Available online at www.sciencedirect.com
ScienceDirect
Transportation Research Procedia 5 (2015) 13 – 29
Transportation Research Procedia
www.elsevier.com/locate/procedia

SIDT Scientific Seminar 2013

The European Bus System of the Future: Research and Innovation

Antonio Musso[a], Maria Vittoria Corazza[a]

Sapienza University of Rome, Dept. of Civil, Building and Environmental Engineering (DICEA), Via Eudossiana 18, Rome 00184, Italy

Abstract

The development of a new generation of bus systems was the goal of the European Bus System of the Future (EBSF) project, funded by the European Commission within the 7th Framework Program. To accomplish this, a series of very different innovative solutions for buses (such as new vehicle layouts, advanced remote maintenance systems, improved on-board communication systems, more performing bus stops and eco-efficient engines) were simultaneously tested in seven Use Cases (UCs) in Europe (Bremerhaven, Brunoy, Budapest, Gothenburg, Madrid, Rome and Rouen). All the tested measures had to increase the attractiveness and improve the image of the mode. The efficiency of all of them was assessed as well as their transferability to other European contexts. The paper describes the tested solutions and focuses on the assessment methodology, the main results achieved and the drivers and barriers for the transfer of such solutions across Europe.

Peer-review under responsibility of the Società Italiana dei Docenti di Trasporti (SIDT).

Keywords: EBSF, Bus, Transferability

1. Introduction: EBSF - European Bus System of the Future

EBSF- European Bus System of the Future (2008-2013) was a project funded by the European Commission (EC) within the 7th Framework Program (FP). The core of the project was to develop a high quality bus system which combined innovative measures for vehicles, infrastructure and operations, with the final goal to increase the attractiveness and improve the image of this mode. To accomplish this, seven Use Cases (UCs) in seven European cities (Bremerhaven, Brunoy, Budapest, Gothenburg, Madrid, Rome and Rouen) tested innovative solutions for buses further described. Under the scientific point of view, the research questions were whether these measures could prove to be really effective and, if yes, be transferable to other European contexts. A specific evaluation methodology was, thus, applied to assess the efficiency of the tested solutions, comparing "before" and "during" situations, through a comprehensive set of Key Performance Indicators (KPIs), divided into four evaluation categories further described. Tests results of each UC served as a basis to develop the Transferability Exercise (TE),

Peer-review under responsibility of the Società Italiana dei Docenti di Trasporti (SIDT).
doi:10.1016/j.trpro.2015.01.014

i.e. the assessment of drivers and barriers which could support the transferability of the solutions tested in the UCs to more urban areas. Also in this case, the TE called for the set-up of a specific methodology to simulate "what" could be transferable of the UCs experiences, and "where to", which resulted to be 20 target cities across Europe (Corazza and Musso 2014).

Each UC tested one or more innovative measures, coherently with the local service features and requirements. Some measures were common to more UCs, whereas others specifically designed for just one of them; however, all were planned to meet specific categories of requirements, as resulted from a users' need analysis previously developed involving a panel of stakeholders actively participating in EBSF. More specifically, in:

