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CityMobil

Towards advanced transport for the urban environment

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Executive Summary

The global objective of the CityMobil project is to achieve a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development.

For this aim, four different technologies will be tested and evaluated in the project: Personal Rapid Transit (PRT), CyberCars (CC), High Tech Buses (HTB), and Dual-mode Vehicles (DMV).

The demonstration, the showcases and the case studies involved in the CityMobil project have to provide a data collection for the evaluation of their feasibility and performances. In such way it is possible to evaluate the results, linked to the introduction of the new technologies proposed in the project, in terms of advantages for the users and improvement of new transport scenarios. Three different evaluation phases are required for each site: initial evaluation, ex-ante evaluation, and ex-post evaluation.

An evaluation framework has been made in the first phases of the project, capable of capturing the social, environmental, economic, legal and technological impacts of Advanced Transportation Systems (ATS). The framework was required to operate at spatial scales ranging from laboratory and test-track interventions, through computer modelling to real-world implementations on a large scale. For the evaluation of passenger transport systems a list of 64 indicators was generated, subdivided in 9 evaluation categories: Acceptance, Quality of service, Transport patterns, Social impacts, Environment, Financial impacts, Economic, Legal impacts, Technological success. This can be viewed as the complete envelope of overarching indicators which could form part of the evaluation of each of the different elements of Citymobil.

This deliverable is the second part of a whole deliverable, obtained together with the first part (D5.2.1a) previously done in the CityMobil project, concerning the evaluations of the demonstrations and the showcases of the project. In this second part the data not available when the first part was done are reported and compared with the first data, where it has been possible. This deliverable reports particularly the ex-ante evaluations of the demonstrations of Castellon and Heathrow, and the ex-post evaluations of the showcases of La Rochelle, Trondheim and Vantaa (for the last two showcases the evaluation plans are also reported in this deliverable).

The data of the locally focused evaluations of the entire Sub-project 5, made of demonstrations, showcases and case studies, are used to fill the cells of a bi-dimensional matrix, taken directly from the Sub-project 2, called “Passenger Application Matrix”.

In this matrix the case studies, the demonstrations and the showcases are grouped according to their origins and destinations (respectively rows and columns of the matrix). Being the possible OD pairs the same, the matrix results to be a two-dimension symmetrical one.

Ten possible origins and ten possible destinations are in the matrix. They are:

- City centre,
- Inner suburbs,
- Outer suburbs,
- Suburban centre,
- Major transport nodes (e.g. airport, central station),
- Major parking lots,
- Major educational or service facilities (e.g. university campus, hospital),
- Major shopping facilities,

- Major leisure facilities (e.g. amusement parks),
- Corridor.

The cells of the matrix represent all the possible OD pairs.

They are filled with the ATSs studied in the project, in terms of results of the local evaluation processes.

In the project different technologies, with different studies, in different contexts and with different methods have been studied. For example the travels from outer suburbs to city centre are studied for the following ATSs: Public Transport Feeder Cybercars in Trondheim, High-Tech Buses in Castellon, Madrid and Trondheim, Personal Rapid Transit in Trondheim, Dual-Mode Vehicles in Gateshead, Madrid, Trondheim and Vienna. The matrix output for this cell is made of Transport Patterns, Social, Environmental, Financial, Economic Impacts of each of those ATS for such kind of trip; it allows to select the most appropriate ATS to be designed for different and specific situations covering such trip.

The filled matrix is therefore the final result of the evaluation, and at the same time the tool to move the focus from the researcher perspective to the decision maker's one, typically more practical, trying to think in terms of what system is best to be implemented in order to improve the mobility in a certain specific situation. Each cell of the matrix contains the results of the local evaluation processes for each ATS evaluated for the combination origin/destination represented in the considered cell, and on the basis of the available indicators it will be possible to define the impacts to be expected by each ATS for the given OD pair and consequently to choose the most appropriate ATS.

The cells of the matrix covered at the moment by demonstrations and showcases are the following, reported with the corresponding demonstration and/or showcase:

- City centre to city centre: La Rochelle showcase with Dual-Mode Vehicles;
- Inner suburbs to inner suburbs: Daventry showcase with PRT;
- Outer suburbs to city centre: Castellon demonstration with High Tech Bus;
- Outer suburbs to inner suburbs: Castellon demonstration with High Tech Bus;
- Major transport nodes to city centre: Vantaa showcase with Cybercars;
- Major transport nodes to major transport nodes: Heathrow demonstration with PRT;
- Major parking lot to suburban centre: Rome demonstration with Cybercars;
- Major parking lot to major transport nodes: Rome demonstration with Cybercars;
- Major educational or service facility to city centre: Castellon demonstration with High Tech Bus;
- Major educational or service facility to major educational or service facility: Trondheim showcase with Cybercars;
- Major leisure facility to city centre: Castellon demonstration with High Tech Bus.

For what concerns the case studies, the results of their evaluation divided according to the cells of the matrix covered are widely reported in the deliverable 5.3.1b, named "Evaluation report for the ex-ante study".

For all the demonstration and showcases (with the only exception of Rome), indicators belonging to the acceptance and quality of service evaluation categories have been measured through interviews, and the average performances of such interviews have been reported in a ranking from 1 (worst performance) to 5 (best performance). With such available performances, comparisons between different cells of the matrix about the users' reactions to the ATS are possible for the common indicators.

Furthermore for the demonstrations of Rome and Castellon and for the showcase of Daventry some of the transport patterns and economic indicators have been measured.

City centre to city centre

In the city centre to city centre scenario the technology evaluated is the Dual-Mode Vehicles of the La Rochelle showcase, based on a car sharing service with automatic relocation and platooning of the vehicles, whose description is reported in the deliverable 5.2.1a and the evaluation is widely reported in section 3.3 of this deliverable.

Figure 1 shows the six acceptance and quality of service indicators measured, which provided the following results:

- Users were generally satisfied with the Dual-Mode Vehicles system, with an average performance rate of 3.8;
- The ease use is the best rated indicator, with 4.0 as performance rating;
- The service was perceived as useful and safe, with both of the corresponding indicators rated 3.8;
- Reliability, perceived comfort and fear of attack, are less rated than the previous three indicators (3.6 for the first two and 3.7 for the last one).

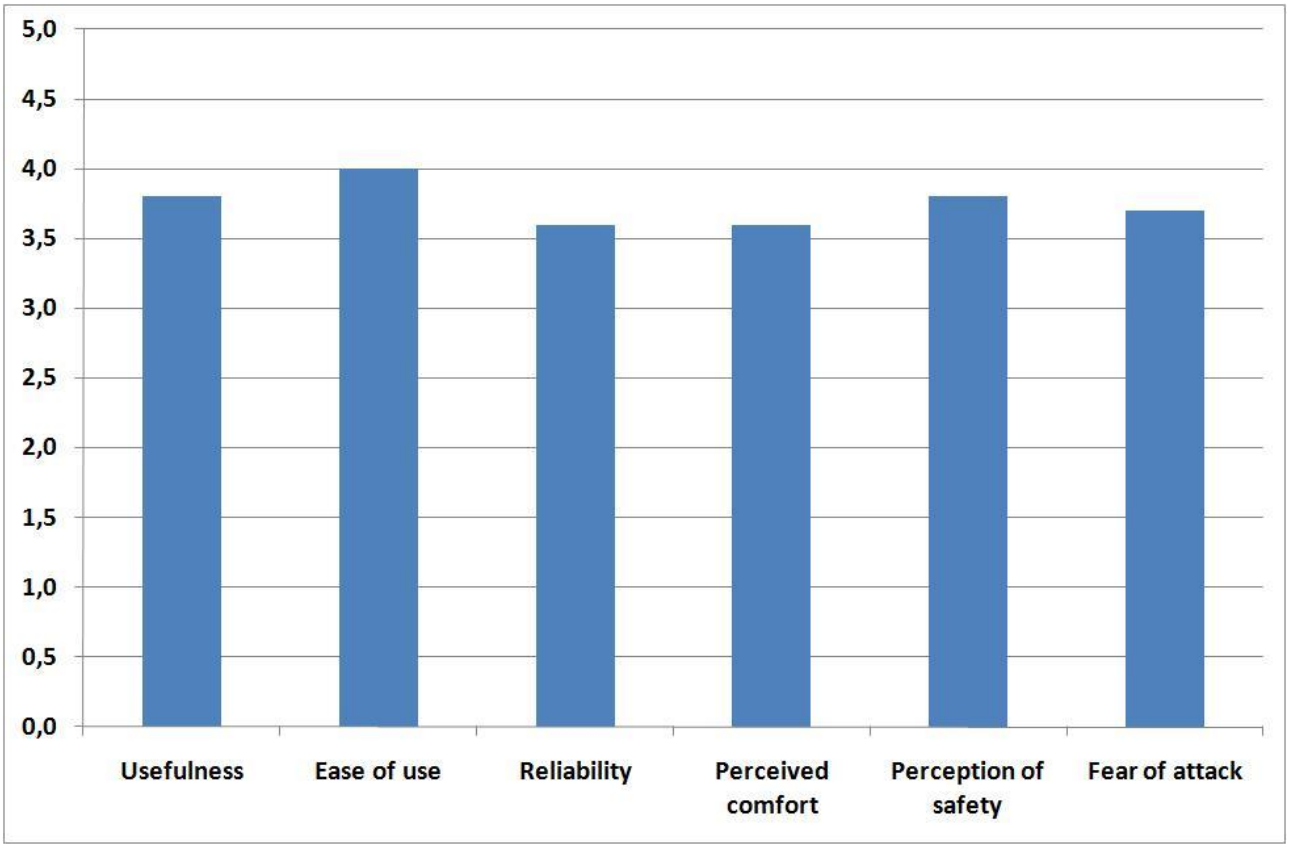

Figure 1 La Rochelle ex-post indicators

Different vehicles were used in the La Rochelle showcase: Yamaha, Fiat, Cycab and a parkshuttle.

Such results mean that the innovations due to this ATS can be applied in the city centre of a small/medium city as La Rochelle with quite good results in terms of users' acceptance and quality of service.

Inner suburbs to inner suburbs

The same indicators of the city centre to city centre scenario are available for the inner suburbs to inner suburbs scenario, where the technology evaluated is the PRT of the Daventry showcase, whose description and evaluation are reported in the deliverable 5.2.1a.

Figure 2 shows the six acceptance and quality of service indicators measured, which provided the following results:

- The users' evaluation of the PRT tested was quite sufficient, with an average performance rating of 3.2;
- The system was perceived as quite useful and easy to use, with 3.5 as rate of the two correspondent indicators;
- The system was also sufficiently safe (3.2), reliable (3.1) and comfortable (3.0);
- The only indicator not completely sufficient was fear of attack, rated 2.9; it can be due to the fact that the vehicles are fully automatic without a driver, thus people fear that an attack would be easy in such conditions.

Although the vehicles used in the Daventry showcase were not properly PRT, but automatic vehicles similar to cybercars, these results lead to consider that the PRT can be applied with fairly satisfactory results for the users in linking different inner suburbs of a small/medium city as Daventry. The users' fear of attack could be avoided with "ad hoc" campaigns on the security on such vehicles, even if without a driver.

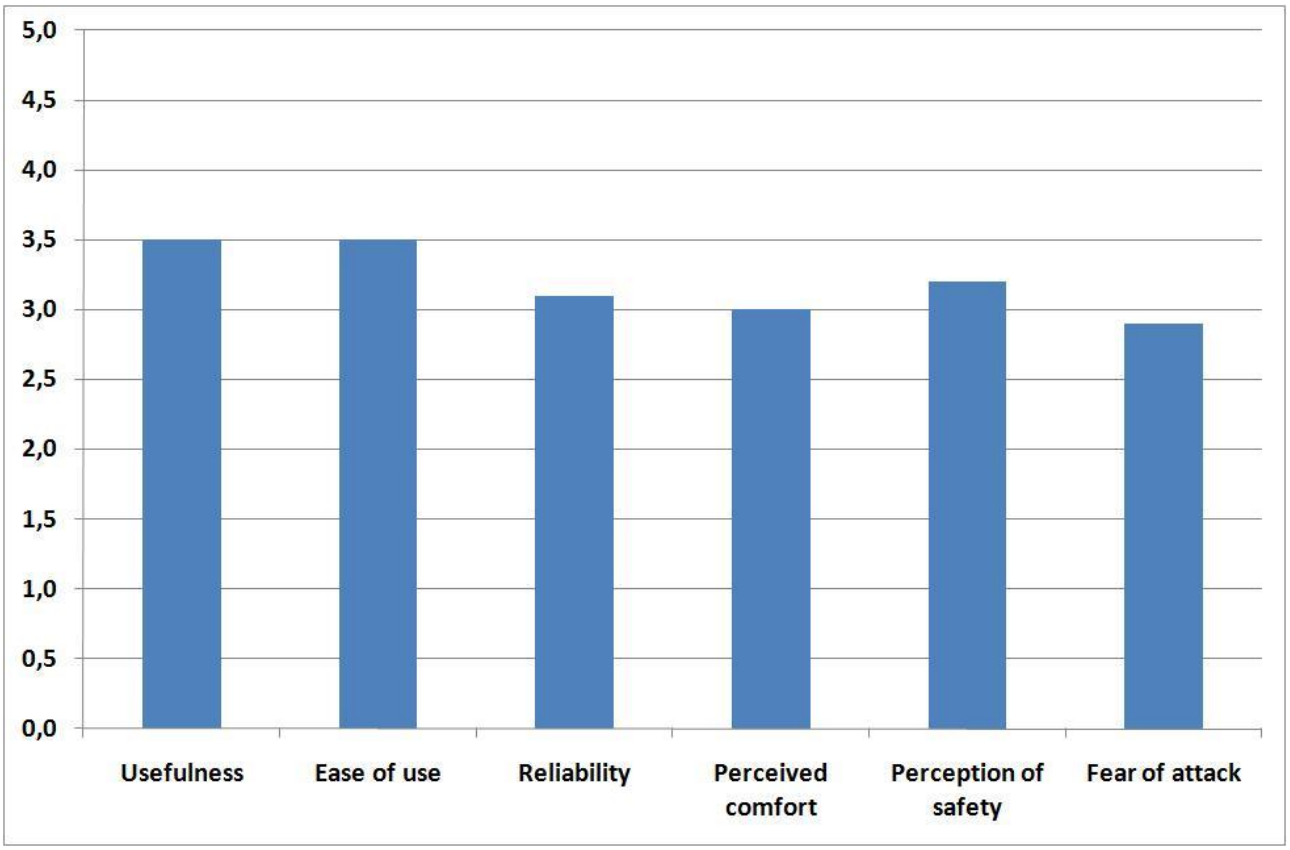

Figure 2 Daventry ex-post indicators

Other than the acceptance and quality of service indicators measured, an economic value was provided about the costs connected with the organization of the showcase: 85 000.00€ (not including VAT) can be assumed as a reference cost to organize a little scale showcase with PRT linking different inner suburbs.

Considering the comparison between the acceptance and quality of service indicators measured in La Rochelle and Daventry, the differences between them seem to be mainly due to the different kinds of service provided in the two cities.

The large number of options of vehicles to be tested in La Rochelle seems also to affect the results in terms of positive user perceptions. This is probably due to the fact that when there are more than one option of vehicle the new concept of transport is taken into account by the users, whereas users consider only the vehicles and not the concept when there are a lower number of available options.

Furthermore, the differences could be also probably due to the different cultures: the global trends of the indicator rates are similar, but those of Daventry seem to be translated to lower values than those of La Rochelle.

Outer suburbs to city centre – Outer suburbs to inner suburbs – Major educational or service facility to city centre – Major leisure facility to city centre

For four different scenarios, outer suburbs to city centre, outer suburbs to inner suburbs, major educational or service facility to city centre, and major leisure facility to city centre, the technology evaluated is the High-Tech Bus of the Castellon demonstration, which links the University campus to the centre of Castellon and then to the harbor, passing through the inner and the outer suburbs. The wide description of the demonstration is reported in the deliverables 5.2.1a and 1.4.5.1.

