stakeholders and travelers' valuation and preferences in 5 interchanges in 3 EU countries. To that end a common survey was conducted in the following sites: *Gothenburg Central Station (Sweden), Avenida de America Interchange in Madrid, Lleida-Zaragoza railway stations (Spain),* and *the Intermodal Station of Part Dieu in Lyon (France).*

The first survey addresses the analysis of the different **stakeholders**' opinion on the interchange management and characteristics. The second survey gives an insight into the key requirements of long/short distance **intermodal passengers** in the selected case studies. This included the following aspects: on one hand, trip origin and destination, connecting transport services and modes, trip characteristics, type of ticket, trip motive and socioeconomic characteristics of the traveller. On the other hand, it was structured in such a way to ask passengers to rate importance/satisfaction of a series of common quality and functional aspects like information, accessibility, transfer times, service supply, etc.

In conclusion, the paper highlights which elements of the interchange are considered as relevant and how different groups of stakeholders value them, both theoretically and in the selected case studies. They also have identified some key barriers as the lack of internal coordination among operators, managers and decision makers, as well as the the poor signage, particularly among connecting services. Travellers seem to have different priorities depending on their age, purpose of trip and mode chosen. In some cases time appears as the most relevant factor, whilst price is decisive in others.

Keywords: Interchanges, intermodality, traveller satisfaction

INTRODUCTION

Interchanges are key elements in urban and interurban mobility to achieve a real *seamless mobility* (EC, 2011). This is clear within urban trips where the rapid transfer among public transport means makes the difference between being competitive against car trips or not. A clear earmarked policy to achieve a full integration of the different transport modes is set in the agenda of many Public Transport Authorities. The integration covers three different dimensions: pricing, administrative and physical. The latter includes interchanges and information systems.

However, in medium-long distance trips the integration is still far away from the minds of the transport planners. In many cases long-distance terminals are not multimodal by nature, while at best bus and rail terminals are just closer but not properly integrated. In both cases, there is no common management of installations, services and information systems.

This is particularly important for interconnecting long-short distance trips. Normally trip decisions are taken considering the most convenient long distance mode (rail, bus, air); but the fact is that *last mile* links are becoming increasingly important, particularly in big metropolitan areas. This is the main reason why high speed train (HST) services are preferable than air ones, even though the former could be longer and more expensive. HST stations are, usually, closer and better communicated with the place of origin and destination, making rail more competitive compared with other modes.

Therefore it is necessary to investigate the perceived quality of the connection between long-short trips. This investigation has two different approaches. First, the stakeholders' approach: they are responsible both for the offer of the whole logistic trip chain and the services and facilities at the terminals. Second, and most relevant for the sake of the efficiency, it is crucial to take into account the travellers' vision and preferences.

So, this paper aims to find out the main barriers and constraints for intermodality at interchange stations and, therefore, those elements to be taken into account when designing intermodal infrastructures and their regulatory framework from the point of view of decision makers, and managers and terminal operators. On the other hand, it deals with the need to know the user's profile, as well as their influence or level of satisfaction with the facilities in the terminals they use, in order to improve those interchange nodes for the near future, according to the most valued aspects by the users.

After a number of interviews carried out among stakeholders and passengers, in the framework of the HERMES project (EU 7[th]FP R&D), some policy recommendations to improve the quality of the long/short distance interchanges are shown.

CONTEXT: THE EU 7TH FP PROJECT HERMES

The HERMES 2010-12 (**H**igh **E**fficient and **R**eliable arrange**ME**nts for Cro**S**smodal Transport) project focused on enhancing Crossmodal Transport Arrangements aiming at exploring and thus developing models for interconnectivity. It was financed by the 7th European Union Framework Programme of Research and Development. The project was developed by an international consortium made up of 11 partners, among them 6 universities, 3 research centres and 2 consulting firms.

The first part of the project was centered on the identification of travelers' key requirements, the corresponding services and the necessary underlying company agreements to provide them, followed by some guidelines for the operation. Then, the project analysed the existing connections in a number of case studies and evaluated the level of interconnectivity in the selected passenger terminals where short and long-distance transport networks cross. The final findings consisted of recommendations to ensure the maintenance of the level of service when the passenger is transferred from one to other.

The cases were selected for validation of its functional, economic and organizational aspects, aiming to provide recommendations regarding how to enhance the co-ordination between decision-making levels on issues such as the interconnection of transport networks at different scales and modes, addressing institutional, legal, design, planning, technical and deployment aspects. Case studies served as test field for analysing travelers' behaviour; first, identifying those key factors that influence their trip election and, second, analysing the travelers' perception of the quality of services offered at the interchange site.

THE CASE STUDIES

The project selected 11 transport terminals as case studies to examine all the main combinations between long and short distance trips. They were classified according to the long distance transport mode: 4 airports for air transport, 2 ports for maritime long distance trips and 5 bus/rail stations for land trips. Note that there are many important differences among the three types. In this paper only the results corresponding to the stations will be analyzed, as following:

- Gothenburg Central Station (SW)
- Avenida de America Interchange, Madrid (SP)
- Lleida-Zaragoza HSR (SP)
- Part Dieu Station of Lyon (FR)

Gothenburg Central Station

Gothenburg is Sweden's second largest city with a population of 510 thousand inhabitants. The city and the region have a high level of population growth which means a high demand for communications to and from the city. Gothenburg Central Station, located in the center of

the city, is the major national transport hub for passenger transportation in the south west of Sweden, providing good connections to the Sweden's capital Stockholm as well as to Denmark's and Norway's capitals' Copenhagen and Oslo. Gothenburg Central Station consists of three buildings: the old but restored railway station, the new meeting place and the quite new bus terminal. These three buildings together constitute a travel centre with shops, cafés, restaurants, offices and a hotel. The railway station has 15 rail platforms where the commuter, regional, interurban and international rail services arrive and departure. Train passengers at Gothenburg Station are very young (32% from 15 to 20 years old) and travel for private reasons (57%); most passengers use public transport modes to access the station.