- Bremerhaven (UC1), the testing activities (from May 2011 to February 2012), focused on two main fields: a) a comprehensive system to improve on board accessibility and comfort which included a special lighting to show passengers the right door to board; an internal layout with ceiling lights to show available/occupied seats, to facilitate their occupancy; wLan router to Internet free access for passengers and sockets to connect laptops; folding seats in the standing areas; and a GPS amplifier to allow passengers to localize the bus via phone app; b) a real-time information system with displays informing boarded passengers on actual departure time from the next bus stops, service disruptions, alternative routes, news, etc. and bus stops equipped with new info-terminals displaying the same information
- Budapest (UC2), a 18.5m articulated bus, with 5 doors to shorten dwell times, was tested from March to November 2011; the vehicle featured a new internal layout with flexible seats arrangements to optimise passenger flows (drivers may release 7 electrically folding seats), a translucent folding bellows to facilitate movements within the two bodies, vertical light barriers which show the access and more efficient engine and on-board video surveillance, fire prevention and air conditioning systems.
- Madrid (UC3), from September 2011 to March 2012 an on board Real Time Passenger Information System (RTPIS) was tested, providing information on estimated travel times and next train departures; RTPIS was tested at a major regional bus/train hub, interchange stations and several stops; RTPIS also operated through a dedicated web page and SMS dispatched from the local Integrated Transit Management Centre.
- Rome (UC4), test activities on a new internal layout, a driver cabin mock-up and an innovative remote maintenance system took place from September to December 2011. As for UC2, the new internal layout was aimed at providing more room for passengers through different seating arrangements (sliding seats), a wider central aisle, no steps for the majority of the low floor area; in addition, 20% more window areas, even on the ceiling, were provided. Innovative ergonomic solutions were tested also in a mock-up cabin for drivers, where a real driving environment was simulated, thus enabling voluntary drivers to test more comfortable working conditions, safer and more proficient driving operations, as well as more sensible driving styles. The third test relied on a "telediagnostic" system to expedite usual maintenance processes, to prevent and forecast further failures, similar to that tested in UC 7Brunoy, below described.
- Gothenburg (UC5), a new internal layout was tested and voluntary drivers trained to more eco-driving styles, from August 2011 to February 2012. The innovative layout featured: a central driver cabin (as in trams') and front wheels in front of the driver; double doors with larger blades; a semi-transparent bellows and more standing places, since folding seats can be blocked or released according to passengers flows. The eco-driving test was based on sessions where drivers were trained to find the most suitable way to stop close to the curb, thanks to specifically designed road markings, and to drive smoothly.
- Rouen (UC6), an enhanced accessibility-for-all on-board system was tested from November to December 2011 and again in February 2012. To reduce vertical and horizontal gaps between curb and bus floor, an electronic suspensions system (including sensors and transponders) and a special flap were installed.
- Brunoy (UC7), similarly to UC4, a remote maintenance system was tested, from June 2011 to February 2012. The common goal for both the UCs was to achieve a proper knowledge of any possible breakdown or failure in order to: speed-up the repair/recovery process, forecast recurring technical failures before the vehicle breakdown and reduce the number of failures during operations. The maintenance and diagnosis methods are based on an ICT system featuring specific on-board sensors for key components (doors/batteries/brakes) and a new predictive back-office software linked to a standardized remote database.

As said, each innovation was meant to provide an appropriate reply to local service requirements, according to the local operators' own point of view, thus resulting in different decisions and approaches (EBSF 2013).

Innovations in the field of comfort serve as a case in point: on the one hand measures aimed at improving on-board comfort were naturally targeted to testing environments where old generations of vehicles were still operational and thus far from providing comfortable travel conditions; but, at the same time, in testing environments where the quality of comfort was already high, innovations in this field were meant to make of travelling by bus a premium experience. In both cases, specific bus lines and routes where tests had to take place were selected after a check on the consistency and appropriateness of their usual levels of service and performance with the features to test (for instance, substantial occupancy levels during most of operation times, routes crossing significant areas of the city, medium-to-long travel times, average headway, etc.).

2. The two-step methodology

For the assessment of the EBSF outcomes a two-step methodology was applied: an initial evaluation of the differences between the situation before the implementation of the EBSF measures in each UC and the test situation (the general evaluation) and the following study of "how" and "if" the achieved results could be transferable elsewhere in Europe (the transferability study). Needless to say, this comparative analysis is in line with similar assessment approaches typically used in projects funded by the EC, dealing with demonstrators or case studies in real environments, funded by the EC. Among these, the main reference are MAESTRO - *Monitoring Assessment and Evaluation Scheme for Transport Policy options in Europe* (1998 – 2000, within the IV FP) and METEOR - *Monitoring and evaluation of transport and energy oriented radical strategies for clean urban transport* (2002-2006). More specifically, within METEOR, a sound evaluation methodology was developed, so to have the assessment procedure divided into two steps: the so-called "process evaluation" and "impact evaluation"; the former aimed at realising the output of the measures to test, the former at assessing the outcome of the measures by the use of qualitative and quantitative indicators (earlier examples of the KPIs used in EBSF). A final analysis to perform was then planned to detect to what extent each measure may turn to be suitable for adoption by other urban areas, or in other words how the measures can be transferable (Macario and Marques 2008, Macario 2011), which became the main reference for the development of the TE within EBSF.

2.1. The general evaluation

As above mentioned, a specific methodology (Karlsson 2010) was applied to assess the efficiency of the EBSF tested measures, initially comparing "before" and "during" situations, through a set of KPIs, divided into four evaluation categories: *Productivity of the system*, *Environmental performance*, *Quality of the service*, *Customer satisfaction*, each corresponding to more areas of investigations.