In section 3.1 of this deliverable the evaluation ex-ante is reported; the data collections were performed before the CityMobil project start, thus the results obtained have to be properly considered as “before” results, and provided two transport patterns indicators, system modal share and total number of daily trips, respectively 15% and about 20000.

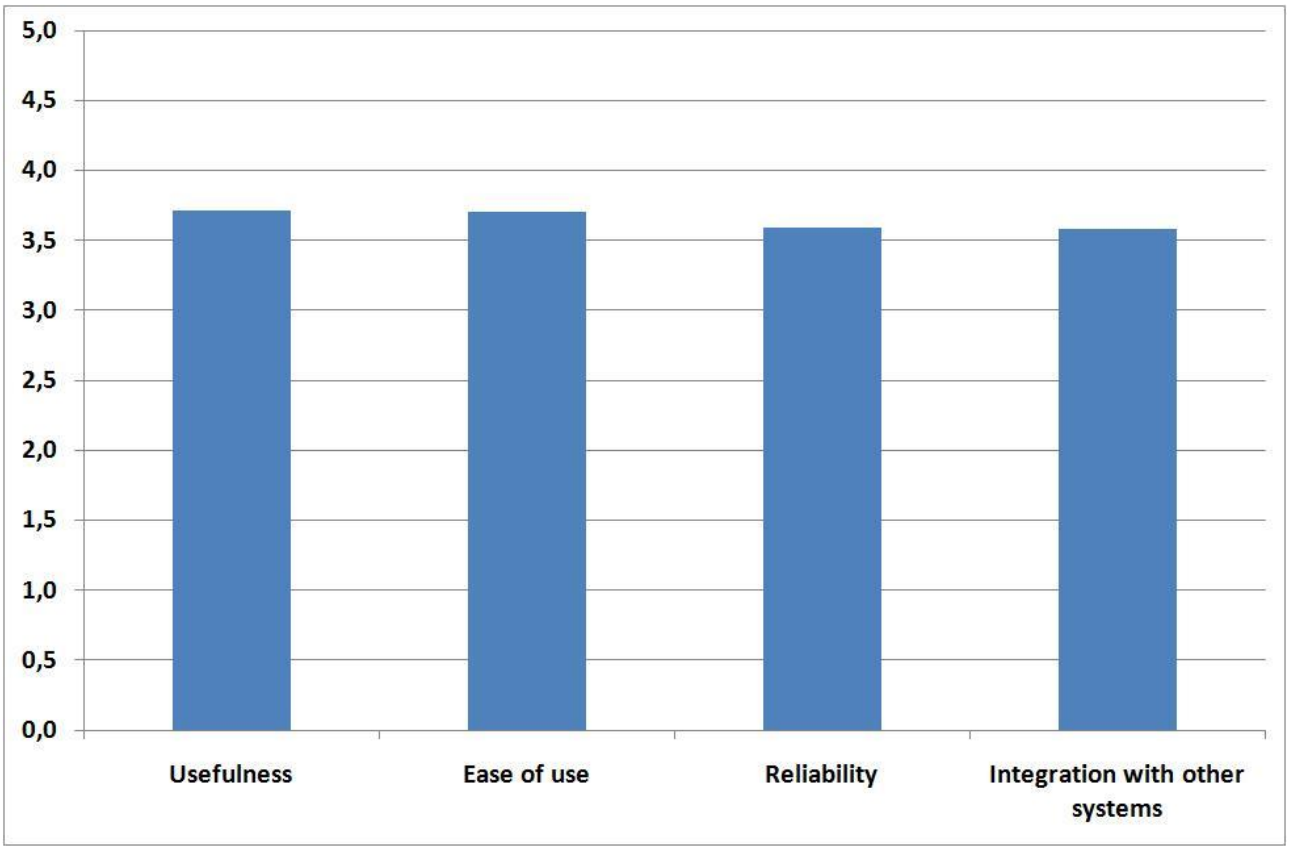

Figure 3 Castellon ex-post user acceptance indicators

At the moment the ex-post data collection of the Castellon demonstration has been completed, and the data are being elaborated in order to calculate the indicators of all the evaluation categories. Such indicators will be reported in the deliverable 1.4.5.3 named “Ex-post impact assessment of the Castellon demonstration” and their complete evaluation will be reported in the deliverable 5.2.2 named “First ex-post report (focus on Castellon)”.

A first overview of the 12 Castellon ex-post acceptance and quality of service indicators collected is reported respectively in Figure 3 and Figure 4.

The four user acceptance indicators measured, reported in Figure 3, provided the following results:

- Users were generally satisfied with the High-Tech Buses, with an average performance rate of 3.65;

- Usefulness and ease use are the best rated indicators, with 3.7 as performance rating;
- The service was perceived as reliable and good integrated with the other systems, with both of the corresponding indicators rated 3.6.

The eight quality of service indicators measured, reported in Figure 4, provided the following results:

- Users perceived a high quality of service for the High-Tech Buses, with an average performance rate of 3.7;
- The information to use the system is available and comprehensible, with the corresponding indicators both rated 3.8;
- The system was perceived as comfortable, safe, secure and with a high level of privacy, and the ticketing was quite good (the corresponding indicators being all rated 3.7);
- The cleanliness of the system was also satisfactory (3.6).

The average rate of acceptance and quality of service indicators is little less than 3.7, meaning that the innovations due to the introduction of this ATS are well accepted by the users, who like this system to cover their travels between city centre, inner suburbs, outer suburbs and major educational and leisure facilities.

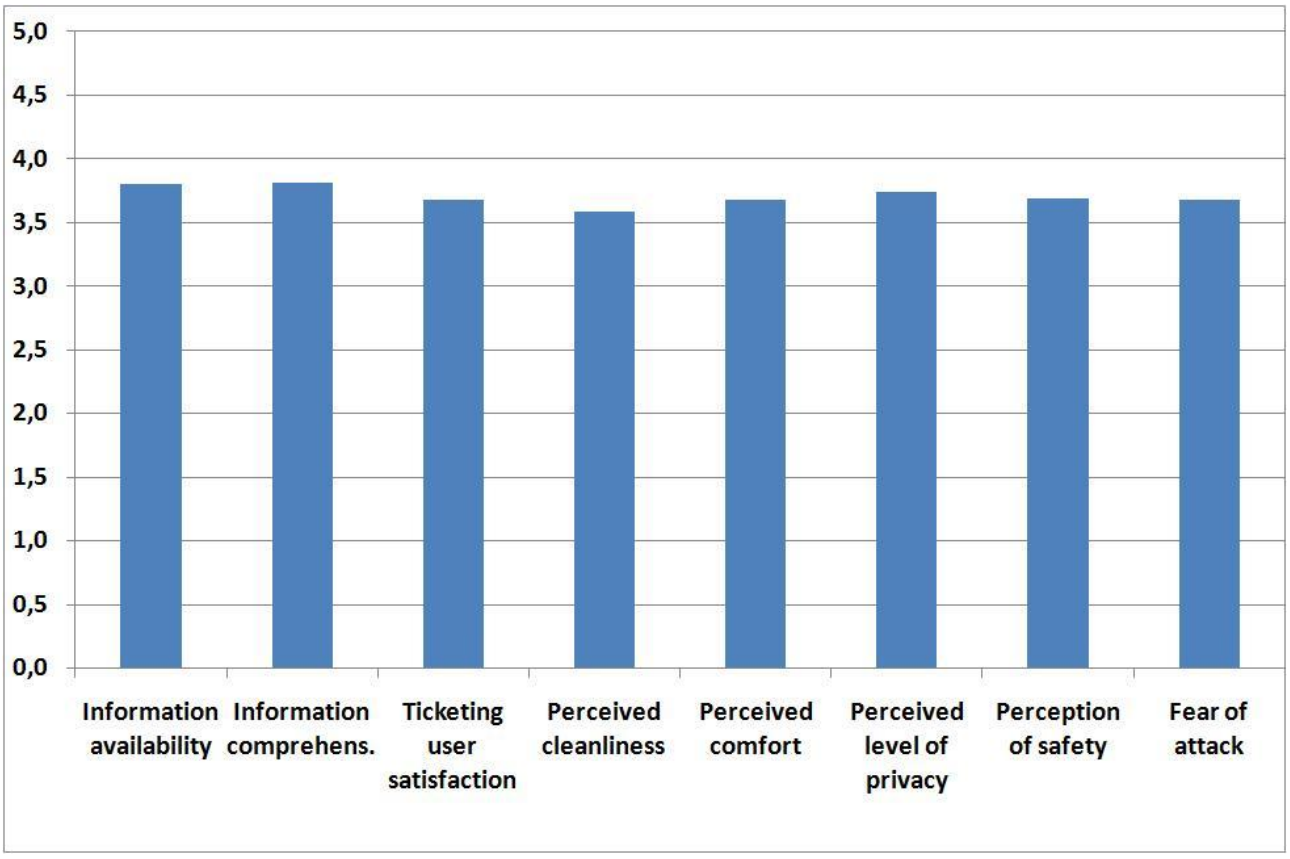

Figure 4 Castellon ex-post quality of service indicators

The remaining indicator evaluations will be reported in the deliverable 5.2.2 once they have been completed, and will concur to the completion of the Passenger Application Matrix by filling the cells involving the Castellon demonstration.

Major transport node to city centre

In the major transport node to city centre scenario the technology evaluated is the Cybercar system of the Vantaa showcase, based on a public transport feeder service in the new area of Marja-Vantaa, whose description and evaluation are widely reported respectively in sections 2.2 and 3.5 of this deliverable.

Figure 5 shows the nine acceptance and quality of service indicators measured, which provided the following results:

- The users' evaluation of the Cybercars tested was sufficient, with an average performance rating of 3.2;
- The acceptance of the system was generally high, with ease of use as the best rated indicator (4.0) and an average value of 3.4 for the five indicators included;
- The quality of service has to be improved: the average rate of the four indicators was little less than sufficient (2.9), with fear of attack as the only one sufficient (3.0), even if the remaining three indicators very near to be sufficient.

The vehicles used in the Vantaa showcase were not last generation prototypes and they were not closed. Probably such features produced not positive impacts on the users for what concerns comfort, privacy, safety and security, as showed by the correspondent indicators.

However the results obtained lead to consider that the system tested in Vantaa can be applied with fairly satisfactory results for the users in linking major transport nodes to the city centre of a small/medium city as Vantaa. The problems linked with the users' low perception of quality during the showcase can be solved by using modern cybercars, more comfortable and safe than those used in the tests.

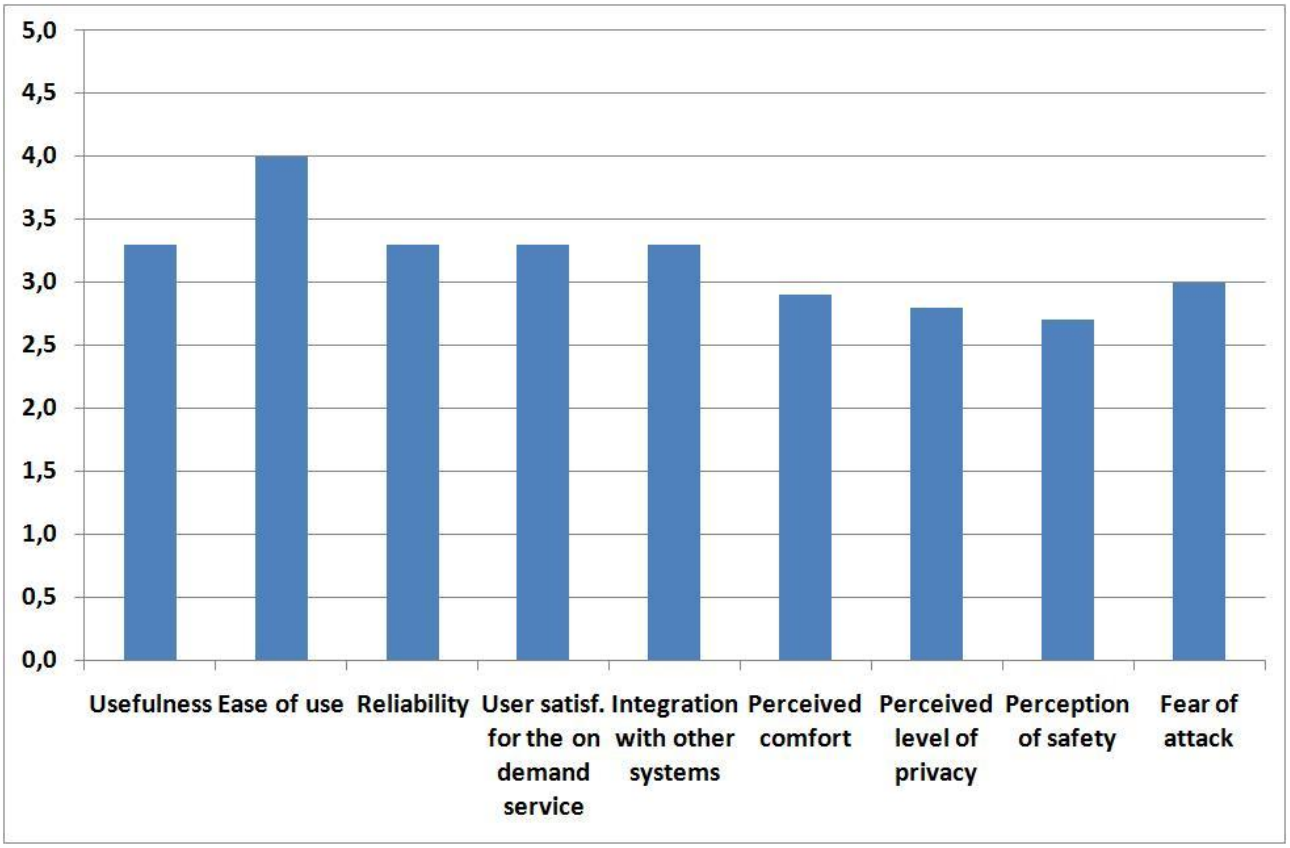

Figure 5 Vantaa ex-post indicators

Major educational or service facility to major educational or service facility

In the major educational or service facility to major educational or service facility scenario the technology evaluated is the Cybercar system of the Trondheim showcase, based on a service provided in the St. Olav Hospital complex, whose description and evaluation are widely reported respectively in sections 2.1 and 3.4 of this deliverable.

Figure 6 shows the nine acceptance and quality of service indicators measured (the same considered in Vantaa), which provided the following results:

- The users' evaluation of the Cybercars tested was fairly good, with an average performance rating of 3.4;
- The acceptance of the system was generally high, with ease of use and user satisfaction for the on demand service as the best rated indicators (3.5) and an average value of 3.3 for the five indicators included;
- The quality of service resulted to be also high: the average rate of the four indicators was 3.5, with perceived comfort and fear of attack as the best rated indicators (3.7), a high perception of safety (3.5) and a sufficient level of privacy (3.1).

The vehicles used in the Trondheim showcase were the same type of vehicles used in Vantaa, beside a parkshutte. The parkshuttle presence can be directly seen by looking at the quality of service user perception, with indicator rates very higher than those obtained in Vantaa.

The results lead therefore to consider that the Cybercar system tested in Trondheim can be applied with very good results for the users in linking major educational/service facilities of a small/medium city as Trondheim, both in terms of acceptance and quality of service.