Avenida de America Interchange, Madrid

Madrid City, with a population of 3.32 million inhabitants is the capital of Spain. It is the center of the Madrid Region that expands over 8.000 km2, with a population of 6 million inhabitants. Transport interchanges play an important role within this context in order to enhance long-/short distance intermodality.

Avenida de America is an Interchange located in the border of the city center. The Interchange collects the bus flows from the North-East of Spain and has very good public transport connections, especially with the metro network. It is structured in four underground floors: the two first floors assigned to long-distance buses and regional or local buses, each one equipped with 18-19 platforms, and the rest are dedicated to the metro lines, a car park, ticket offices and commercial areas. At Avenida de America, passengers are also young people (52% from 20 to 35 years old) who travel for leisure, and metro lines are the most common way to access the Interchange (74%).

Lleida-Zaragoza HSR

Zaragoza and Lleida are two cities located in the north-east of Spain, separated by 160 km and strategically situated in the middle of the Madrid- Barcelona corridor.

Zaragoza has 700 thousand inhabitants. Zaragoza new railway station was built for the arrival of the high-speed train (AVE). The interchange is far from the city center and which was highly criticized by the local government at the time of the construction. The central bus station is physically integrated in the building, providing interurban and long distance bus service (national and international) and allowing intermodal connections among long distance bus and rail modes (9 % of the trips according to the surveys). The railway and bus station are endowed with 8 and 46 platforms respectively.

Lleida has a population of 140 thousand inhabitants and connects the Mediterranean Corridor with the French border. Lleida railway station is located in the north of the city. The station has 6 rail platforms.

Train passengers from Zaragoza and Lleida have more or less the same profile: middle age (40% from 36 to 55), travelling for business (39%), and they valuate mainly travel time and comfort when they choose how to travel. They access to the stations mainly by car (39%), although both stations have good local bus connections and taxi services, also quite used. Bus passengers from Zaragoza have different characteristics: most of them are young people

(50% from 21 to 35 years old), travelling for leisure (63%), and looking for low prices. They use to arrive to the station by local bus.

Part Dieu Station of Lyon

Lyon is a city located in the east-central France, in the Rhône-Alpes Region, situated between Paris (470 km) and Marseille (320 km), with a population of 480 thousand inhabitants.

The Part-Dieu intermodal station entered into service in 1983 as a part of a new urban planning policy aiming at building a second urban city centre in Lyon. The station is part of the development plan of an administrative, financial and commercial centre in the neighborhood. The Part-Dieu station is served by national and international high-speed lines (TGV), national rail lines (Intercités and Lunéa) and regional lines.

Surveys conducted at the Lyon Station show that passengers are usually young people (50% from 21 to 35 years old), travelling for private reasons (57%), who first valuate saving time, and second saving money. Public transport modes are the most common way to access the station, mainly local buses and metro, although, compared to the other case studies, there is a high percentage (11%) of people who arrive by walking.

Passengers' profiles and access modes

The customer surveys provided a good analysis of passengers' profile at each one of the stations. It is worth to highlight some features: there is a majority of leisure trips, except in the case of the high speed rail services, where both leisure and business trips have a similar percentage. The majority of travelers is rather young (21-35 years old), even younger than those of Gothenburg. Again, in the case of HSR there are a bigger proportion of users aged between 36 and 55. Finally it is remarkable that women predominate in all cases, particularly when it comes to using bus services and in the case of Gothenburg.

Table 1 – Travelers' profiles

Stations	Age (%)					Purpose (%)				Gender (%)
	15-20	21-35	36-55	56-64	>64	Business	Studies	Leisure	Other	Female
Zaragoza-Lleida HSR	7,9	**40.2**	**38.8**	6.1	7.0	**39.7**	7.9	**36.9**	15.4	53.3
Lyon train	12.9	**50.2**	26.2	7.3	3.3	33.2	8.8	**57.3**	0.8	52.8
Gothenburg train	**32.4**	**29.9**	18.4	10.1	9.3	22.9	13.1	**57.1**	6.8	65.3
Avenida America (Madrid)-Bus	13.9	**51.2**	24.1	6.0	4.7	17.8	3.7	**64.3**	14.2	56.3
Zaragoza Bus	16.6	**49.5**	22.0	5.8	6.2	17.3	6.4	**63.4**	12.9	64.5

There are significant differences in the access mode to the station. In the case of Avenida de America, which is very well served by metro and bus, 84% of the users have accessed by both modes. On the contrary, for expensive services like HSR taxi and car account for more than 60% of access trips. In general, it can be said that public transport is the most frequent access mode for long distance trips, but there are differences depending on the location of the station and the existing PT offer.

Table 2 – Access mode to the stations

Stations	Access mode (%)							
	Local bus	Metro/ Tramway	Commuter train	Taxi	Car	Bicycle/ moped	Walking	Other
Zaragoza-Lleida HSR	**25.5**	-	9.4	**24.1**	**39.2**	-	-	1.9
Lyon train	**47.6**	**30.2**	4.1	1.5	3.7	1.1	10.9	0.9
Gothenburg train	**35.7**	**28.9**	15.1	2.8	11.2	0.8	-	5.4
Avenida America (Madrid)-Bus	**9.8**	**73.7**	-	7.9	8.4	-	-	0.3
Zaragoza-Bus	**73.9**	-	0.9	8.1	**16.2**	-	-	0.9