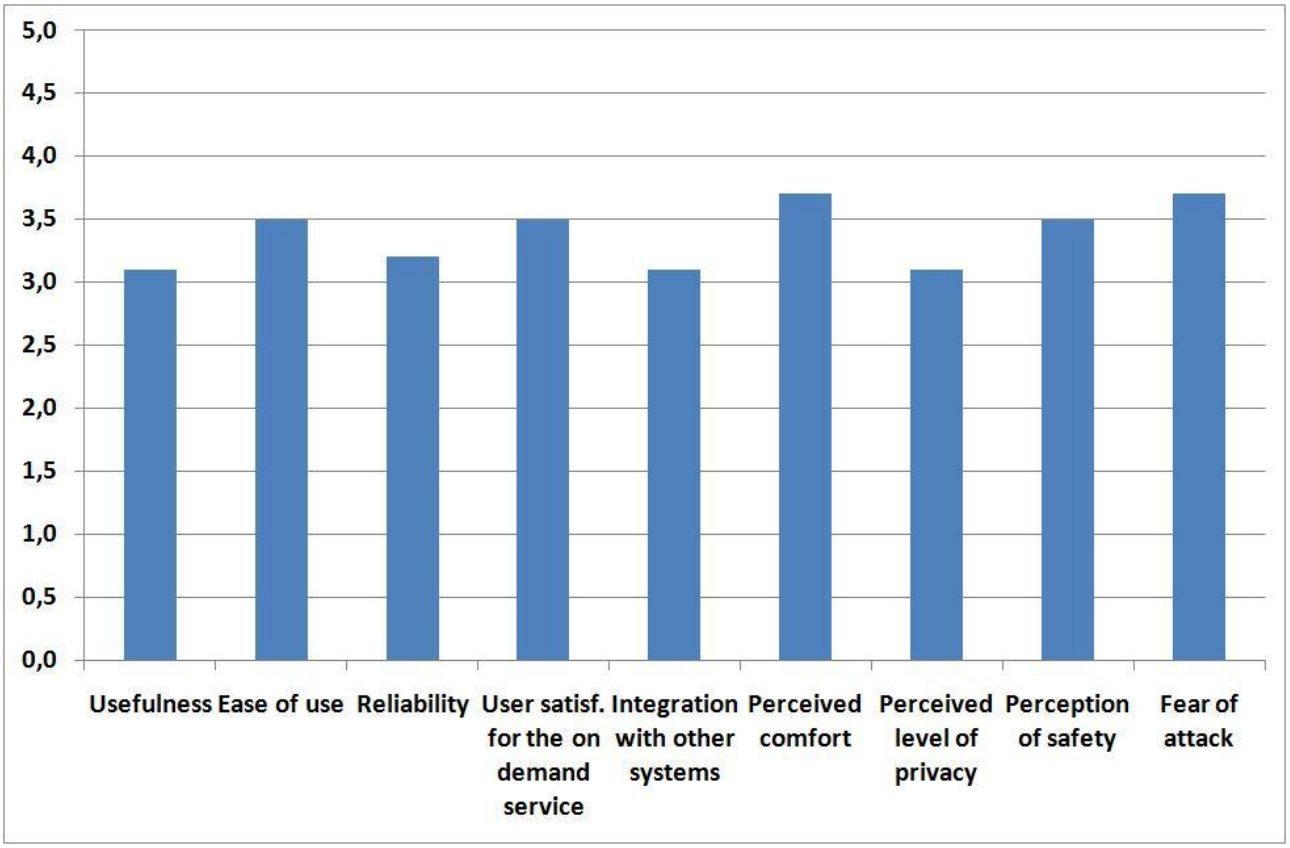

Figure 6 Trondheim ex-post indicators

Major transport node to major transport node

In the major transport node to major transport node scenario the technology evaluated is the PRT of the Heathrow airport, designed to conduce people from the Business Car-park of the airport to the new Terminal 5 and vice-versa, whose description is reported in the deliverable 5.2.1a and the ex-ante evaluation is widely reported in section 3.2 of this deliverable.

Figure 7 shows the seven acceptance and quality of service indicators measured, which provided the following results:

- The users' evaluation of the PRT was quite good, with an average performance rating of 4.0;
- The ease of use was considered as the best feature of the system, with a rate of 4.3;

- Perception of safety and reliability was also considered as quite good, with rates of 4.1 and 4.0 respectively;
- The four remaining indicators were also good, with integration with other systems last rated, but with a high rate of 3.7.

Two further indicators (not included in acceptance and quality of service categories) were measured through the ex-ante interviews: perception of environment-friendliness and modern image of the airport. Both of them were quite sufficient, with rates of 3.5 for modern image of the airport and 3.2 for perception of environment-friendliness.

These results lead to consider that the potential users are well disposed for the PRT system for the Heathrow airport, which they consider as easy to use, comfortable, reliable, well integrated and without any problems due to its fully automatic configuration.

Major parking lot to suburban centre - Major parking lot to major transport nodes

For two different scenarios, major parking lot to suburban centre and major parking lot to major transport nodes, the technology evaluated is the Cybercar system of the Rome demonstration, which links the main car-park of the new building for the Rome exhibition to the railway station and to the building entrance. The wide description of the demonstration and the ex-ante evaluation are reported in the deliverable 5.2.1a.

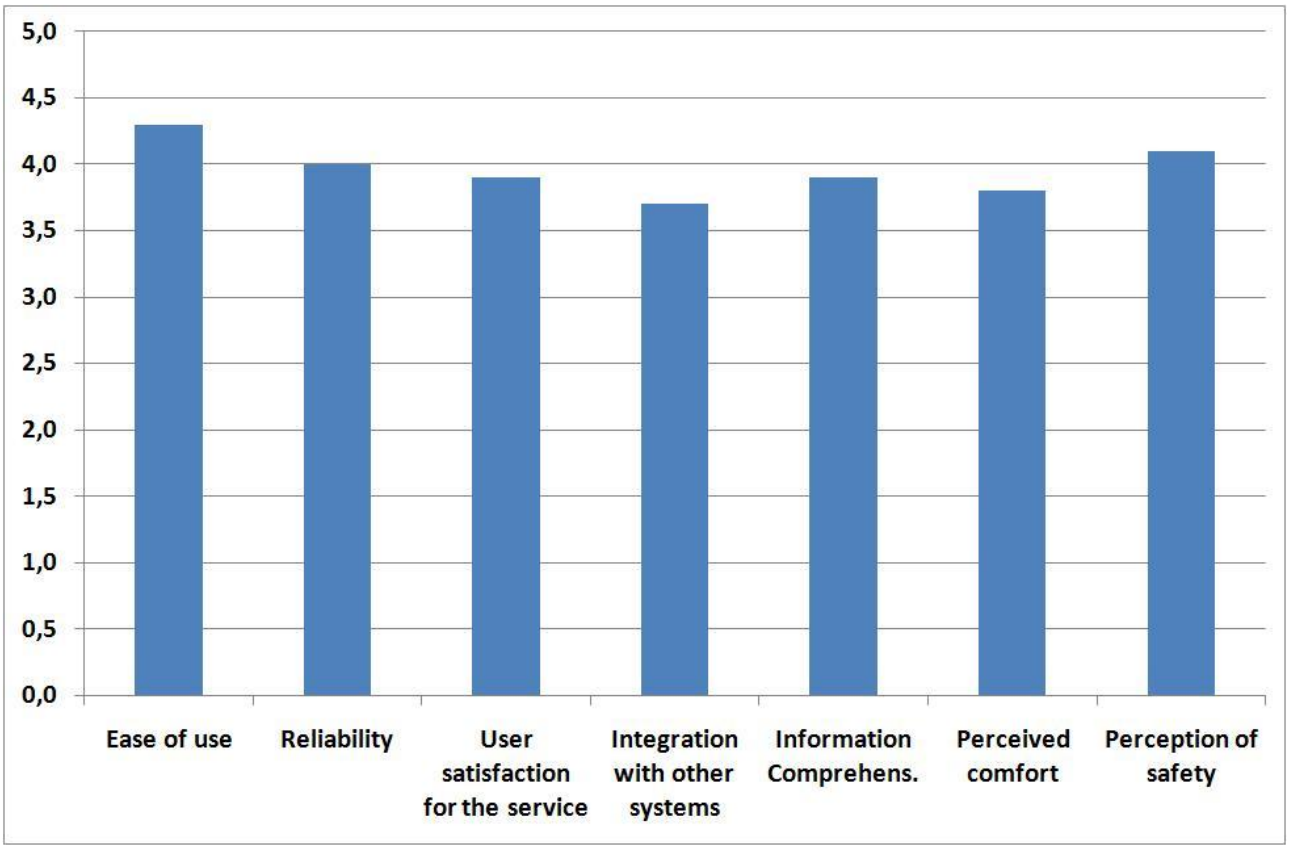

Figure 7 Heathrow ex-ante indicators

Concerning the acceptance and quality of service indicators, only one of them (usefulness) has been rated with a different method, by expressing people satisfaction in a percentage scale, from 0 to 100%. The usefulness rate for Rome was 94%. For the other indicators of such categories, the interviews allowed to calculate the reference case and the threshold for success, to be used once the system will be operated and the ex-post evaluation will be done.

Another indicator, specific of the Rome demonstration, was rated with the same procedure: illegal parking tendency, showing a 62% rate.

Three transport pattern indicators were measured: 1) modal shift from private car to Cybercar system (60%), 2) daily passenger·km travelled (3200), and 3) Daily trips (14000).

Concerning the financial and economic indicators, the start-up costs of the system are 3 300 000.00€ and the operating costs 455 000.00€/year. With 25 000.00€/year as revenues, the Net Present Value of the Cost-Benefit Analysis (CBA) of the system with a time horizon of 10 years is about -7 000 000.00€.

The main results that outcome from the demonstration and showcase evaluations made can be summarized as the following:

- The ATSs tested were generally perceived as easy to use and useful to solve mobility problems in different contexts;
- The ATSs were also evaluated as reliable, mainly in those applications with a driver (High-Tech bus and Dual-Mode vehicles);
- The evaluations of comfort, privacy, safety and security are directly affected by the number and kind of vehicles available for demonstrations and showcases:
  - When there were a large number of options of vehicles available (La Rochelle and Trondheim), users considered the new concept of transport represented by the showcases and evaluated the indicators as positive;
  - When there were few kinds of vehicles available (Daventry and Vantaa), users took into account only the vehicles tested and did not consider the entire concept of transport, thus feeling not positive about such indicators.
- The different cultures can probably influence the evaluations of such new systems. Considering La Rochelle and Daventry, the indicator trends of the two showcases were similar, but the rates of those concerning Daventry seem to be translated into lower values than those concerning La Rochelle.

The complete Passenger Application matrix is reported in section 5. It is the third release of the matrix, filled with the demonstrations and showcases and with the case studies reported in the deliverable 5.3.1b.

The matrix is on-going, because it is continuously filled with the data provided by the site evaluations; therefore each one of the future SP5 deliverable will show a further release of the matrix, filled with the data provided by the evaluations included in the deliverable, other than the data yet included in the matrix.

For example, in this deliverable there is the ex-ante evaluation of the Castellon demonstration: in the next deliverable 5.2.2 the ex-post evaluation of Castellon will be reported and the fourth release of the matrix will include both the ex-ante and the ex-post evaluation of Castellon in the cells regarding such demonstration, with the indicators measured and evaluated in both such evaluation phases.

Summarizing what concerns the rest of the Workpackage 5.2, three further deliverables will be made:

- D5.2.2 – First ex-post report (focus on Castellon) - delivery date: October 2010;
- D5.2.3 – Second ex-post report (focus on Heathrow) – delivery date: January 2011;
- D5.2.4 – Final ex-post report (focus on Rome and small demonstrations) – delivery date: April 2011.

In each one of them a new release of the Passenger Application Matrix will be reported, further filled with the data coming from the latest evaluations reported.

TABLE OF CONTENTS

Field trial B ex-ante evaluation report

1 Introduction

The objective of the CityMobil project is to contribute to a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development. In order to achieve this objectives advanced concepts for advanced road vehicles and passengers are developed. Furthermore new tools for managing the urban transport are introduced and barriers that are in the way of large-scale introduction of automated systems are removed.

The demonstration, the showcases and the city studies involved in the CityMobil project have to provide a data collection for the evaluation of their feasibility and performances. In such way it is possible to evaluate the results, linked to the introduction of the new technologies proposed in the project, in terms of advantages for the users and improvement of new transport scenarios. The evaluations have to be done according to the MAESTRO and CONVERGE methodologies, considering three different evaluation phases: initial evaluation, ex-ante evaluation, and ex-post evaluation.

This deliverable is the second part (named “B”) of a whole deliverable obtained together with the first part (“A”) previously done in the CityMobil project. In this part the data not available when the A part was done are reported and compared with the A data, where it has been possible.

This is the first section of the deliverable and represents an introduction to the document.

In the second section the evaluation plans of the two CityMobil showcases of Trondheim and Vantaa are reported.

The third section reports the evaluation done in this second phase of the work: for the two demonstrations of Castellon and Heathrow the ex-ante evaluation has been performed, whereas for the showcases of La Rochelle, Trondheim and Vantaa the ex-post evaluation is reported.

The fourth section reports the cross-comparisons and findings done, on the basis of the available data from each demonstration and showcase.

The fifth section of the deliverable reports the passenger application matrix filled with the data obtained from demonstrations and showcases.

2 Evaluation Plans

2.1 Trondheim

2.1.1 Site description

Trondheim is a 150000 inhabitants town, 30000 of which are students. The city hosts the regional public administration, and is also a centre for commerce, though the number of industrial companies is limited. Most offices are located in the city centre. The topography of the city creates challenges for transport, making it difficult to connect the east and west parts of the city.

In 2006 the city closed down the toll ring after 15 years of operation. Public transport in Trondheim is served by a bus system with local and regional routes. There is also a tram line connecting the city centre, Byåsen, to a recreational area on the western side of the city. The map of bus routes also includes the tramline as line 1. The bus system has 42 lines that serve 1100 stops. On average there are 70 000 bus passengers daily. The bus system length is 787km in one direction. The modal share in Trondheim is 57.6% car, 10.8% public transport and 31.6% walking and cycling.

Within the CityMobil project Trondheim has been the object of a modeling study which, using an high level transport land use interaction model, evaluated how best to implement in the cities three different advanced transport systems: High Tech Buses, Personal Rapid Transits and Cybernetic Transport Systems (a network of CyberCars).

The schemes for **High tech bus** include services on major routes into the city centre, and a route linking the city centre to a key facility. The high-tech bus routes will run for 3.3km from the west, 5.3km from the east, and 4.3km from the south. All the routes except for the University loop are main arterials towards the city centre. An important part of the studied HT Bus scheme is giving priority to public transport at intersections giving to public transport a reduced travel time in the peak.

As for the **PRT**, the schemes include a city centre network linking key facilities. The 18.5 PRT network includes a west-east line linking the two sides of the river and the city centre to the university campuses, and a north-south line linking the harbor to the city centre.

Two sets of schemes were designed for **Cybercar –** a city centre network, and feeder services in suburban zones linking to the existing public transport. The feeder system in the suburban zones will allow the bus routes to be simplified as the buses will not have to take detours to cover the whole area (most users will use the feeder to get to and from the bus stops) and will therefore reach the city centre more quickly.

Integrated ticketing between the bus and the feeder system is foreseen, as well as a coordination with their operational times.

The Trondheim showcase, a cybercar showcase, will be a typical feeder service and will be used to better investigate the local user reactions should such a system be implemented in St Olav Hospital complex.

The main transport objective of the showcased system is to facilitate displacements of patients and visitors between the hospital buildings, spread on a large area. The advanced transport system will help carry persons from the Studentersamfundet bus stop and Marienborg parking lot to the correct hospital division or clinic for their appointment. The new system will help phase out current traffic between buildings and reduce the need for private vehicle parking spaces around the hospital complex.

The advanced transport system will consist of the Pluss bus service from Marienborg parking lot and a number of cybercars running from Studentersamfundet bus stop. The driverless cars will be useful outside of the rush hours to mainly serve reduced mobility and aged persons, while the Pluss bus will cater for rush hour service, also taking care of hospital employee displacements. Both services will run simultaneously, but with different user groups, where persons having an

appointment at the hospital being given priority to cybercar access. The transport system will additionally make use of underground corridors and bridges between hospital buildings.

The cybercars will automatically transport patients/visitors to the destination of their choice. The destination will be entered using touch screens, via mobile phone (to call a vehicle and choose its destination) or by talking to an operator at a calling central. Patients will be able to receive personal information by typing in an appointment code; information about expected delays and waiting time will then appear. The hospital will also have a call system to order a vehicle for patient transport between two departments.

2.1.2 Indicators to be measured and measurement methods

23 indicators have been planned to be measured: system usefulness, system ease of use, system perceived reliability, user satisfaction for the on demand service, integration with other systems, user willingness to pay, system perceived comfort, perceived level of privacy on board of the vehicles, system perceived safety, fear of attack, induced mode changes in the other segments of the journey, system modal share, failure rate, mean time between failures, mean time to repairs, number and type of accidents and incidents, log of obstacle avoidance procedures, log of emergency stops, speed profiles, total passenger·km travelled and total number of trips, daily consumption and energy efficiency.

Each indicator needs measuring; some will be measured by interviewing people who just rode on the system, some via logbooks of events happening to the vehicles; some are simply obtained by calculations.

User interview

Twelve indicators are measured by interviewing users using questionnaires: system **usefulness**, system **ease of use**, system perceived **reliability**, **user satisfaction for the on demand service**, **integration with other systems**, **user willingness to pay**, system **perceived comfort**, **perceived level of privacy on board of the vehicles**, system **perceived safety**, **Fear of attack; Induced mode changes in the other segments of the journey** and **System modal share**. 9 of such indicators are measured first by ranking their importance in their evaluation category and then having the new system scored in a scale from 1 to 5. The other three **user willingness to pay**, i**nduced mode changes in the other segments of the journey** and **system modal share** are measured differently. The willingness to pay is directly asked while the other two are derived from behavioural questions of present behaviour and future should the system be made available.

The sample of interviewees is expected to be statistically significant. The sample size should be calculated per each indicator according to the expected results and to the necessary tolerance and confidence interval; however since the showcase will run for a limited time and the number of people who will ride on the system might not be high any number of interviews above a threshold of 100 will be considered satisfactory.

Vehicle and system logbooks

The indicators to be collected through the vehicle and system logbook are: **Failure rate, Mean time between failures, Mean time to repairs, Number and type of accidents and incidents, Log of obstacle avoidance procedures, Log of emergency stops, Speed profiles**. From the speed profiles (if collected at any single trip) it will be possible to determine the total km travelled and in case a record is kept on whether there was a passenger or not on board (or else if the vehicle never moves without the passenger) it will be possible to measure also **Total passenger·km travelled** and **Total N° of trips**.

Calculations

Energy environmental indicators will be calculated upon the data collected through on-board vehicle measurements (speed profiles in particular): **Daily consumption (KWh)** and **Energy Efficiency (KWh/pkm)**.

2.1.3 Measurement plan

Measurements to be done in the two showcases weeks are only of indicators to be measured through: user interviews and vehicle and system logbooks.

User interviews should be done with the help of Trondheim City council. A number of people should be asked to interview (using the questionnaire reported in Annex duly translated from English to Norwegian) passengers after riding on the system.

2.2 Vantaa

2.2.1 Site description

The City of Vantaa is an autonomous municipality of the Helsinki Metropolitan area in Southern Finland. Vantaa is located 20 km north of Helsinki centre. The Helsinki-Vantaa international airport is lying in the heart of the city. Vantaa has nowadays around 193,000 inhabitants. It can be called a “new-town” because its population began to grow in 1960's when new areas for city development around Helsinki were needed. The city has two official languages: Finnish and Swedish.

The public transportation system in Helsinki region is based on three railway lines starting from Helsinki centre to west, north and north-west. The north and west are main train lines used by urban and long distance trains while the north-west one is shorter and for urban trains only. There is also a metro line from Helsinki centre to east.

Both the urban rail and metro networks are under strong renaissance. The project to continue the metro line along the west coast has begun and the urban rail system is being developed. The short rail northwest will be continued through the airport and furthermore to east. The urban rail line will be connected to existing rail line from Helsinki to north. The connection of these rail lines will complete a Ring Rail around Helsinki Metropolitan Area. Tikkurila (the central zone of Vantaa) will be the connection point between the two railways.. The new rail developments will include also the first rail connection to the Helsinki-Vantaa airport. Ring Rail Line is a vital urban rail line that will provides a high-class public transport connection within reach of 200.000 inhabitants and 200.000 working places. The construction of this new ring line has started and it will be completed in 2014.

Alongside the Ring Rail the transport system will be developed and reorganised. Feeder services to the new stations as well as new roads will be developed.. The largest single development will be highway 3 in the core area of Marja-Vantaa in Kivistö.

This new urban rail line also creates new possibilities for city development. The largest development is in Marja-Vantaa for 30000 inhabitants and 26000 working places. There will be three new stations in Marja-Vantaa of which two are for working areas due to aircraft noise areas.

There is also a bus traffic system feeding passengers to the closest railway or metro station or to Helsinki centre. A tram network is only serving in the centre of Helsinki.

The car-sharing system is quite new in the Helsinki region. There is only one company in this field, CityCarClub, which started to operate in 1999. The company has nowadays approximately 70 car parking bays in the Helsinki-Espoo-Vantaa area. In Vantaa there are only five bays. One reason for low attractiveness of car sharing system is a large number of private cars. In Vantaa there is the highest share of private car per inhabitant in Helsinki Metropolitan Area. One reason for that is a good situation of parking lots.

The large share of private car has caused the traffic jams in Helsinki region. Year by year the traffic has got worse and the traffic noise has increased. The emission of small particles of traffic and their negative impacts on air quality has also grown when traffic has increased, although the technique of fuel motors has been developed

Several attempts to increase the attractiveness of public transportation has been made. Direct and fast connections of trains, metros and buses to the centre of Helsinki are working well. The problem is the public transportation in the sparsely populated housing areas and the deficiencies in the feeder traffic from housing areas to the railways stations, and also to the lack of cross-town bus

service. Due to low amount of passengers the service level of public transportation is not good enough.

The City of Vantaa is interested in to find out the possibilities of using of CyberCars as a part of public transportation there where it is not profitable to arrange bus routes. This occurs especially in short distance journeys from housing areas to the railway station and in public transportation in housing areas.

The City of Vantaa is also willing to be involved in developing new technical solutions for public transportation. Logistics is the most important development area that the city is promoting with the local companies and institutes in the Helsinki region. CyberCar would match in this concept very well.

The City of Vantaa is planning a new development area, Marja-Vantaa. The area is nowadays mainly unpopulated forest area. The easiest way to promote the use of new transport system is in new development areas, where all the arrangement can be planned from very beginning. CyberCars could work as a part of public transportation system, in those areas where heavier system is unprofitable or it is not flexible enough. CyberCars could serve to and from Kivistö railway and bus station and the CyberCar routes could link those places attracting high demand as schools, sporting areas, shopping centre, church and other public service and housing areas. While CyberCars use specific routes, the car-sharing system could complement CyberCars network.

Main objectives of the City of Vantaa for the CityMobil showcase are:

1. to study how a new type of unpolluted vehicle will suit for city public transportation.
2. to demonstrate for inhabitants and experts new technological solution for public transportation.
3. to find out by a survey how the passengers consider to use this new type of transportation
4. to arrange a conference especially for Finnish traffic and land use planning experts.
5. to arrange a information meeting for inhabitants
6. to promote discussion in Finnish press and other media of CyberCars and its potential possibilities in city traffic
7. to show how CyberCars are working
8. to arrange a safety route for demonstration of CyberCars.

The showcase will be arranged in the centre of Vantaa in Tikkurila. The showcase route is between the railways station and the city hall. The length of the route is over 200 m. Thus showcase route is in the most visible place in the city. The exhibition tent is by the City Hall.

The questionnaire includes also questions of local interest. The purpose is to get both the first impression of new type of vehicle and also to influence people's thoughts for to reduce the use of private cars.

2.2.2 Indicators to be measured and measurement methods

23 indicators have been planned to be measured: system usefulness, system ease of use, system perceived reliability, user satisfaction for the on demand service, integration with other systems, user willingness to pay, system perceived comfort, perceived level of privacy on board of the vehicles, system perceived safety, fear of attack, induced mode changes in the other segments of the journey, system modal share, failure rate, mean time between failures, mean time to repairs, number and type of accidents and incidents, log of obstacle avoidance procedures, log of emergency stops, speed profiles, total passenger·km travelled and total number of trips, daily consumption and energy efficiency.

Each indicator needs measuring; some will be measured by interviewing people who just rode on the system, some via logbooks of events happening to the vehicles; some are simply obtained by calculations.

User interview

Twelve indicators are measured by interviewing users using questionnaires: system **usefulness**, system **ease of use**, system perceived **reliability**, **user satisfaction for the on demand service**, **integration with other systems**, **user willingness to pay**, system **perceived comfort**, **perceived level of privacy on board of the vehicles**, system **perceived safety**, **Fear of attack; Induced mode changes in the other segments of the journey** and **System modal share**. 9 of such indicators are measured first by ranking their importance in their evaluation category and then having the new system scored in a scale from 1 to 5. The other three **user willingness to pay**, i**nduced mode changes in the other segments of the journey** and **system modal share** are measured differently. The willingness to pay is directly asked while the other two are derived from behavioural questions of present behaviour and future should the system be made available.

The sample of interviewees is expected to be statistically significant. The sample size should be calculated per each indicator according to the expected results and to the necessary tolerance and confidence interval; however since the showcase will run for a limited time and the number of people who will ride on the system might not be high any number of interviews above a threshold of 100 will be considered satisfactory.

Vehicle and system logbooks

The indicators to be collected through the vehicle and system logbook are: **Failure rate, Mean time between failures, Mean time to repairs, Number and type of accidents and incidents, Log of obstacle avoidance procedures, Log of emergency stops, Speed profiles**. From the speed profiles (if collected at any single trip) it will be possible to determine the total km travelled and in case a record is kept on whether there was a passenger or not on board (or else if the vehicle never moves without the passenger) it will be possible to measure also **Total passenger·km travelled** and **Total N° of trips**.

Calculations

Energy environmental indicators will be calculated upon the data collected through on-board vehicle measurements (speed profiles in particular): **Daily consumption (KWh)** and **Energy Efficiency (KWh/pkm)**.

2.2.3 Measurement plan

Measurements to be done in the two showcases weeks are only of indicators to be measured through: user interviews and vehicle and system logbooks.

User interviews should be done with the help of Vantaa City council. A number of people should be send to interview (using the questionnaire reported in Annex duly translated from English to Finnish) passengers after riding on the system.

3 Evaluations

This section reports on the continuation of the work described in D5.2.1a on the evaluation of the user acceptance level for the Advanced Transport Systems developed within the Citymobil project. In that first part the results of the surveys for the two demonstrators of Rome (cyber-cars) and Castellon (high-tech bus) and those of the Daventry cyber-car showcase were analysed and commented. Opinions were collected from a high number of people that were called to report, with different modes, on the three sites: focus groups were set-up for Castellon, questionnaires for Rome and Daventry. In the case of Daventry the survey was an ex-post one, i.e. people were interviewed after having experienced the ATS system; in the case of Rome and Castellon the survey had instead the purpose to collect the impressions of potential travellers even before the system was implemented (ex-ante survey).

Four new sites are now submitted to the user acceptance evaluation, namely the cybercar system showcase in Trondheim, for which the data for the ex-post questionnaire are available, the cybercar system showcase in Vantaa, also object of an ex-post questionnaire, the showcase in La Rochelle, with data from the ex-post questionnaire on the advanced car-sharing system, and the Heathrow demonstrator, where an ex-ante evaluation is performed on the bus system which is going to be partially replaced by the PRT[1]. As far as this demonstrator is concerned, it is worth remarking that here the ex-ante survey was intended as to evaluate the pre-existing public transport system in order to have at disposal a basis for the ex-post evaluation, while in the Rome demonstrator the ex-ante survey was performed with the aim to assess the importance, or weight, given by potential users of the system to the different aspects adopted as indicators for the ex-post evaluation (in that case, in fact, no pre-existing public transport system is available for comparison).

The other aspect to underline is that within this user acceptance evaluation, both in case of the sites that were dealt and for this second part, “users” are intended exclusively as travellers, while the concept of user as the transport system manager is neglected.

All the indicators for the user acceptance assessment are derived from the evaluation methodology reported in D5.1.1 (Evaluation Framework). A number of standard indicators for the User Acceptance aspects was extracted from the global collection of indicators that was setup within that part of the work. The indicators of this collection are grouped into so-called “Impact” clusters, and, in turn, Impacts are grouped into “Evaluation Categories”.

In the following Table 1 all the indicators used to quantify the systems User Acceptance in the four sites are listed. In the same way as for the surveys in D5.2.1a it can be seen that, aside those belonging to the “Acceptance” Evaluation Category, extra indicators from different categories of the framework list have been considered, due to the strong implications they have with the users' perception, thus acceptance, of the system. In particular, the Quality of Service category was considered and also some indicators from the Transport Patterns and Social Impacts categories.

The set of indicators used for the four surveys is not exactly corresponding, given that each questionnaire was adapted to the single demonstrator or showcase. In particular, due to the nature of the ex-ante survey, the questionnaire used for Heathrow differs largely from those used for the three showcases, which instead are very similar to each other; in this case, as reported in the dedicated paragraph, a correspondence is created between the questions of that questionnaire and the standard set of indicators.

Other than analysing the results of the single surveys, in the present evaluation the results obtained in the single sites are compared, in order to find, where possible, any common

[1] For a complete description of the systems submitted to evaluation see document D1.2.4.1.

conclusions for the ATS systems in general, with the final purpose of raise, if any, weakness points in the general concept that lays under this type of automatically guided public transport systems. In this document the cross comparison between the ex-post surveys for the showcases of the cyber car system, which are four globally, that is the three here reported (Trondheim, Vantaa, La Rochelle) and that already reported in the previous document (Daventry) is reported. It is therefore understandable that having a common set of indicators is essential.

Evaluation Category	Impact	Indicator
Acceptance	User acceptance	Usefulness
		Ease of use
		Reliability
		User satisfaction for the on demand service
		Integration with other systems
	Willingness to pay	User willingness
Quality of service	Information	Availability
		Comprehensibility
	Comfort	Perceived comfort
	Privacy	Perceived level of privacy
	Perception of safety and security	Perception of safety
		Fear of attack
Transport patterns	System performance	Average journey time
Social Impacts	Service Accessibility	Access times for mobility impaired users

Table 1 The indicators used to quantify the systems User Acceptance in the four sites

As already mentioned, the questionnaires (except for Heathrow) were built in a way to allow collecting the users' feedback at two different levels:

- **Weights**: these give an indication on the importance assigned by the travellers to the various aspects of the system,
- **Performance ratings**: for each indicator the average evaluation by the users is provided.

A complete evaluation on the acceptance, leading to address improvement actions in the system definition, can be made where both the weight and the performance ratings are available. In fact, an indicator may be given a high performance score and a low weight, meaning need for a lower focus on that aspect; conversely, an indicator may get a low performance score and a high weight, suggesting a high priority at system deployment level.

The first subsection is however about the Castellon demonstration ex-ante analysis, performed in the region of Valencia before the CityMobil project start, and not concerning user acceptance indicators. The surveys were done to assess the mobility in the region and in its municipalities (including Castellon) and produced results about the transport patterns, allowing to calculate two of the indicators, the system modal share and the total number of trips.

3.1 Castellon - Ex-ante

Analyses on the mobility in the Valencia region with its municipalities, including Castellon, were done.

The analyses were performed before the CityMobil project start, thus the results obtained have to be considered as “before” (and not ex-ante) results, and only few of the indicators chosen for the Castellon demonstration (and reported in D1.4.5.1) can be inferred from such results.

The results are going to be presented both for the Valencia region and Castellon, in order to have a further comparison between the two different kinds of results.

Concerning the general information, in the 1841 houses considered as sample there were about 5000 persons, with an average of 2.61 persons/family. Such value slightly decreases to 2.57 persons/family in Castellon.

1.31 vehicles per house were counted in the region, whereas in Castellon such value was 1.16. Considering the population with people more than 5 years aged, 321000 in the region and 131000 in Castellon, 55% of them had the driving license and 44% of them owned a car (in Castellon such percentages are respectively 52% and 41%).

Employees represented 41% of the region population and students 20%. The same percentages were inferred for Castellon.

About 690000 daily trips were counted from the surveys, with 2.1 as average value of the trips per person. 56% of such trips were done with vehicles and 44% on foot.

The correspondent figures for Castellon were: 255000 daily trips (meaning 1.93 trips per person), 53% of them done with vehicles and 47% on foot.

The reasons of the trips were the following: work (48% in the region, 50% in Castellon), study (16% in the region, 15% in Castellon), shop (8% region, 9% Castellon), medical (2% both region and Castellon), leisure (14% region, 16% Castellon), other (11% region, 8% Castellon).