STAKEHOLDERS' VISION

The first part of the project (Work Packages 3&4) was dedicated to obtain the opinion of four different Stakeholders Groups: Public Decision Makers (G1), Terminal Managers (G2), Transport Operators (G3) and Users' Associations (G4). A specific semi-structured questionnaire was designed to collect their views on six different interconnectivity domains: physical, logical, economical, contractual, institutional and legal&regulatory. Each questionnaire presented a general part to cross-compare countries, and an interconnection specific part developed looking at the HERMES case studies and the different terminals/interchanges typologies. All six domains were extended to all stakeholders group, with the exception of the "contractual" domain for G1 (public decision makers) and G4 (users associations), and the "legal and regulatory" domain for G4. These aspects are showed in figure 1, since they were not applicable to those groups.
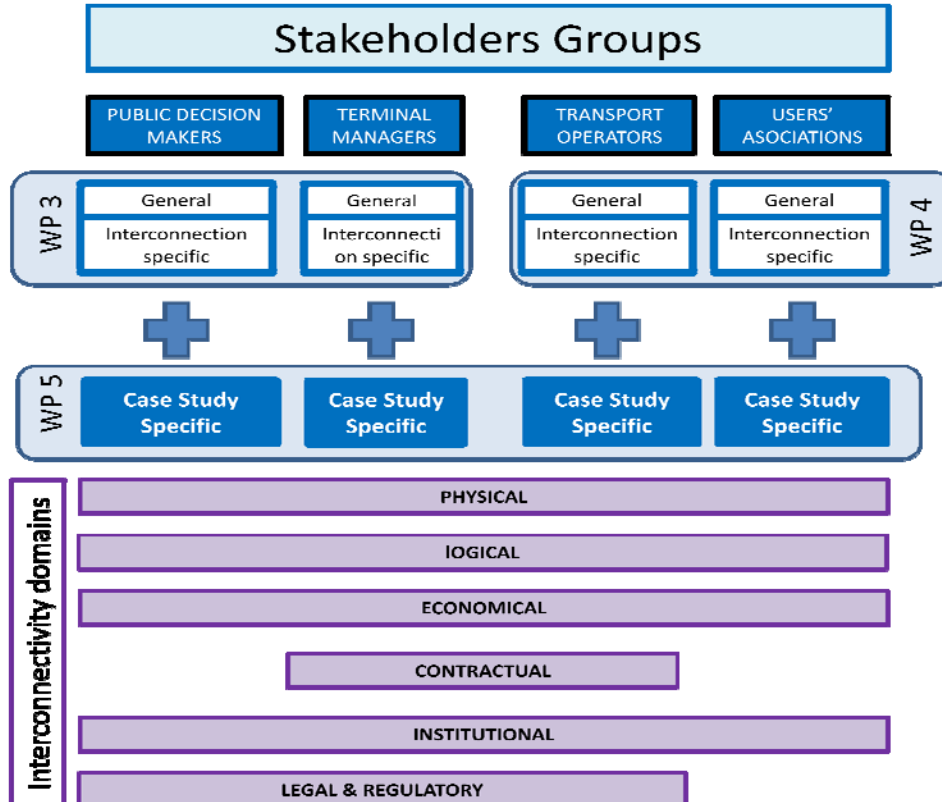

Figure 1 – General structure of the stakeholders' semi-structured survey.

Regarding the methodology, the domain analysis followed two main approaches:

a) Descriptive Statistic: to give a brief picture of the state of the art and better understanding of the long-short distance interconnectivity domains.
b) Cross-tabulation Analysis: to gain knowledge on the (statistical) significant differences among the variables and cross-compare them: stakeholder group, country, long and short modes, opinions, etc.

Finally, it is important to remark that this approach is the best one since the questionnaires only include ordinal and nominal variables - most of the questions were designed according to a Likert scale 1-4. As regards the open questions on key-barriers and key-measures ("General Item" section of the questionnaires) they were analyzed registering the text variables as nominal variables, thus redefining them according to the six HERMES domains.

The Stakeholders' survey

The semi-structured survey was designed according to four different questionnaires, one for each stakeholders group. It is worth noting that 148 completed surveys were collected by the HERMES partners throughout Europe (see figure 2): that means a 57% response rate.
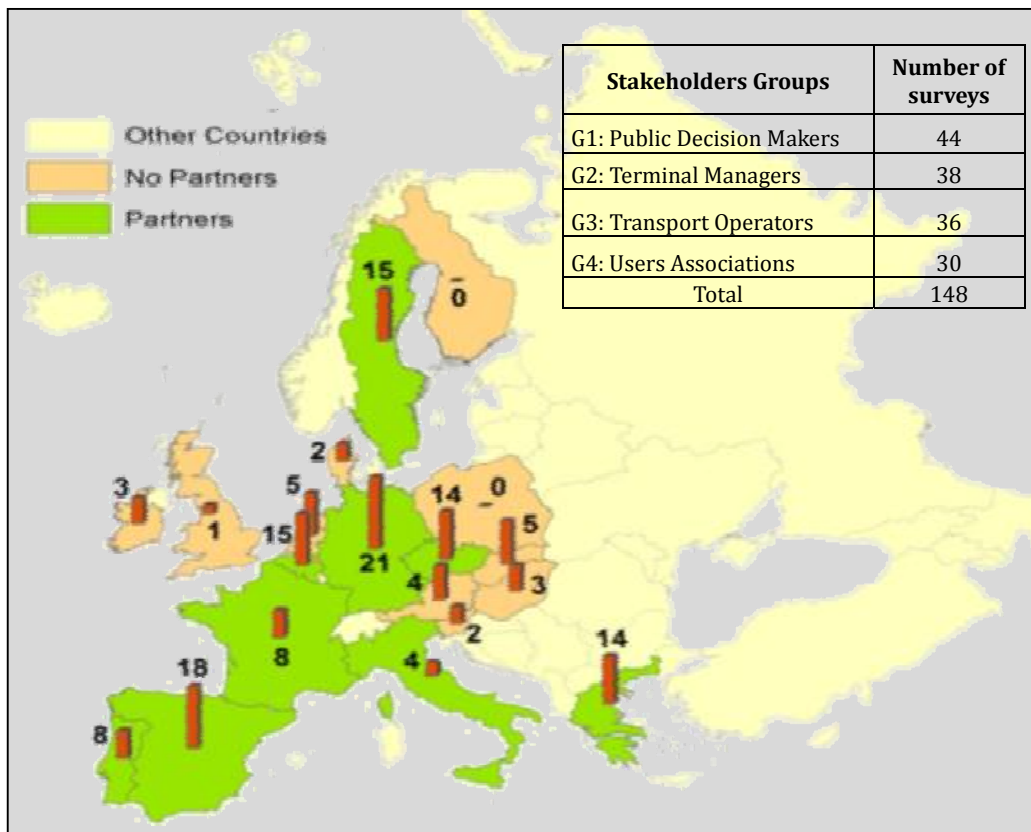

Stakeholders Groups	Number of surveys
G1: Public Decision Makers	44
G2: Terminal Managers	38
G3: Transport Operators	36
G4: Users Associations	30
Total	148

Figure 2 – Distribution of Collected Questionnaires

The questionnaire included questions related to the following topics for each domain:

Physical domain
- Safety/Security
- Accessibility
- Parking facilities, Kiss&Ride, Cycle storage
- Feeding services (TP, taxi, bicycle, etc)
- Comfort (waiting areas, cleanliness, toilets, other services, etc)

Information domain
- Information (pre-trip & on-trip, route and services, etc)
- Signage
- Time synchronization between services

Economical domain
- Ticketing (integrated ticket, special ticket, cross-border job ticket);
- Joint financial agreement among "foreign operators";
- Willingness of transport operators to pay for implementing extra services.