The modes of transport used are reported in Table 2.

Table 2 Modes of transport in the region and in Castellon

Mode of transport	Region	Castellon
Private car	90%	83.9%
Bus	8.3%	14.8%
Train	1.1%	0.5%
Bus+Train	0.1%	0.1%
Other	0.4%	0.8%

In the region 90% of the trips were covered through the private car, and the remaining 10% was divided between different means of public transport: more than 8% used the bus, about 1% the train and the remaining 0.5% the combination of bus and train and other means of transport.

The results were slightly different in Castellon: about 84% used the private car, about 15% adopted the bus as public transport and the remaining 1.4% used the train, the combination of bus and train or other means of transport.

The **system modal share** of the bus in Castellon has been obtained directly from those figures: considering the categories bus and bus+train, it can be considered as about 15%.

The total number of daily trips outcoming from such value can be calculated as follows: 53% of the 255000 daily trips of Castellon people were done using vehicles, meaning 135150 trips per day. 15% of them were done using the bus, thus the **total number of trips** was about 20300.

With regards to the reasons of non-use of the public transport, in the region two were the main causes: the low quality of the service (43% of the sample) and the uncomfortable perception of the

public transport (44%). The other three reasons were the following: high distance between the stops and the destinations (8%), low frequency of the service (4%) and high service costs (1%).

In Castellon the main cause of the non-use of the public transport was uncomfortable perception of it, with 75% of the sample answering in such mode. 11% of the sample considered as high the distance between the stops and the destinations, 9% perceived a low quality of the service provided and 3% did not like the low frequency of the service. No one considered the service as too expensive.

Another important result of the trips analysis was the main destination of the trips generated and attracted: for both of them the main destination is the same municipality they started in. In the region 78% of the generated trips and 79% of the attracted trips ended in the same municipality, whereas such figures in Castellon were respectively 86% and 79%.

Concerning the parking, 56% of the sample parked in free parking areas, 39% in private garages, and the remaining 5% subdivided between payment areas (1%), public parking (2%) and other private zones (2%).

The average duration of the parking was 3 hours, 84% of the parking areas were used, and 23% of the vehicles were illegally parked.

According to the data collected in the private vehicle user survey, the average occupancy of the vehicles was 1.5 passengers per vehicle.

The last figures obtained were about the average number of pedestrians in the central roads of the municipalities analyzed: 2700 pedestrians per hour in the average hour and 3700 pedestrians per hour in the peak hour.

3.2 Heathrow - Ex-ante

As mentioned in the introduction of this section, the Heathrow survey was conducted with a questionnaire on the bus service bringing travellers from the car park and terminal 5, and for this reason the questions submitted to users were different from those used for the showcases. In order to prearrange the future results from the ex-post survey to the comparison with the ex-post results of the other studies (Rome, Vantaa, Trondheim, Daventry, La Rochelle) and possibly derive common conclusions, a correspondence is set between the questions of the Heathrow questionnaire and the standard indicators (the correspondence is reported in the following Table 3).

As for cross comparison with the other demos or showcase sites on the ex-ante results, this has no reason to be made instead, in fact:

- It is not possible with the showcases of Vantaa, Trondheim, Daventry and La Rochelle because these were evaluated ex-post.
- It would have no relevant meaning with the Castellon demonstration, because the system is definitely different.
- It might be meaningful with the Rome demonstrator if both surveys were conducted with the same purpose to establish the importance (i.e. the weight) of the different indicators to be used for the ex-post evaluation; however, this vision was not adopted for Heathrow, where the focus was put on assessing the pre-existing public transport system (bus), which is justified by the fact that the PRT is going to replace it.

Evaluation Category	Impact	Indicator	Weight	Ex-ante performance rating	Heathrow Questions
Acceptance	User acceptance	Usefulness			
		Ease of use		✓	2, 3
		Reliability		✓	18
		User satisfaction for the ~~on demand~~ service		✓	19, 20
		Integration with other systems		✓	7, 8, 9, 10, 11, 12, 13
Quality of service	Information	Availability			
		Comprehensibility		✓	15
	Comfort	Perceived comfort		✓	4, 5
	Privacy	Perceived level of privacy			
	Perception of safety and security	Perception of safety		✓	6
		Fear of attack			
Social Impacts	Service Accessibility	Access times for mobility impaired users			
Environment	Emissions *(Heathrow specific)*	Perception of environment-friendliness		✓	17
Other	Image *(Heathrow specific)*	Modern image for the airport		✓	16

Table 3 Indicators dealt in the user acceptance survey of the Heathrow demonstrator

"✓"= indicator was quantified by matching corresponding survey questions (see last column on the right);

= no rating available

From Table 3 it can be seen that no opinion was collected on the weight given to the different aspects of the system perception.

The performance ratings are reported in Table 4. All indicators resulted with an average score of more than 3, which makes quite challenging an over-performance by the PRT. The best rated indicators for the bus were ease of use (4.3), perception of safety (4.1), and reliability (4.0). PRT is expected to have good improvements particularly on perception of environment friendliness (3.2 for the bus), modern image of the airport (3.5).

Evaluation Category	Impact	Indicator	Weight	Ex-ante performance rating
Acceptance	User acceptance	Usefulness		
		Ease of use		4.3
		Reliability		4.0
		User satisfaction for the ~~on demand~~ service		3.9
		Integration with other systems		3.7
Quality of service	Information	Availability		
		Comprehensibility		3.9
	Comfort	Perceived comfort		3.8
	Privacy	Perceived level of privacy		
	Perception of safety and security	Perception of safety		4.1
		Fear of attack		
Social Impacts	Service Accessibility	Access times for mobility impaired users		
Environment	Emissions *(Heathrow specific)*	Perception of environment-friendliness		3.2
Other	Image *(Heathrow specific)*	Modern image for the airport		3.5

Table 4 Average values for indicators in the ex-ante user acceptance survey of the Heathrow demonstrator. Values for the bus service that will be partially replaced by the PRT. Values were obtained by matching corresponding survey questions (see previous table).

Since a detailed study of the results of this ex-ante survey was performed within SP1 (reported in D1.2.4.1), no further analysis is performed on this survey at this stage.

3.3 La Rochelle - Ex-post

3.3.1 Indicators

For the showcase at La Rochelle a reduced number of indicators were collected compared to the other showcases. As shown in the next Table 5, the questionnaire included questions on 7 indicators among those measuring the user acceptance level, 4 of which belonging to the "Acceptance" evaluation category ("Usefulness", "Ease of use", "Reliability", "Willingness to pay") and 3 to the "Quality of service" category ("Comfort", "Safety", "Security"). All these indicators were surveyed both in terms of weight and performance, including the willingness to pay (in the other surveys this indicator was not surveyed in terms of importance).

The whole situation is reported in the following Table 5. The surveyed indicators are marked with a "✓".

Evaluation Category	Impact	Indicator	Importance	Ex-post performance rating
Acceptance	User acceptance	Usefulness	✓	✓
		Ease of use	✓	✓
		Reliability	✓	✓
		User satisfaction for the on demand service		
		Integration with other systems		
	Willingness to pay	User willingness	✓	✓
Quality of service	Information	Availability		
		Comprehensibility		
	Comfort	Perceived comfort	✓	✓
	Privacy	Perceived level of privacy		
	Perception of safety and security	Perception of safety	✓	✓
		Fear of attack	✓	✓
Transport patterns	System performance	Average journey time		
Social Impacts	Service accessibility	Access (times) for mobility impaired users		

Table 5 Indicators dealt in the user acceptance survey of the La Rochelle showcase

"✓"= indicator quantified through specific question;

= no rating available

3.3.2 Results

In the following Figure 8, Figure 9, Figure 10, Figure 11 the distribution of the sample (made of 253 interviews) is shown, according to the different available characteristics of the interviewed people (age, education, employment and income).

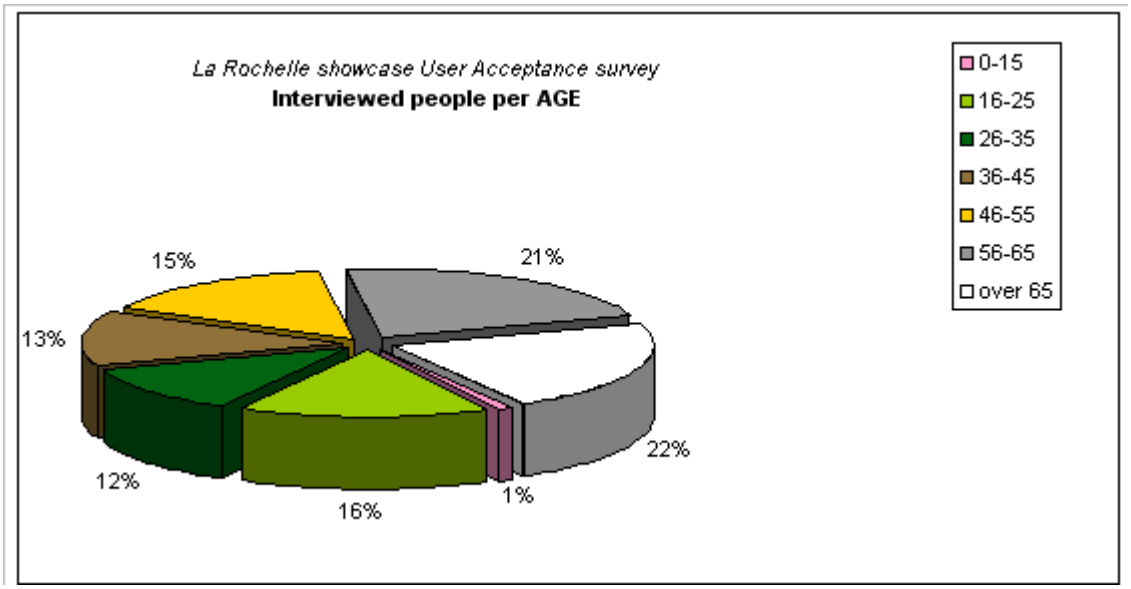

Figure 8 La Rochelle interviewed people divided per age

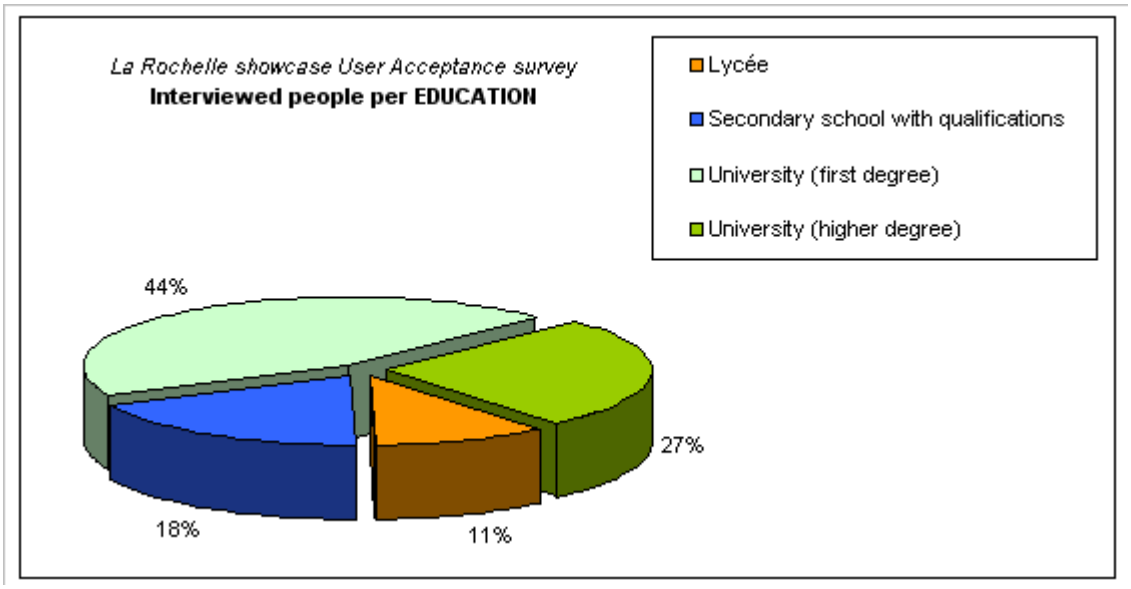

Figure 9 La Rochelle interviewed people divided per education

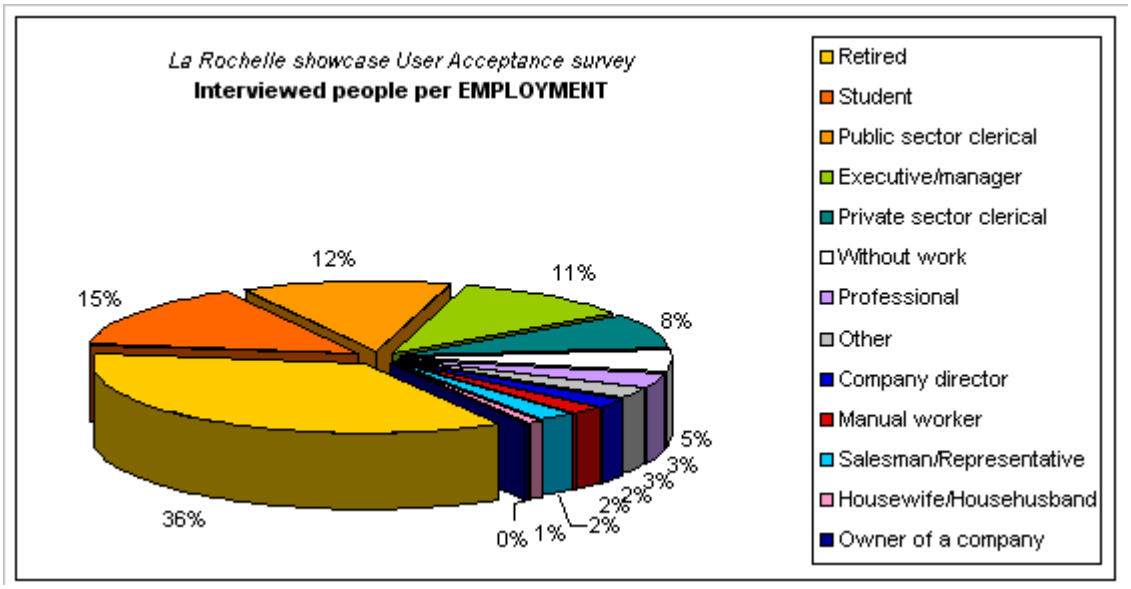

Figure 10 La Rochelle interviewed people divided per employment

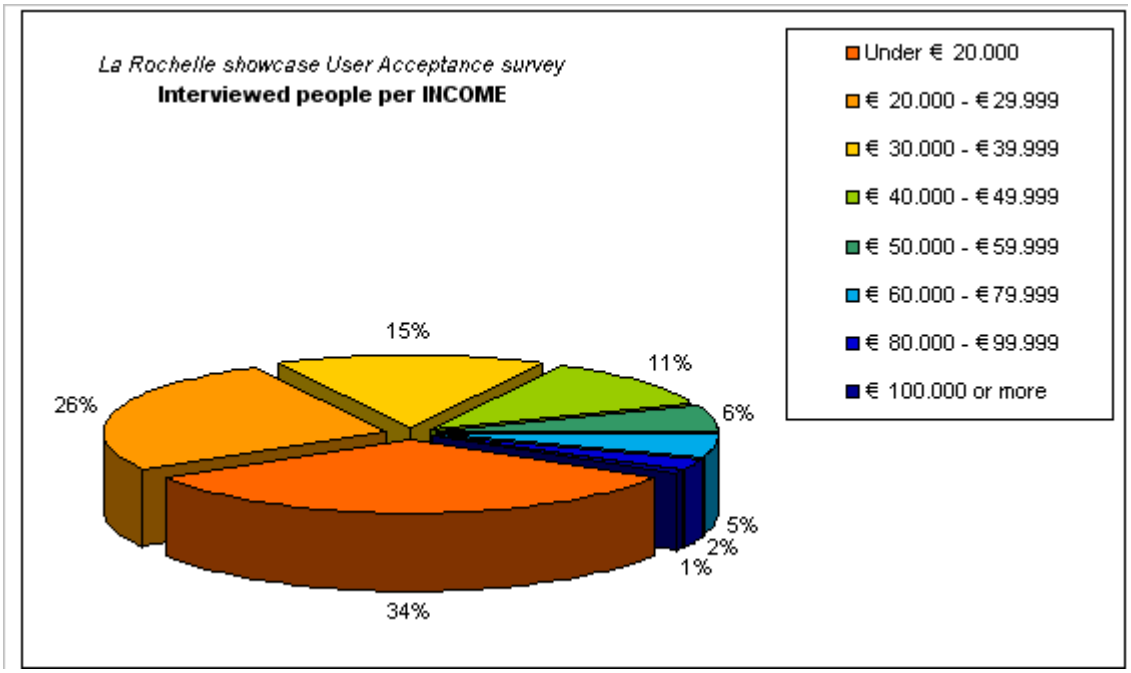

Figure 11 La Rochelle interviewed people divided per income

The results averaged on the whole interviews are reported in the following Table 6.

Evaluation Category	Impact	Indicator	Importance (1=most, 5=less)	Ex-post performance rating
Acceptance	User acceptance	Usefulness	2.7	3.8
		Ease of use	2.4	4.0
		Reliability	3.2	3.6
		User satisfaction for the on demand service		
		Integration with other systems		
	Willingness to pay	User willingness	4.0	2 to 3€
Quality of service	Information	Availability		
		Comprehensibility		
	Comfort	Perceived comfort	2.7	3.6
	Privacy	Perceived level of privacy		
	Perception of safety and security	Perception of safety	2.1	3.8
		Fear of attack	2.6	3.7
Transport patterns	System performance	Average journey time		
Social Impacts	Service accessibility	Access (times) for mobility impaired users		

Table 6 Average values for indicators dealt in the User acceptance survey of the La Rochelle showcase.

Ease of use was rated as the most important indicator within the Acceptance evaluation category, and it got a good 4.0 as for performance. Also the Reliability and Usefulness indicators, perceived as of lower importance, were rated fairly high, respectively 3.8 and 3.6. Willingness to pay scored a definitely high value (2 to 3€), but it must be recalled that in this case the fee is referred to one hour usage and moreover the system offers in this case a private use of the vehicle and not a shared cab as in the other sites. The importance of this aspect, however, was rated as the lowest within this category.

In the Quality of Service category Safety was rated as the most important aspect and, similarly to “ease of use” in the previous evaluation category, also scored definitely good (3.8/5), indicating a high user satisfaction. Security and Comfort got quite similar results, with a fairly good weight (2.6 – 2.7) and performance (3.7/5, 3.6/5).

Also for this site, since the interviewed people profiles are available (gender, age, education, employment, income), the indicators averages were calculated distinctly for two couples of respondents categories. As for Vantaa, the following groups were considered:

- users with high school education (or higher),
- users with primary school education (primary school plus junior high school),
- people up to 30 years old,

- people over 30 years old.

The ratings for these user categories are reported in Table 7.

The main differences are recorded in the weight that was averagely given to the Ease of use and Reliability indicators. Ease of use was rated as more important by mature people, while Reliability by younger people. Lower differences emerge for the importance given to safety and security: under-30 people care slightly more for safety compared to the over-30, the opposite for security. Security is given a little more importance by lower-educated people compared to highly educated.

On the performance side, lower educated people gave a slightly higher rate to the perception of reliability compared to highly educated people (3.8 vs. 3.5); both averages were fairly high however. Finally, highly educated people surpassed (although just slightly) the threshold of 2€ for the willingness to pay.

Globally the level of acceptance by travellers turned out to be good, considering that the lowest scored indicators got a 3.6. Some indicators (e.g. ease of use) may benefit from the fact that people in La Rochelle already use and know a car-sharing system, although not with the advanced characteristics that were presented in the showcase. Therefore a higher value within the assessment is deserved by the indicators that are addressed to the advanced features introduced by the new system (reliability - 3.6/5, usefulness - 3.8/5, perception of safety (3.8).

Evaluation Category	Impact	Indicator	Importance					Ex-post performance rating				
			All	**Secondary school**	**Higher education**	**Under 30**	*Over* **30**	**All**	**Secondary school**	**Higher education**	*Under* **30**	*Over* **30**
Acceptance	User acceptance	Usefulness	2.7	2.8	2.7	2.7	2.7	3.8	3.9	3.8	3.6	3.8
		Ease of use	2.4	2.3	2.4	2.9	2.3	4.0	4.0	4.0	4.2	4
		Reliability	3.2	3.2	3.2	2.8	3.3	3.6	3.8	3.5	3.5	3.6
		User satisfaction for the on demand service										
		Integration with other systems										
	Willingness to pay	User willingness	4.0	4.1	3.9	4.0	3.9	2 to 3€	1 to 2€	2 to 3€	2 to 3€	1 to 2€
Quality of service	Information	Availability										
	Comfort	Perceived comfort	2.7	2.8	2.6	2.7	2.6	3.6	3.7	3.6	3.6	3.7
	Privacy	Perceived level of privacy										
	Perception of safety and security	Perception of safety	2.1	2.3	2.1	1.9	2.2	3.8	3.7	3.8	3.7	3.8
		Fear of attack	2.6	2.3	2.7	2.9	2.6	3.7	3.7	3.7	3.6	3.8
Transport patterns	System performance	Average journey time										
Social Impacts	Service accessibility	Access (times) for mobility impaired users										

Table 7 Average values for indicators dealt in the User acceptance survey of the La Rochelle showcase distinct by two age categories

= no rating available

= difference between Under30 vs. Over30 is >0.5 (or 1€ as for the willingness to pay)

= difference between Under30 vs. Over30 is >0.2

3.4 Trondheim - Ex-post

3.4.1 Indicators

In the Trondheim showcase all the Acceptance indicators (“usefulness”, “ease of use”, “reliability”, “user satisfaction for the on demand system” and “integration with other systems”; "user willingness to pay") and also four out of six Quality of Service indicators (perceived comfort”, “perceived level of privacy”, “perception of safety” and “fear of attack”) were measured in the ex-post survey through specific questions. Also an indicator belonging to the Social impacts was investigated, the “access times for mobility impaired users”.

Moreover, an open question was inserted in the questionnaire where the interviewed people were asked to comment on their experience and express free opinions ("What are the reasons for fear to use CyberCar? What kind of requirements for traffic safety should be carried out? What other kind of improvements should be done?"). The answers were structured and related to the standard indicators in order to confirm or disprove the score they got with the questionnaire.

All the scored indicators were obtained in terms of **weight** and **performance**, except two of them ("user willingness to pay", "access times for mobility impaired users"), for which the weight was not investigated.

The whole situation is reported in the following Table 8. The surveyed indicators are marked with a “✓”.

Evaluation Category	Impact	Indicator	Importance	Ex-post performance rating
Acceptance	User acceptance	Usefulness	✓	✓
		Ease of use	✓	✓
		Reliability	✓	✓
		User satisfaction for the on demand service	✓	✓
		Integration with other systems	✓	✓
	Willingness to pay	User willingness		✓
Quality of service	Information	Availability		
		Comprehensibility		
	Comfort	Perceived comfort	✓	✓
	Privacy	Perceived level of privacy	✓	✓
	Perception of safety and security	Perception of safety	✓	✓
		Fear of attack	✓	✓
Transport patterns	System performance	Average journey time		
Social Impacts	Service accessibility	Access (times) for mobility impaired users		✓

Table 8 Indicators dealt in the user acceptance survey of the Trondheim showcase.

“✓”= indicator quantified through specific question;

= availability of comments from answers to open question;

= no rating available

To summarize, the interviewed persons were submitted to a set of 15 questions, subdivided as follows:

- 7 questions were related to the evaluation of the system: 4 of these referring to the system **performance**, 3 to the **weight** to be given to the different performance indicators
- 3 questions dealt about the users habits
- 5 questions were related to the users main characteristics (age, gender, education, occupation, income). These provided the opportunity to analyze the answers by distinguishing different user profiles.
- finally, the users were given the possibility to express with free words any comment on their experience with the ATS

Totally, 11 indicators were quantified, while the free answers were reported to 7 indicators, of which 5 in common with the scored ones and 2 extra, but still belonging to the global reference set.

3.4.2 Results

A total of 133 interviews was performed.

In the following Figure 12, Figure 13, Figure 14, Figure 15 the distribution of the sample is shown, according the different available characteristics of the interviewed people (age, education, occupation, income).

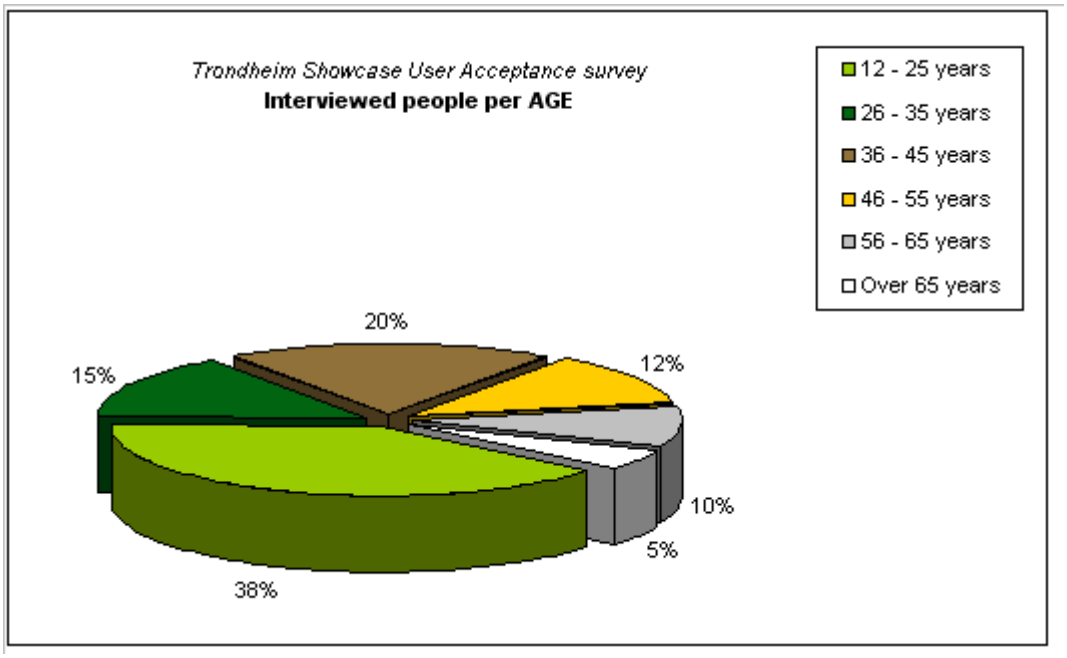

Figure 12 Trondheim interviewed people divided per age

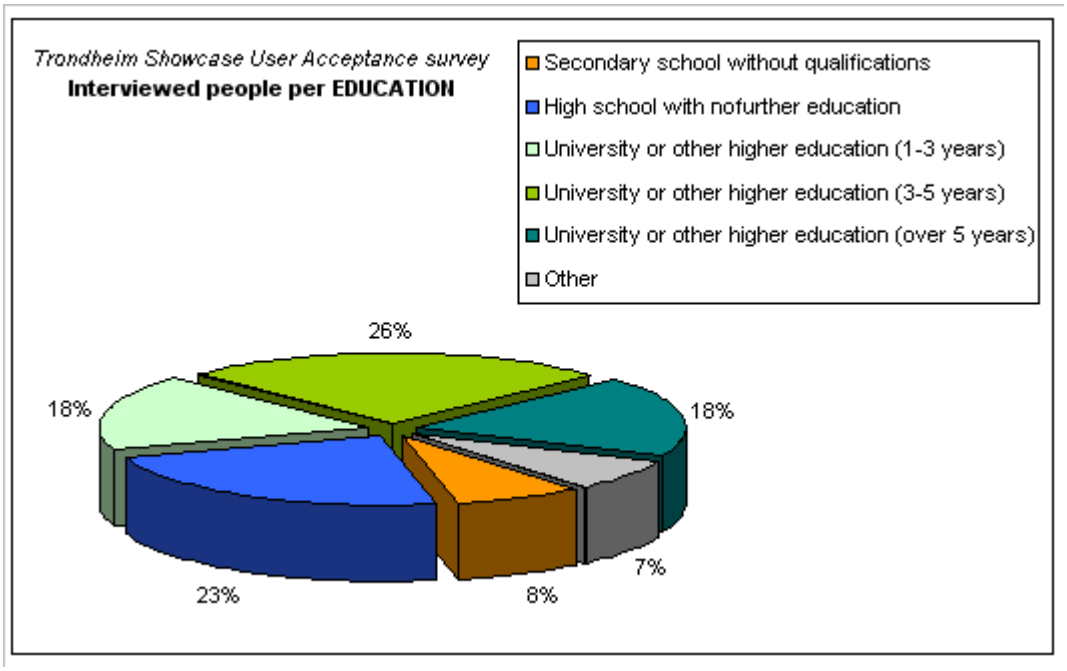

Figure 13 Trondheim interviewed people divided per education

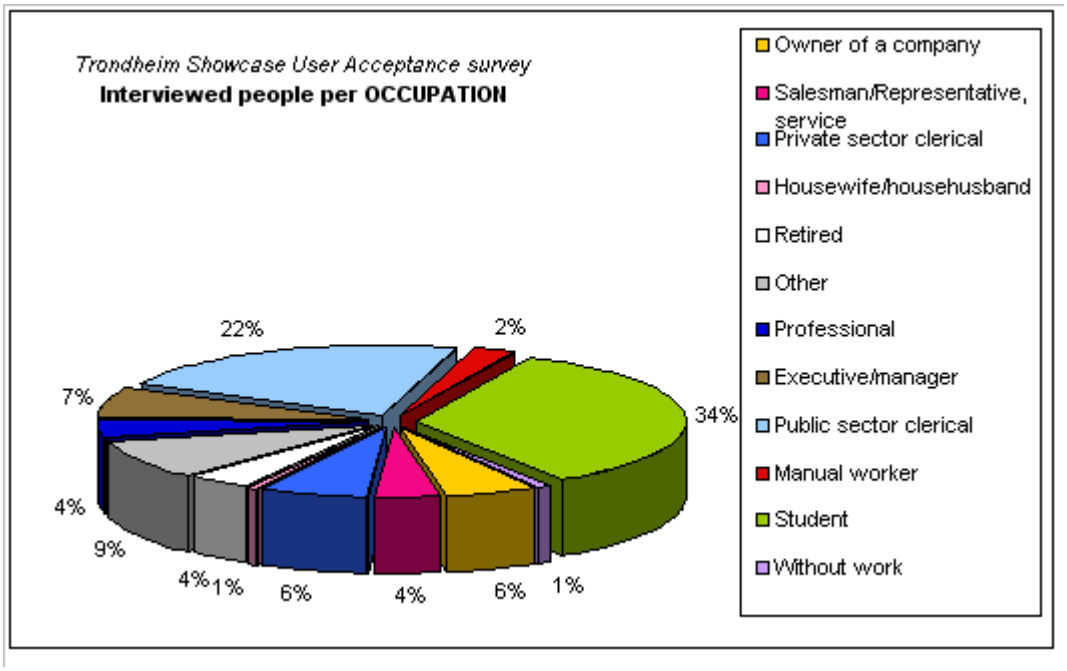

Figure 14 Trondheim interviewed people divided per occupation

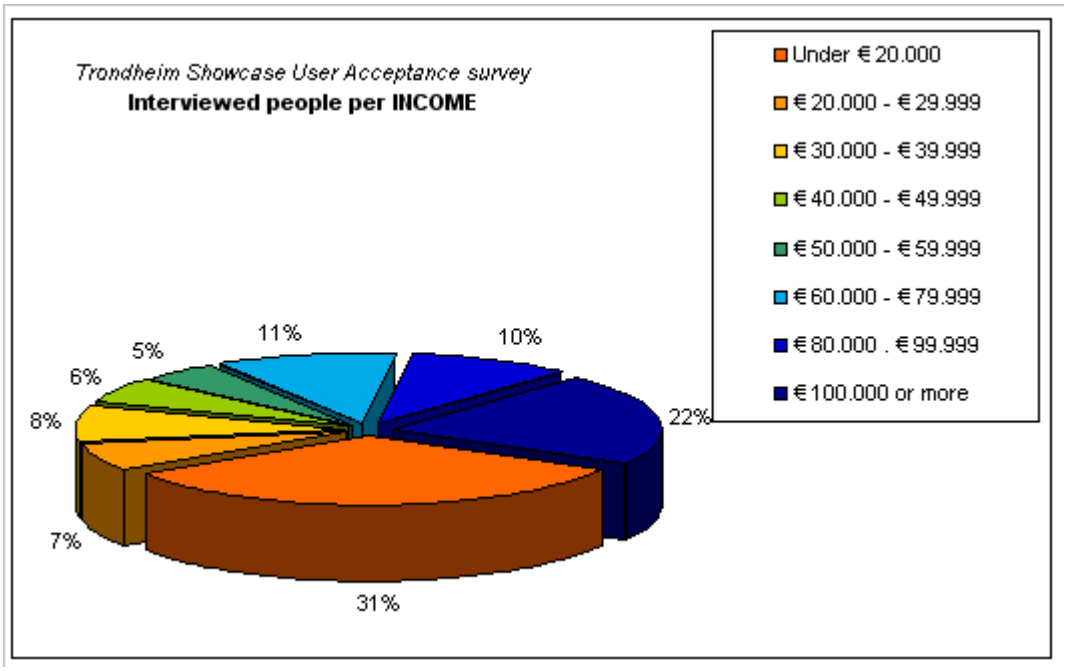

Figure 15 Trondheim interviewed people divided per income

The following Table 9 reports the ratings averaged on the whole interviewed population. The numbers reported on Table 9 have the following meaning:

- as for the **weight** values obtained for the different indicators, collected in terms of order of importance (1=maximum importance), the average value was provided simply averaging the rating of the single answers; it is important to notice that the scores in this case have no general value, instead they are “levels of importance” referred to the specific Evaluation Category only;
- as for the **performance**, in this case the numbers have the meaning of a score average (1 to 5);
- for the indicators that were also assessed through answers to the **open question**, the results were summarized in Table 9 itself (blue cells).