Contractual domain
- Management System;
- Interchange/Project Manager appointment;
- Quality standards in contracts (indicators for measuring intermodality).

Institutional domain
- Institutional authority to coordinate passenger intermodality;
- Competences on the coordination of interchanges´ planning;
- Competences on the coordination of interchange's management;
- Competences on promotion and marketing strategies;
- Integration with urban planning and land use.

Legal/regulatory domain
- Harmonization and integration of existing standards on law and regulation issues concerning information services;
- Agreements among cross-border administrations / authorities (different countries);
- National and/or regional funding for interchange development.

The main results from the Stakeholders' survey

This section focuses on the main results obtained from the semi-structured survey related to the six HERMES interconnectivity domains of the four types of stakeholders. The main findings are presented from a descriptive perspective.

Legal/Regulatory Findings

Several main results with regard to the legal/regulatory domain are obtained and analyzed by cross-tabulation. Concerning which aspects should be considered in the regulatory framework of the interchange, the results are shown in the figure 3. More than 70% of the respondents think that recommendations for the design of the installations, the information services and

the accessibility standards should be homogenous and fixed by the regulating authority. At the same time they consider that such a regulation does not exist at the present time in any country.

On the contrary, the majority of stakeholders see the management of the shops as something that should be not regulated but business-oriented in a free market.
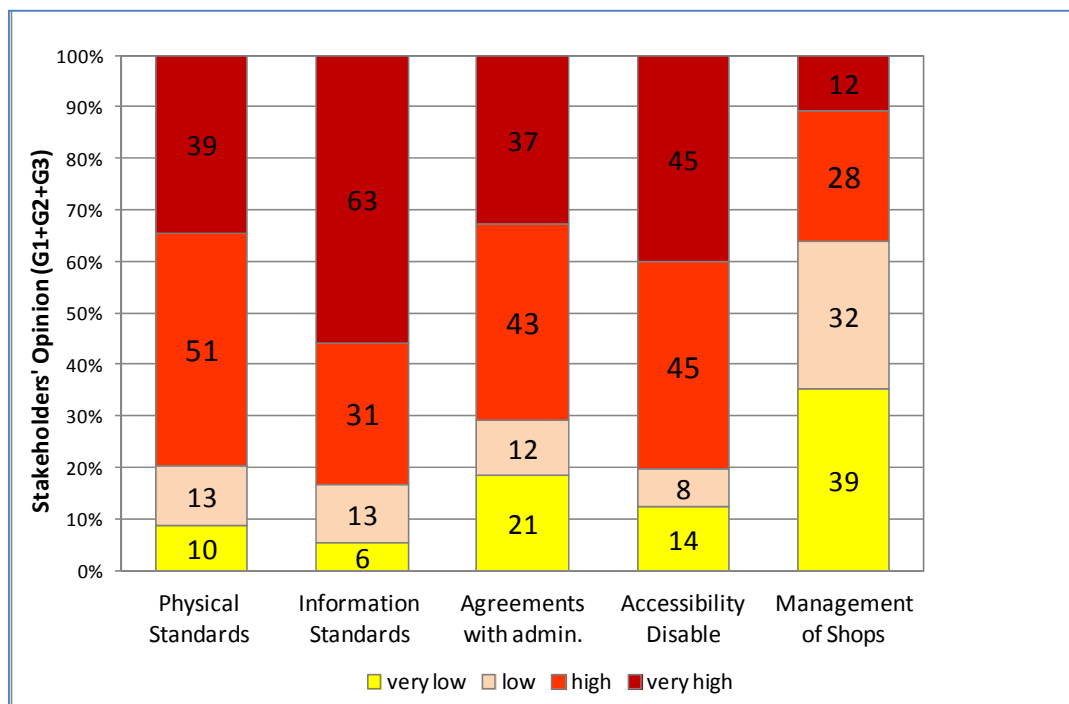

Figure 3 – Stakeholders opinion on the legal&regulatory framework

The stakeholders were asked about the need for standardisation in signalling, facilities and regulation. They identify three important actions to achieve that goal. First, there should be some central guidelines for developing interchanges at regional/national level. These recommendations should be part of the tender requirements, and they should produce a more homogeneous system. The second action refers to who is responsible for the promotion of new interchanges. Stakeholder's opinion is that competencies should be clearly assigned to any governmental body with the necessary skills and knowledge. This is not the case in reality, where most of the interchanges are designed as public buildings or merely oriented to the requirements of the main mode, i.e., the rail services. The approach should be different having in mind the integration of all modes and services in an ordered scheme.

Finally, as third action, more than 60% of the respondents see a problem in the management of the interchange. So, they propose an independent single authority to manage it. Again, it is not the case at the present time, where each mode of transport manages its corresponding space without coordination with the others. Shops and other commercial activities are sold as concessions to intermediaries without looking for the proper integration with transport activities. The proposed solution is to designate a manager responsible for all the activities, including not only the transport terminal, but also the quality of the auxiliary services

(lounges, waiting areas, cleaning, safety, etc.) and the complementary activities like shopping, parking, hotels, etc.