Evaluation Category	Impact	Indicator	Importance (1=most, 5=less)	Ex-post performance rating
Acceptance	User acceptance	Usefulness	3.0	3.1/5
			4 respondents complained on Usefulness. 2 of these complained about no possibility of bringing luggage	
		Ease of use	2.8	3.5/5
			1 person complained on ease of use	
		Reliability	2.6	3.2/5
		User satisfaction for the on demand service	3.3	3.5/5
		Integration with other systems	3.2	3.1/5
	Willingness to pay	User willingness		1 to 2€
Quality of service	Information	Availability	3 respondents complained about Information Availability. 2 of these suggest to provide travel information on board	
		Comprehensibility		
	Comfort	Perceived comfort	2.6	3.7/5
			9 respondents complained about Perceived Comfort. 4 of these complained about uncomfortable driving style 3 of these feel the cab is too narrow	
	Privacy	Perceived level of privacy	3.1	3.1/5
	Perception of safety and security	Perception of safety	1.7	3.5/5
			22 respondents are concerned about Safety 10 of these are concerned about collision with other traffic (need for separate lane, reliable sensors, reliable breaking system) 4 of these are concerned with travellers protection, complained about the absence od safety belts	
		Fear of attack	2.5	3.7/5
Transport patterns	System performance	Average journey time	29 respondents complained about slow speed	
Social Impacts	Service accessibility	Access (times) for mobility impaired users		83%
			11 respondents consider the system as non suitable for mobility impaired users	

Table 9 Average values for indicators dealt in the User acceptance survey of the Trondheim showcase

Looking at the results both in terms of **weight** and **performances** the average ratings show the following:

- within the “Acceptance” evaluation category, Reliability results to be the most important indicator, with an average position of 2.6 (1 = “most important”, 5 = “less important”). The performance on this indicator was rated in average as quite good (3.2/5), although higher scores should be targeted on this aspect. Travellers felt in average that the less important aspects are instead the integration with other transport systems (average rate = 3.2) and the on demand service performance (3.3). However both the indicators were scored quite positively (3.1/5 and 3.5/5). Concerning the integration, the result suggests that users may perceive the ATS as a stand-alone system rather than part of the whole public transport service driving them from home to the hospital; this is quite surprising considering that in the configuration they experienced the cyber cars would carry persons from a bus stop (Studentersamfundet) to their final destination; as for the satisfaction with the on-demand service, the rather low rating as for its importance is counterbalanced by a fairly good score on its performance (3.5). This aspect apparently did not represent an issue for travellers. Ease of use and usefulness lay in the middle as for importance within this evaluation category. The performance got a passing score for usefulness (3.1/5), although in the open question some passengers complained especially about no possibility of bringing luggage on the cab; for the ease of use indicator the score was fairly good (3.5/5) and no issues were raised in the open question either.
- Within the “Quality of service” evaluation category, a great importance is given by the respondents to safety. The weight was rated with an average 1.7 and 22 respondent expressed some concern about this aspects, mainly regarding collision with other traffic (need for separate lane, reliable sensors, reliable breaking system) and with travellers protection (lack of safety belts). However, performance on this indicator was rated in general as fairly good (3.5/5). On the opposite side, the level of privacy was not considered as of major importance (only 3.1 with no comments) and however as sufficient (3.1). Comfort and security got an average score as for importance (2.6 and 2.5) but a good performance (3.7). About the comfort, 7 comments were collected mainly about the driving style (that we know having been an issue during the showcase before it was solved with an intervention) and the narrow cockpit.
- Three more indicators were quantified or commented: the access ease for mobility impaired users got an 83% positive feedback; this rating is the same also within the small group of people that declared to be patients of the hospital (5 out of 133 respondents). Moreover a very high rate of travellers (29) criticized through the open question the slow speed of the cabs for what concerns average journey time. Finally, the travellers expressed an average willingness to pay in a range of 1 to 2€ per journey.

As in the previous research (D5.2.1a) the possibility of having scores distinct by people profiles (gender, age, education, employment, income), was exploited in order to draw more detailed conclusions on user acceptance. For the sake of uniformity, and for making it possible to cross-compare the results between different sites, the following categories were considered:

- users with high school education (or higher),
- users with primary school education (primary school plus junior high school),
- people up to 30 years old,
- people over 30 years old.

Differently from the previously assessed sites, however, in this case only the distinction by age was possible, in fact the lower-education group would include only 8% of the respondents out of 133, not enough for significant conclusions.

The ratings for the two age categories are reported in Table 10; differences compared to the global values are highlighted in yellow, lower differences in green. In general, no high difference was

encountered; the highest differences were found in the weight given to the various aspects by the two age categories rather than in performances: Privacy scored an average 3.4 (1= max importance) for young travellers and a 2.8 for over 30; on the contrary, the under-30 were more concerned about safety (1.4 against 1.9 for over-30). Lower differences were recorded on the performance side: young people perceived the system as more useful (3.3/5 vs. 2.9/5), comfortable (3.9/5 vs. 3.5/5) and secure (3.8/5 vs. 3.5/5) than over-30.

Evaluation Category	Impact	Indicator	Importance			Ex-post performance rating		
			All	**Under 30**	*Over* **30**	**All**	*Under* **30**	*Over* **30**
Acceptance	User acceptance	Usefulness	3.0	2.9	3.0	3.1/5	3.3/5	2.9/5
		Ease of use	2.8	2.9	2.7	3.5/5	3.5/5	3.6/5
		Reliability	2.6	2.4	2.8	3.2/5	3.3/5	3.1/5
		User satisfaction for the on demand service	3.3	3.4	3.2	3.5/5	3.6/5	3.4/5
		Integration with other systems	3.2	3.3	3.1	3.1/5	3.0/5	3.1/5
	Willingness to pay	User willingness				1 to 2€	1 to 2€	1 to 2€
Quality of service	Comfort	Perceived comfort	2.6	2.7	2.6	3.7/5	3.9/5	3.5/5
	Privacy	Perceived level of privacy	3.1	3.4	2.8	3.1/5	3.1/5	3.0/5
	Perception of safety and security	Perception of safety	1.7	1.4	1.9	3.5/5	3.6/5	3.4/5
		Fear of attack	2.5	2.4	2.6	3.7/5	3.8/5	3.5/5
Social Impacts	Service accessibility	Access (times) for mobility impaired users				83%	81%	84%

Table 10 Average values for indicators dealt in the user acceptance survey of the Trondheim showcase distinct by two age categories.

= no rating available

= difference between Under30 vs. Over30 is >0.5

= difference between Under30 vs. Over30 is >0.2

3.5 Vantaa - Ex-post

3.5.1 Indicators

For the Vantaa showcase all the User Acceptance indicators (“usefulness”, “ease of use”, “reliability”, “user satisfaction for the on demand system”, “integration with other systems”) were included in the questionnaire, both in terms of importance and performance; the willingness to pay was also rated as the ticket price people would be willing to pay for one trip.

As for the Quality of Service indicators “perceived comfort”, “perceived level of privacy”, “perception of safety” and “fear of attack”), all of them were measured as for their weight and performance, except the “information availability” and “information comprehensibility”, which were not investigated at all.

The whole situation is reported in the following Table 11. The surveyed indicators are marked with a “✓”.

Evaluation Category	Impact	Indicator	Importance	Ex-post performance rating
Acceptance	User acceptance	Usefulness	✓	✓
		Ease of use	✓	✓
		Reliability	✓	✓
		User satisfaction for the on demand service	✓	✓
		Integration with other systems	✓	✓
	Willingness to pay	User willingness		✓
Quality of service	Information	Availability		
		Comprehensibility		
	Comfort	Perceived comfort	✓	✓
	Privacy	Perceived level of privacy	✓	✓
	Perception of safety and security	Perception of safety	✓	✓
		Fear of attack	✓	✓
Transport patterns	System performance	Average journey time		
Social Impacts	Service accessibility	Access (times) for mobility impaired users		

Table 11 Indicators dealt in the User acceptance survey of the Vantaa showcase

“✓”= indicator quantified through specific question;

= no rating available

To summarize, the interviewed persons were submitted to 16 questions subdivided as in the following:

- 5 questions were related to the evaluation of the system: 3 of these referring to the system **performance**, 2 to the **weight** to be given to the different performance indicators
- 2 questions dealt about the users habits (use of transport means, use of private car)
- 6 questions were related to the users main characteristics (age, gender, education, occupation, income), including also the reason for attending the showcase. These provided the opportunity to analyze the answers by distinguishing different user profiles.
- 2 important questions regarded the general acceptance of the system, while they were not reported to the general set of indicators (questions number 5 and 6).

Totally, 9 indicators were quantified, other than the willingness to pay which had no weight but only performance rating. Moreover, questions 5 and 6 gave extra information on the privacy aspect (“If Cyber-Cars would be in used in your area, how would you like to travel? Only alone with friends you know or with any passengers?), and on the general acceptance of cyber cars as private means of transport[2] (could Cyber Car replace your private car?).

3.5.2 Results

A total of 487 interviews were performed for this showcase. In the following Figure 16, Figure 17 and Figure 18 the distribution of the sample is shown, according the different available characteristics of the interviewed people (age, education, employment).

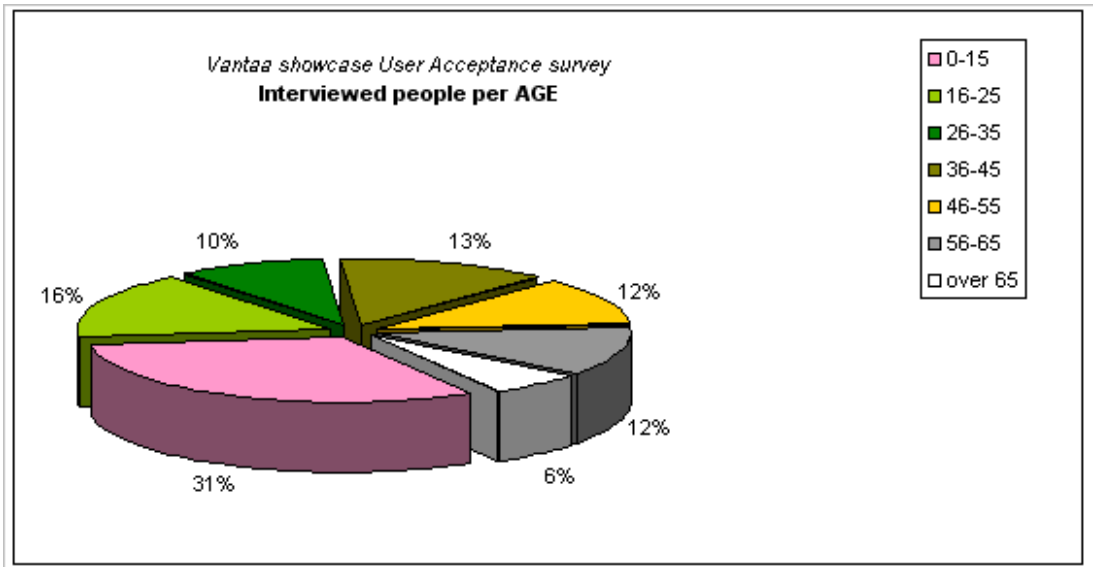

Figure 16 Vantaa interviewed people divided per age

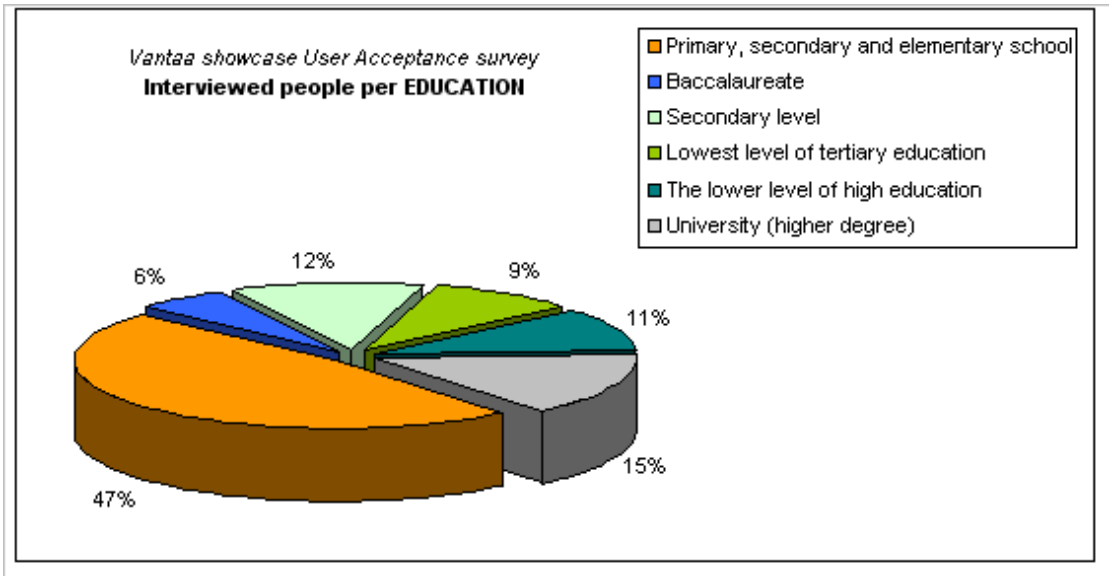

Figure 17 Vantaa interviewed people divided per education

[2]however this second aspect investigates the private use of the ATS which is rather extraneous to the project purposes.