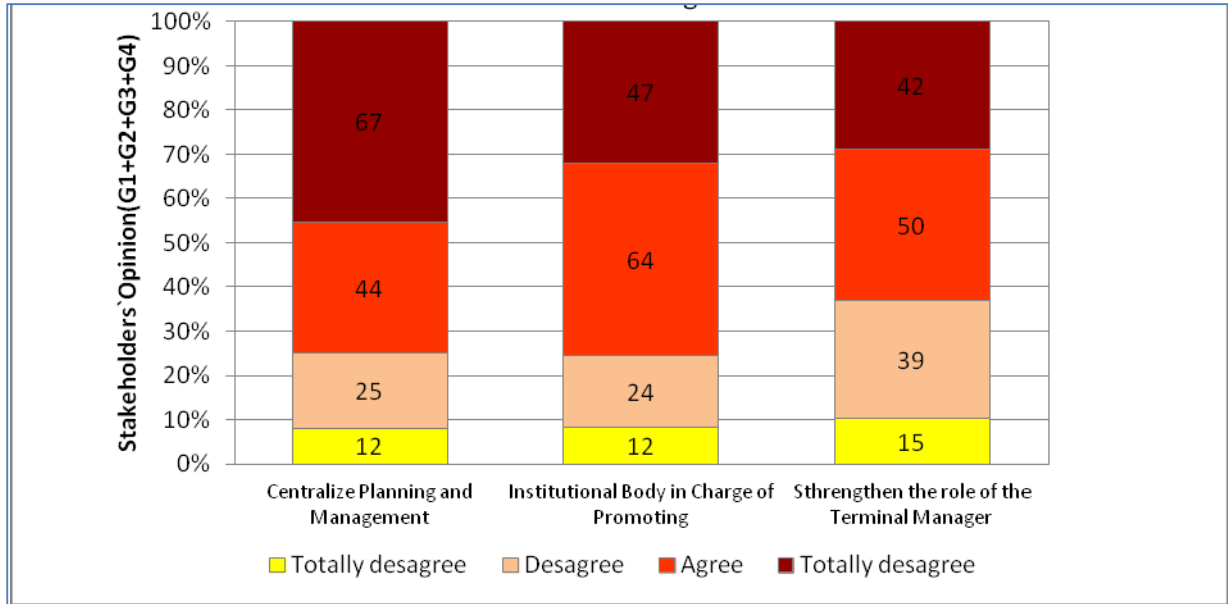Their opinions on this regard are summarized in the Figure 3

Figure 4 – Stakeholders opinions on centralize planning, promotion and management

Provision of infrastructures and facilities

Another relevant aspect of the stakeholders' survey was to identify which infrastructures and facilities are key elements for offering a good level of service at the interchange.
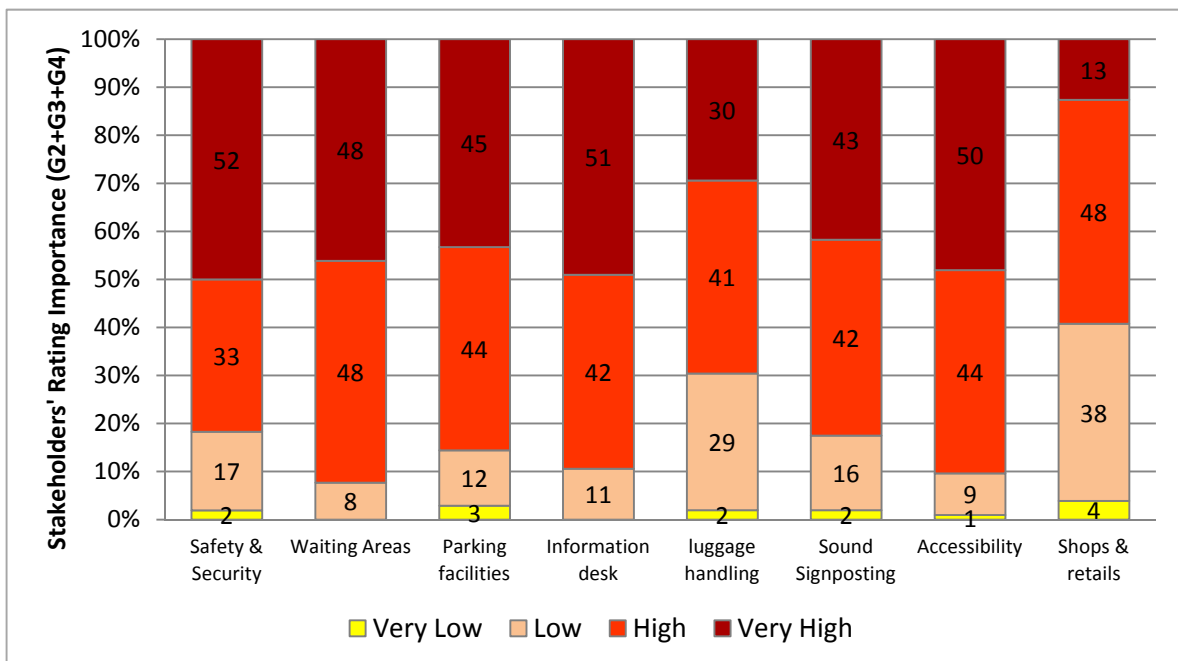

Figure 5 – Stakeholders opinions on relevant infrastructures and services

As Figure 5 shows, most of the identified elements are regarded as important. The highest scores correspond to the waiting areas, accessibility standards and information desk. Then, as important elements of the interchange are parking, safety&security and signage. The less important appear to be luggage handling and shops (Lopez-Lambas et al, 2012).
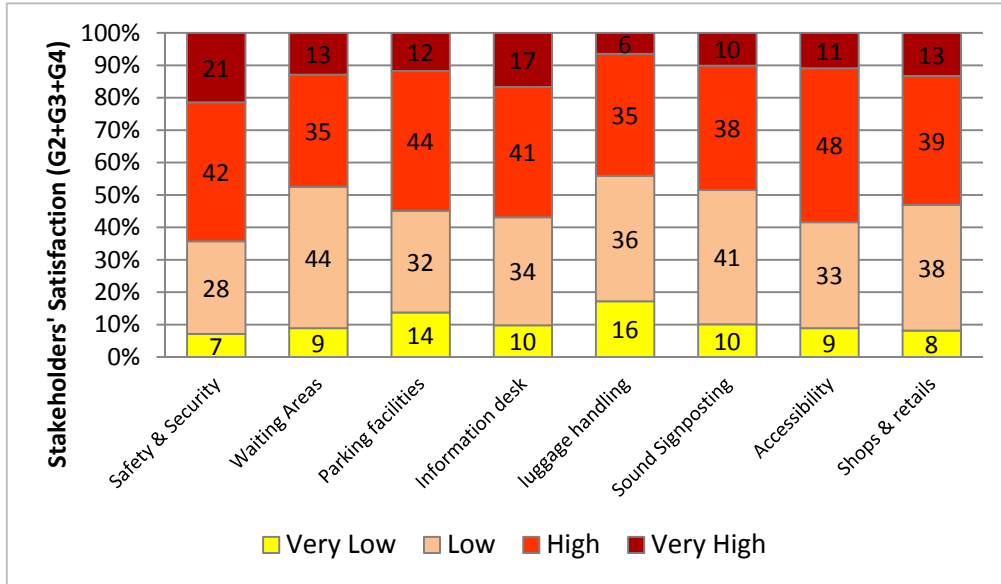

Figure 6 – Stakeholders satisfaction with the quality of infrastructures and services

Nevertheless, the answers of the stakeholders about if those infrastructures and facilities are properly offered at the present time show a very different picture: satisfaction with all of them is particularly low for more than 40% of respondents; and very few consider to have *very high* satisfaction, except for safety&security and for information desk, which are scored as very high by some 20%. The results are included in the Figure 6.

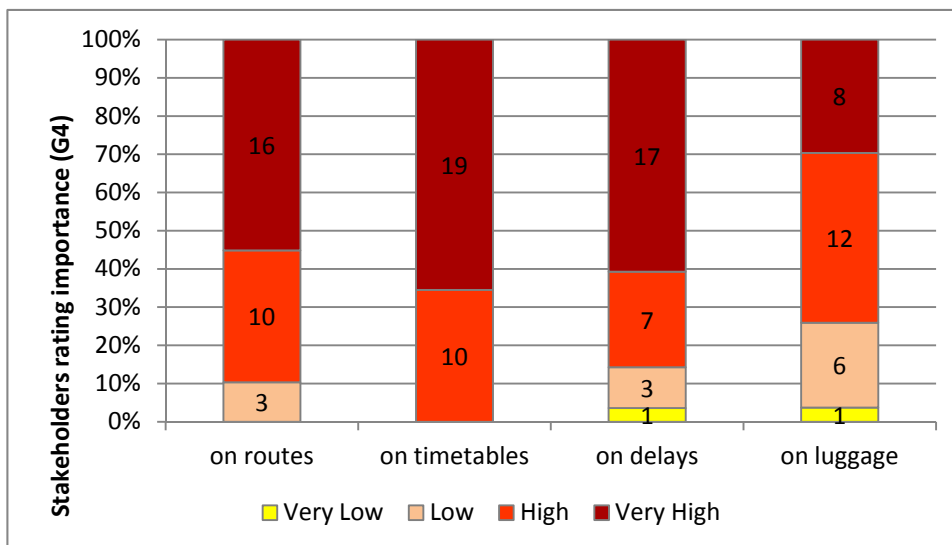*Information systems and their quality*

Figure 7 – Stakeholders values of information services

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Information seems to be a key element of the perceived quality of the interchange because it becomes the link for connecting the different modes of transport, and also to orient travelers towards services and facilities (EC, 2007).

According to the stakeholders' opinions routes, delays, timetables and luggage storage are very relevant: 90% consider them as *important* or *very important*. The lower importance score is assigned to luggage and the highest to timetables. Figure 6 show those results.

At the same time the interviewees feel that some key aspects are not good at the present time. So, more than 90% of their opinions claim for better *real time information,* for the integration of the information of *long and short distance services* and for improving *the information flows* among the different management levels: terminal, operators and travelers. These results are presented in Figure 7
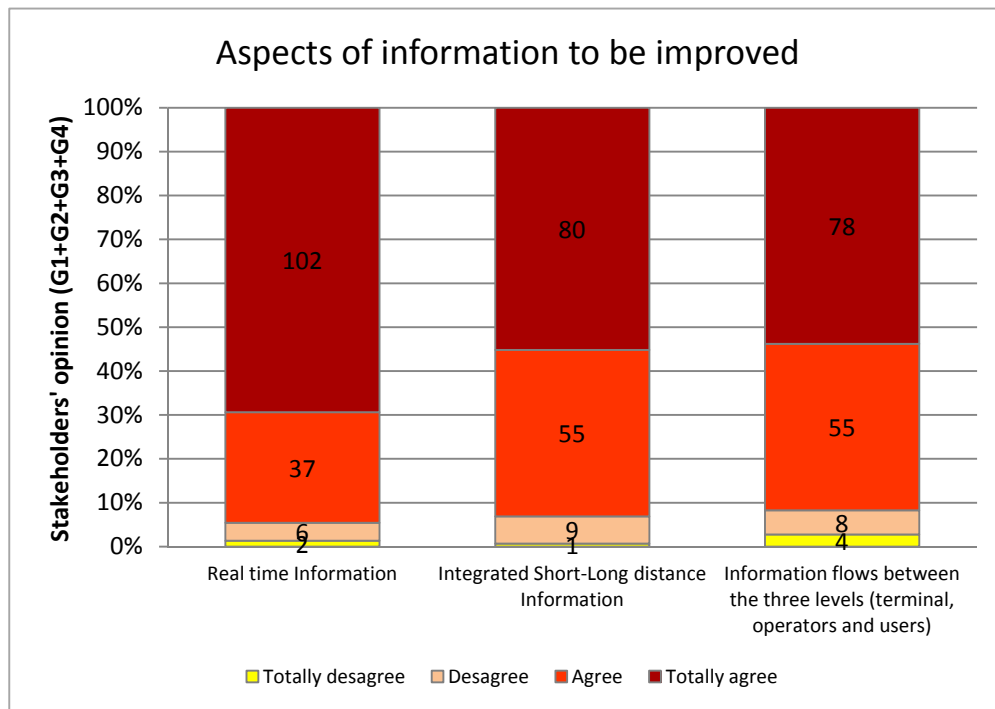

Figure 7 – Information systems that should be improved

Barriers to overcome to improve interchanges performance

Finally stakeholders were asked to identify the main barriers to improve the integration of facilities and transport modes, and how to achieve a better overall quality of services. To this purpose, they identified 5 main barriers covering infrastructure aspects as well as information and ticketing. But there are also relevant barriers referred to the coordination and management aspects: the problems of coordination among the different transport operators, the poor coordination among different stakeholders' levels and the public bodies. Table 3 summarizes these barriers.