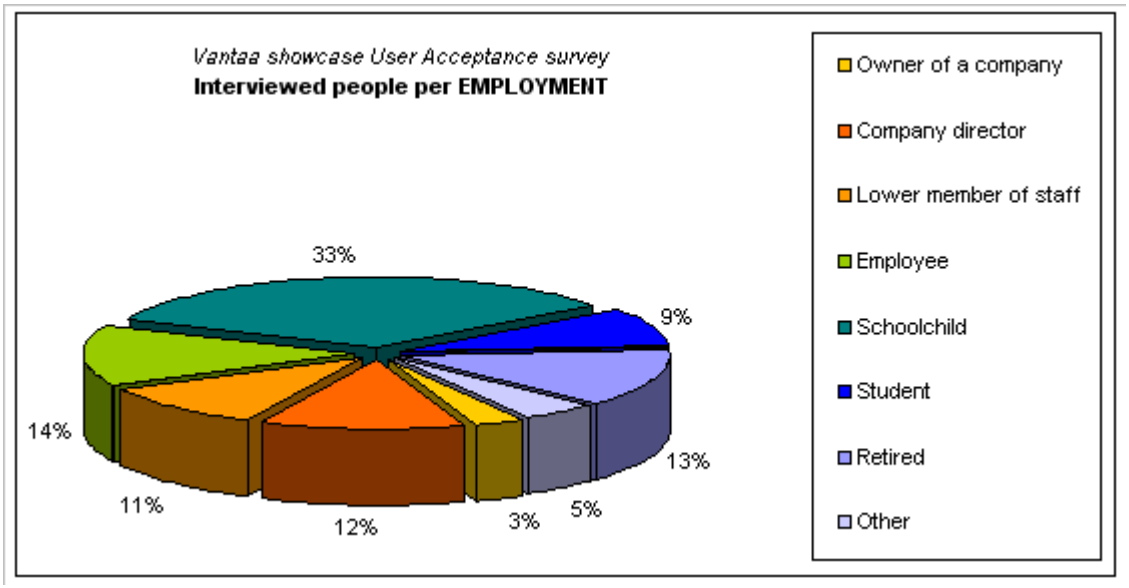

Figure 18 Vantaa interviewed people divided per employment

The following Table 12 reports the ratings averaged on the whole interviewed population.

Evaluation Category	Impact	Indicator	Importance (1=most, 5=less)	Ex-post performance rating
Acceptance	User acceptance	Usefulness	2.7	3.3/5
		Ease of use	2.7	4.0/5
		Reliability	2.4	3.3/5
		User satisfaction for the on demand service	3.8	3.3/5
		Integration with other systems	3.8	3.3/5
	Willingness to pay	User willingness		1 to 2€
Quality of service	Information	Availability		
		Comprehensibility		
	Comfort	Perceived comfort	2.4	2.9/5
	Privacy	Perceived level of privacy	3.2	2.8/5
	Perception of safety and security	Perception of safety	2.0	2.7/5
		Fear of attack	2.7	3.0/5
Transport patterns	System performance	Average journey time		
Social Impacts	Service accessibility	Access (times) for mobility impaired users		

Table 12 Average values for indicators dealt in the User acceptance survey of the Vantaa showcase

The resulting average ratings show the following:

- within the “Acceptance” evaluation category, Reliability results to be the most important indicator, with an average position of 2.4. The performance on this indicator was rated in average as quite good (3.3/5). Travellers felt in average that the less important aspects are instead the Integration with other transport systems and the On-demand service performance (both of these got an average level of importance of 3.8). However both indicators were scored quite positively (3.3/5, same value as Reliability and Usefulness). Ease of use and usefulness lay in the middle as for importance within this evaluation category (2.7 for both). The performance got a quite good score for usefulness (3.3/5); for the ease of use indicator the score was definitely good (4.0/5). Globally all the average ratings show an acceptable performance rating (if we assume that 3/5 is the minimum positive level) except the Ease of use, which apparently impressed somehow more the travellers.
- Within the “Quality of service” evaluation category, performance was instead appreciated not quite as much as in the previous one: three indicators out of four were rated below 3 in average (comfort, privacy, safety) and the perception of security got a weak 3.0. As or the weights, a great importance is given by the respondents to safety. The weight was rated with an average 2.0; the second rated was comfort (2.4), then security and finally privacy.
- “Extra” question number 5 obtained a 51%/49% on the preferred private/public use, while question number 6 showed quite promisingly that approximately two thirds of respondents would be ready to change their travelling habits and move to the use of cybercars instead of private car.
- Finally, the travellers expressed an average willingness to pay in a range of 1 to 2€ per journey.

The most relevant result here is on safety, which got a very high importance and, in contrast, the lowest performance (2.7/5).

Also for Vantaa the results were grouped according to certain correspondent profiles: the following categories were considered:

- users with lower school education (primary and secondary school),
- users with higher school education,
- people up to 30 years old,
- people over 30 years old.

The ratings distinct for the four categories are reported in Table 13; differences compared to the global values are highlighted in yellow, lower differences in green.

In general, the distinctions by education and age did not raise high discrepancies; Reliability is always rated as definitely important within the Acceptance indicators, but in the Under 30 category it is surpassed by the Usefulness indicator; in this case the discrepancy with the Over 30 category rate is very high (0.8). As for the other indicators, lower differences are recorded and in all cases the same order of importance as in the overall average is kept. Concerning the perceived performances, the disaggregated situation is even more flat: some minor differences are recorded for the “Integration with other systems” aspect, that was better rated by people with higher education and age.

Evaluation Category	Impact	Indicator	Importance					Ex-post performance rating				
			All	Primary and secondary school	Higher education	Under 30	*Over* 30	All	Primary and secondary school	Higher education	*Under* 30	*Over* 30
Acceptance	User acceptance	Usefulness	2.7	2.7	2.6	2.3	3.1	3.3/5	3.3/5	3.2/5	3.2/5	3.3/5
		Ease of use	2.7	2.8	2.5	2.7	2.6	4.0/5	4.1/5	3.9/5	4.1/5	4.0/5
		Reliability	2.4	2.5	2.2	2.5	2.3	3.3/5	3.3/5	3.2/5	3.3/5	3.3/5
		User satisfaction for the on demand service	3.8	3.7	4.1	3.7	3.9	3.3/5	3.3/5	3.4/5	3.3/5	3.4/5
		Integration with other systems	3.8	3.8	3.8	3.8	3.8	3.3/5	3.2/5	3.5/5	3.2/5	3.5/5
	Willingness to pay	User willingness						1 to 2€	1 to 2€	1 to 2€	1 to 2€	1 to 2€
Quality of service	Information	Availability										
	Comfort	Perceived comfort	2.4	2.4	2.5	2.3	2.5	2.9/5	2.9/5	2.8/5	2.8/5	2.9/5
	Privacy	Perceived level of privacy	3.2	3.1	3.5	3.1	3.3	2.8/5	2.7/5	2.9/5	2.7/5	2.8/5
	Perception of safety and security	Perception of safety	2.0	2.1	1.7	2.0	1.9	2.7/5	2.8/5	2.6/5	2.7/5	2.8/5
		Fear of attack	2.7	2.8	2.5	2.8	2.5	3.0/5	3.0/5	3.1/5	2.9/5	3.1/5
Social Impacts	Service accessibility	Access (times) for mobility impaired users										

Table 13 Average values for indicators dealt in the User acceptance survey of the Vantaa showcase distinct by two age categories

= no rating available

= difference between Under30 vs. Over30 or Lower vs. Higher education is >0.5

= difference between Under30 vs. Over30 or Lower vs. Higher education is >0.2

4 Cross-comparisons and findings

4.1 User acceptance

Several interesting global conclusions can be drawn by putting aside the ex-post surveys, three from the present document (Trondheim, Vantaa, La Rochelle) and one from the previous one (Daventry). In Table 14 all the indicators are compared; it should be pointed out that La Rochelle, although having some characteristics in common with the other three, is not completely comparable, therefore that is just added as an extra-reference.

The comparison among at least two of the Trondheim, Vantaa and Daventry sites is possible for nine indicators in total: Usefulness, Reliability, Ease of use, User satisfaction for the on demand service, Integration with other systems, Perceived comfort, Perceived level of privacy, Perception of safety, Fear of attack.

From the comparison between the weights given to the various indicators[3], the following aspects catch the eye:

- for the “Acceptance” evaluation category the highest importance is disputed by the “Ease of use” and “Reliability” indicators. Usefulness is considered in average an indicator with medium importance, while the aspects of integration with other systems and on-demand service received a lower attention;
- for the “Quality of service” evaluation category the situation is more definite: for all sites (including La Rochelle) the most important aspect is safety; security follows, then comfort and unanimously (even though here Daventry is missing) low weight was given to privacy.

With regards to the performances, ease of use is the best perceived with an average value of 3.65. Good satisfaction values were obtained by usefulness, reliability and user satisfaction for the on-demand system (3.4), although user satisfaction for the on-demand system was measured only in Trondheim and Vantaa. Perceived level of privacy closes the ranking, with average value of 3.0.

The general conclusions that can be drawn from this comparison are similar to what already obtained in the previous analysis of D5.2.1a: the central aspect for these systems is safety, which is recognised in a shared way as the most important aspect but also as one of the less convincing aspects as for performance, therefore deserving a high level of attention.

Like safety, ease of use is recognised as very important, but in this case that is also the indicator that obtained the maximum success of performance. Reliability records a less extreme situation, with an average importance very high, not surprisingly, but a performance level only moderate on all sites.

The level of privacy is commonly recognised as low, but also as the less important aspect.

[3] Technical note: for the comparison between weights a conversion was brought on the numbers reported in the previous tables for Trondheim, Vantaa, La Rochelle, for sake of uniformity with Daventry: the average value for every single site, obtained as arithmetic average of the ordinal numbers of all respondents, is now replaced by the global ordinal number, i.e. that indicating its position in the ranking of the average values of all indicators (for each single evaluation category).

Evaluation Category	Impact	Indicator	Importance				Ex-post performance rating			
			Trondheim	Vantaa	La Rochelle	Daventry	Trondheim	Vantaa	La Rochelle	Daventry
Acceptance	User acceptance	Usefulness	3	2	2	2	3.1/5	3.3/5	3.8/5	3.5/5
		Ease of use	2	2	1	1	3.5/5	4.0/5	4.0/5	3.1/5
		Reliability	1	1	3	3	3.2/5	3.3/5	3.6/5	3.5/5
		User satisfaction for the on demand service	5	4			3.5/5	3.3/5		
		Integration with other systems	4	4			3.1/5	3.3/5		
	Willingness to pay	User willingness			4	4	1 to 2€	1 to 2€	2 to 3€	1 to 2 €
Quality of service	Comfort	Perceived comfort	3	2	3	2	3.7/5	2.9/5	3.6/5	3.0/5
	Privacy	Perceived level of privacy	4	4			3.1/5	2.8/5		
	Perception of safety and security	Perception of safety	1	1	1	1	3.5/5	2.7/5	3.8/5	3.2/5
		Fear of attack	2	2	2	3	3.7/5	3.0/5	3.7/5	2.9/5
Social Impacts	Service Accessibility	Access (times) for mobility impaired users					83%			

Table 14 Cross-comparison among the four cyber-car systems ex-post evaluation: average values of the indicators for user acceptance

4.2 Transport patterns

The only data about transport patterns obtained in this phase are the **system modal share** and the **total number of trips** in the ex-ante evaluation of the Castellon demonstration, respectively 15% and 20300.

The total number of trips is the only indicator which can be compared with that one calculated for another demonstration, Rome, and reported in D5.2.1a.

Such value was 14132 daily passengers for the system based on the use of cybercars designed for Rome exhibition building, whereas the largest value calculated for Castellon is mainly due to the different kind of service provided by the demonstration, based on the use of buses from the University to the city centre.

Although the network lengths are similar at the moment, 2.2 km in Rome and 1.7 km in Castellon, the Castellon network will become 7.5 km long in the future plans. Furthermore the Castellon demonstration covers an area with users during all the day, whereas the Rome demonstration operations are directly linked with the exhibitions made in the building during the year.

5 Passenger application matrix on the basis of demonstration and showcase evaluation

The final step of the evaluation process, which will be addressed in the next WP5.4, will be to formalize the generalization of the results coming from the different inputs to the CityMobil technologies appraisal and finally provide a global assessment of the technologies.

In order to set the stage to this process, a dedicated table was built by the evaluation team, named Passenger Application Matrix. The purpose of this tool is to move the focus from the researcher perspective to the decision maker's one, typically more practical, trying to think in terms of what system is best to be implemented in order to improve the mobility in a certain specific situation.

In this matrix the case studies, the demonstrations and the showcases are grouped according to the type of areas linked by the single scheme. Being the possible OD pairs the same (rows and columns), the matrix results to be a two-dimension symmetrical one. The information for each OD pair, expressed in terms of the available indicator values, can be considered as the third dimension.

The use of this general view should be ideally focused on each cell of the matrix, and help evaluate pro and cons of the implementation of the different technologies in each particular environment. Nevertheless a strict "single cell based" analysis will not be always feasible, in particular when the city-study modeling are involved; in fact in the modeled scenarios, due to the different dimensions of the cities, the area types may not be consistent with the categorization of the matrix, or the same area type of cities that are very different in dimension may lead to non proper comparisons; on the other hand, the indicator values resulting from the models may refer to single zones of the modeled area and not to the entire city, and this may avoid the cross comparisons as well. Such cases do not however represent a problem to the matrix filling, because in these cases it will be possible to provide valid results to the decision makers by changing the level of the geographical scale and evaluating the information on a more aggregate geographical level, i.e. grouping more cells.

In Figure 19 the third release of the passenger application matrix is represented.

It represents the third step of the matrix evolution: after the first release presented in D5.3.1a, it has been filled with case studies results, reported in D5.3.1b, and with the results of demonstrations and showcases obtained in this deliverable and in D5.2.1a.

Destination⟶ **Origin** ↓	City centre	Inner suburbs	Outer suburbs	Suburban centres	Major transport node	Major parking lot	Major service facility	Major shopping facility	Major leisure facility
City centre	ICCC (Gateshead. Madrid. Trondheim. Vienna) **PRT** (**Gateshead. Madrid. Trondheim. Vienna**) DMV (La Rochelle)								
Inner suburbs	ICCC (Gateshead. Trondheim) **PRT** (**Gateshead. Trondheim**) HT-bus (Gateshead. **Madrid**. Trondheim. **Vienna**) DMV	ICCC (Gateshead. Trondheim) PTFCC (**Gateshead**. Madrid. Trondheim. Vienna 1) **PRT** (Gateshead. **Trondheim**) HT-Bus (Gateshead. **Madrid**. Trondheim. **Vienna**) DMV PRT (Daventry)							
Outer suburbs	PTFCC (Trondheim) PRT (Trondheim) **HT-bus** (**Madrid**. Trondheim, Castellon) DMV (Madrid. **Trondheim**)	PTFCC (Trondheim) PRT (Trondheim) **HT-bus** (**Madrid**. Trondheim, Castellon) DMV (Madrid. **Trondheim**)	PTFCC (Trondheim) **PRT** (Trondheim) HT-bus (Trondheim) DMV						
Suburban centre (within an intermediate distance range)	HT-bus (Gateshead)	HT-bus (Gateshead)							
Major transport node (e.g. airport, central station)	HT-bus (Gateshead) CC (Vantaa)	HT-bus (Gateshead)			PRT (Heathrow)				
Major parking lot				CC (Rome)	CC (Rome)				
Major educational or service facility (e.g. University campus, hospital)	PRT (Trondheim) HT-bus (Castellon)	PRT (Trondheim)	PRT (Trondheim)				CC (Trondheim showcase)		
Major shopping facility	ICCC (Gateshead) **PRT** (Gateshead) HT-bus (Gateshead)	ICCC (Gateshead) **PRT** (Gateshead) HT-bus (Gateshead)		HT-bus (Gateshead)					
Major leisure facility (e.g. amusement parks)	HT-bus (Castellon)								
Corridor	**HT-bus** (**Gateshead. Madrid. Trondheim. Vienna**) DMV	**HT-bus** (**Gateshead. Madrid. Trondheim. Vienna**) DMV	HT-bus (Trondheim) DMV	HT-bus (Gateshead) DMV					

Figure 19 Third release of the Passenger Application Matrix

6 Sources

Reference list

CITYMOBIL CONSORTIUM, 2009, *Field trial A ex-ante evaluation report*, D5.2.1a of CityMobil project

CITYMOBIL CONSORTIUM, 2010, *Castellon impact assessment framework*, D1.4.5.1 of CityMobil project

CITYMOBIL CONSORTIUM, 2010, *Ex-ante impact assessment of the Castellon demonstration*, D1.4.5.2 of CityMobil project