Table 3 – Main barriers identified by stakeholders

5 main barriers	Relative importance (%)	Elements included in the barrier
Cooperation among operators	31	– Lack of cooperation/ coordination – Lack of incentives – Different tariff structures and timetables 　　Integrated ticketing systems
Coordination among different stakeholders	24	– Conflicting interests and responsibilities – Coordination of operators with other stakeholders – Provision and exchange of information among actors Lack of a coordinating authority
Improvement of physical infrastructure	23	– Long winded planning and financing – Inadequate design and congestion – Lack of an integrated infrastructure and terminal management – Reluctance to open terminals for other modes
Passenger information and ticketing integration	12	– Insufficient passenger information – Accessibility and price of intermodal tickets
Coordination of public activities	10	– Lack of coordination among public authorities – Administrative and regulatory constraints – Different standards and regulations

PASSENGER VALUES AND PERCEPTIONS

Passengers' decision making processes or perceptions are complex and much influenced by their own personnel characteristics (Hoogendoorn-Lanser et al., 2006). If stakeholders (Decision Makers, Terminal Managers and transport Operators) could get to understand them, they could provide better services and prioritize actions for improvement. No-one better than the passengers themselves can tell us which factors they weight up more or which aspects of the terminal cause them more dissatisfaction (Hine and Scott, 2000). When selling a product, companies investigate the market segment and the customer profile, expectations or satisfactions, in order to offer what they are looking for. Intermodal nodes are used by many passengers (customers), and to understand their point of view is essential for the efficient management of the existing Interchanges or Stations, as well as for improving the infrastructure design in the near future.

Travellers' Survey

In the HERMES project, questionnaires were thought to be a suitable tool to evaluate the level of interconnectivity in the passenger terminals where short and long-distance transport networks cross, as well as the fluidity among crossing networks. To ensure reliability, the survey was based on a simple random sampling plan, in which every element of the population has a known and equal probability of selection. As regards the sample size, it was planned to get 300 valids interviews per interchange. The population surveyed were travellers

aged over 15 years, who were stood or seated at bus and rail stations, platforms, halls, ticket offices, waiting areas and shops in the interchange. It is worth to note that interviews at waiting areas were easier to do, since respondents did not suppose a loss of time to answer to the questions. The surveys were carried out in May-June 2011, covering both peak and non peak hours (from 6:30 to 21:00).

The questionnaire was made up of 20 questions, as follows:

- 8 regarding the intermodal trip: origin and destiny, accessing mode to the terminal, main trip mode, distance and time of each stage and waiting time.
- 4 on the personal characteristics of the passenger: gender, age, trip purpose and factors influencing on the decision making for travelling.
- The remaining questions aimed to evaluate the passengers' satisfaction (from 1 to 5) regarding different aspects of the terminal such as facilities, accessibility, cleaning, security and information.

Table 4 below presents both the number of interviews and passenger/year for each case study.

Table 4 – Case Studies and their surveys

	Passengers per year (millions)	number of surveys
Zaragoza-Lleida HRS	3.3	214
Zaragoza Bus	2.3	138
Lyon train	22.8	746
Gothenburg train	16.8	603
Avenida de America (Madrid)-bus	27.9	383

Analysis of results from travelers' survey: influencing factors for trip choice

It is reasonable to assume that from a customers' perspective the most important step of an intermodal long-short distance journey is the long distance trip; trip in which they spend most of the money and time. This means that travellers will probably choose first the long distance mode and then, depending on the short distance mode connections and facilities, the transfer node. Therefore it is crucial to understand which aspects they weight up in their choices since any improvement will determine the success or not of the Station or Interchange involved.

This research had two targets in what respect to travellers behaviour. The first one is oriented to identify which factors passengers value more when they decide how to make the journey. The first phase of the analysis of results consisted of the identification of the key influencing factors in choosing their transport option. For this end we have investigated the influence of the type of station, the age and the trip motives. The results are shown as a percentage over the total sample (i.e., a population of 2,804 individuals), grouped by stations, age and trip purpose in the interest of the analysis. From the surveys carried out in the case studies the results are showed in Table 5.

Table 5 – Influencing factors analysis

	Trip choice influencing factors per Case Study (%)								
	Price	Comfort	Punctuality	Environment	Time spent	Safety	Simplicity	Quality services	Other
Av America (Madrid)-Bus	**47.4**	16.3	9.6	0.8	5.8	1.4	4.7	2.2	11.8
Zaragoza Bus	**41.6**	8.0	4.0	0.0	11.2	1.6	5.6	2.4	25.6
Zaragoza-Lleida -HRS	5.0	**22.3**	9.9	0.0	**46.0**	1.0	2.0	1.5	12.4
Lyon Train	**29.2**	10.0	4.6	3.3	**33.0**	4.1	4.5	0.5	10.7
Gothenburg-train	**33.7**	**19.3**	5.5	10.3	14.4	8.5	3.3	1.0	4.1

	Trip choice influencing factors per age (%)								
	Price	Comfort	Punctuality	Environment	Time spent	Safety	Simplicity	Quality services	Other
15-20	**37.5**	6.9	7.5	4.6	**17.6**	6.3	6.3	1.2	12.1
21-35	**35.2**	9.8	6.7	4.6	**25.1**	2.6	3.9	1.3	10.9
36-55	**21.7**	**18.4**	9.3	3.8	**29.0**	3.5	4.0	0.9	9.3
56-64	**21.9**	**21.9**	7.8	5.5	**18.8**	7.8	3.1	4.7	8.6
>64	13.5	**33.3**	6.3	3.1	10.4	15.6	4.2	3.1	10.4

	Trip Choice influencing factors per purpose (%)								
	Price	Comfort	Punctuality	Environment	Time spent	Safety	Simplicity	Quality services	Other
Business	**21.0**	13.1	9.2	5.8	**32.8**	3.0	2.1	1.1	12.0
Studies	**25.8**	5.3	10.0	3.7	**26.3**	4.2	6.8	1.6	16.3
Leisure	**35.6**	14.9	5.6	4.1	**19.0**	5.4	4.9	1.6	8.9
Other	**35.1**	13.5	11.5	2.0	**16.2**	4.7	5.4	2.0	9.5

The analysis of these results shows some interesting conclusions: there are three main factors influencing travel decisions: time, price and comfort, which importance varies a lot depending on the age. So, the youngest and oldest value more to save money and less to save time, and the importance of comfort increases with the age. Also the purpose of travel makes a difference: passengers travelling for business purposes are much more influenced by time spent and less by travel time than those travelling for leisure. Between those three factors mentioned, time and price become more important in such a way as to distinguish two kinds of passengers:

- Those influenced mainly by the time spent in the whole chain trip, like train travelers from Lyon Station and Zaragoza and Lleida-HRS. Furthermore, the latter do not consider ticket prices as an important factor.

- Those influenced by Ticket Prices, such as bus travelers of Zaragoza and Avenida de America or Gothenburg Station who, on the opposite ,do not consider travel time as relevant for their trip election.

To summarize, it could be stated that both price and time are fundamental variables for passengers' choices, but usually only one of them is taken into consideration when making the decision.

Finally, both kinds of passengers state that comfort and punctuality are also important (although secondary factors), even if it is much more important for HRS train users, who are willing to pay more for a better service.

In the HERMES project all the Case Studies involved are relevant nodes which performance is reasonably good, the key is to give to the passengers what they look for (Monzon et al, 2012).

Nevertheless, facing the future, to build efficient nodes should require a first analysis on the target, i.e., on the kind of passengers to be attracted and, then, focus on what they are really looking for. In the cases analyzed it is seen that the travelers made their choices because of the low prices or the short time to spend. So stakeholders should agree on improving those factors involving these issues.

However, a certain level of quality in terms of comfort and punctuality should be always a service requirement. In fact, the surveys show that not everyone considers time and not everyone considers price, but everybody agree on comfort and punctuality So, stakeholders (transport operators and terminal managers mainly) should assume competences to force transport operators to assure punctuality and comfort through, for instance, quality contracts where any failure should be penalized.

Analysis of results from travellers' survey: interchange satisfaction

The second target of this investigation was to know which elements of the interchange are consider more relevant for fulfilling travellers expectations in their transfer among modes. Therefore, another outcome from the surveys is the satisfaction of passengers about some issues in the interchange, we have selected the results of the evaluation made for shops, cleaning at the terminal, accessibility and safety and security (Litman, 2009). Table 6 shows the main results.

Table 6 - Passenger satisfaction with the present facilities

Interchanges	Rating of Passengers satisfaction (0-4)			
	Shops and Retail	Cleaning	Accessibility	Security
Lleida	1.9	2.7	**3.0**	**3.1**
Lyon	2.2	2.4	2.2	2.1
Gothenburg	**3.1**	2.4	2.4	2.5
Avenida de America	2.0	2.3	-	2.5
Zaragoza	2.1	2.9	2.9	2.9

In Lleida, except for the opinion on shops and retails (less than 2 points out of 4), passengers showed a very high level of satisfaction regarding all aspects. Respondents especially express a good opinion about accessibility and security in this station (in fact, Lleida gets the highest evaluation regarding these issues). It is worth to mention that the station is not a big one, and does not have facilities and shops, but it is very nice and completely constructed in just one level. Lyon Station and Avenida de America were both good considered in general, although satisfaction rate was not very high regarding any aspect. At Gothenburg Station, passengers

were quite satisfied, especially with shops and retails. Zaragoza got the best global punctuation: cleaning, accessibility and security were quite well considered.

In general, although each terminal has its weak and strong points, the satisfaction rate was reasonably good for all stations, reaching practically all stations scores over 2. We should remark that all these stations are a reference and were chosen by each partner of HERMES project because of their relevance. This is confirmed for the valuation given for the travellers at these terminals who are quite pleased with the services provided.

CONCLUSIONS AND POLICY RECOMMENDATIONS

From the above results it can be concluded that stakeholders rated highly the accessibility to the stations and the waiting areas (Figure 5). When the access is good by public transport means most of the travellers prefer to use them; on the contrary, when they are poor, car and taxi become the main access modes (Wardman and Hine, 2000). This is the case of Avenida de America interchange which serves to almost 28 million travellers per year, which has very good accessibility by metro and buses. The case of Goteborg rail and bus terminal is a good example of integration of shops in the waiting areas in a liveable atmosphere. Small stations are good from the point of view of good access and security if their manager care of that, which is the experience of Lleida.

It is also relevant that most trips are made for leisure purposes and more than a half of the travellers are women. These two facts should be taking into account when designing the interchange and to identify the facilities to offer and the space dedicated to each of them.

Regarding the interchange infrastructures and services, there is a clear perception of its importance, although the present situation does not fulfil the expectations. Some key barriers that should be overcome to improve the current unsatisfactory situation have been identified. There is a lack of coordination among stakeholders: planners, decision makers, operators and terminal managers. At the same time different transport providers do not coordinate their services and timetables. Information provision appears to be a clear area of improvement, both inside the interchange and for the connecting services.

Time and price are the most influencing factors but for different groups of people. Young travellers, particularly bus users, make their decision trip according to low prices. On the contrary, business trips in high level rail services are decided on the basis of trip time. Comfort appears to be very relevant for the elder above any other consideration.

Travellers clearly perceive the different elements which fulfil their satisfaction indexes, which include cleaning, security, quality of shops and accessibility levels.

Those results indicate a way forward to develop new policies to design, manage and operate services in the interchanges. Hence, to make them more efficient and attractive is a key element to achieve a clear seamless mobility for connecting long and short distance trips.

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