Coherently with the directions coming from both MAESTRO and METEOR, within EBSF data to "feed" the KPIs were collected both through direct measurements of the technical performance of each tested solution, and via questionnaires submitted to the involved actors (operators, drivers, passengers) for all the issues concerning perception and acceptance. A full-featured, web-based software (SoFi) was available to store and process the KPIs data. KPIs were both common, if applied to more UCs, or specific, when tailored for a single one. Since the tested measures, as well as the testing environments, duration and conditions were very different, a simple "before/during" comparison at each UC was not sufficient to assess the efficacy and the benefits of the whole package of EBSF innovations. To this aim, a cross-site evaluation, i.e. a further comparative assessment was carried out: the core of this phase was to evaluate the different impacts for each area of evaluation or each KPI, and homogenize them through a number of utility functions. Therefore impacts, to be measured, required first to convert the variation of a given KPI between the before and during scenarios into a homogeneous value scaled from 0 (no change) to 1 (maximum change), and then to assign a weight to the different areas of investigations in order to quantify its importance in the development of each EBSF innovation. The weighted sum of all the KPIs used to measure a given EBSF solution described its overall impact, thus defining its social utility (Cascajo, Monzon and Hernandez 2012), further described.

2.2. Test results

Selected KPIs (some specific of a single UC) measured the performance of every innovative solution in each UC, comparing results before the implementation (ex ante) and while testing it (during). Surveyed variations (Figure 1) allow highlighting two categories of results: a) Performance which fully improved in all the UCs and b) Performance which either improved or worsened, or did not vary at all.

Theoretically, category a) performance can be assumed as points of strength, whereas those of category b) as elements of uncertainty. It is also worth noticing that none of the KPIs recorded negative performance in all the UCs, which allows to state that no general elements of weakness can be detected. Focusing on category b), the amount of yellow cells corresponding to performance levels with different outcomes among the UCs (Figure1) stresses that uncertainty prevails, although with different degrees of significance; more specifically:

- Performance with no strong variations (i.e. where, for the majority of UCs involved, the KPI variation is equal to 0), corresponding to KPIs *Commercial speed*, *Technical Maintenance of the bus* and *Operating costs*;
- Performance with negligible improvements (i.e. where, for the majority of UCs involved, the KPI variation is equal to 0 and higher than 1), corresponding to KPIs *Service efficiency* and *Energy consumption*;
- Performance with significant improvements (i.e. where, for the majority of UCs involved, the KPI variation is higher than 1), corresponding to KPI *Passenger capacity*(only Rouen reported no variation)
- Performance with contrasting outcomes (i.e. where there is a mix of positive and negative variations), corresponding to KPIs *Customer perception of the bus safety*, *Vehicle failure* and *Passenger demand*.

Negative or not fully satisfactory results are due mainly to three reasons which are: 1) very short time for testing the measures or to small size of fleets tested (longer testing times or implementation at larger scale could have provided more consolidated results and therefore a more decisive assessment for UC4 Rome and UC7 Brunoy); 2) external factors intervened beyond any forecast, as the changes in the economic situation, affected specific performance categories. For example, a general drop of the passengers demand between 2010 and 2011 is behind the decrease of the KPI *Passengers demand* in UC1 Bremerhaven and the 2% decrease of KPI *Level of modal integration services* in UC3 Madrid); 3) differences between "before" and "during" testing conditions, since testing conditions could not be always equally replicated and in some cases slight differences occurred between the ex-ante and during tests.

KPIs belonging to category a) are: *Dwell time, Bus punctuality Perceived comfort level on board, Perceived quality of service, Customer perception of image, Accessibility of Real Time Information, Availability of information for connecting with other PT service* and *Days in workshop.* It is worth noticing that the results of three KPIs concerning "perception" were achieved through the passengers' assessment, which implies that customers' favour and satisfaction can be considered as fully achieved within EBSF. The most efficient performance were achieved in the evaluation category *Productivity of the system* (with areas of investigation: *Maintenance*, *Pricing and commercial policies*, and *Economic and operational issues*) and *Customer Satisfaction and attractiveness of bus systems* one (with areas of investigation: *Information to passengers* and *Comfort, cleanness*). A minor role is played by the evaluation category *Quality of the bus system* (with the only strong area of investigation: service performance), whereas *Environmental issues* is the only which seems to be of no relevance, due to the majority of negligible results among the involved UCs.

a) KPIs Evaluation Category	b) Areas of investigation	c) KPI Name	d) KPI Units	e) Variation [(Vd-Va)/Va] x 100 Va= ex ante value; Vd = during value						
				UC1	UC2	UC3	UC4	UC5	UC6	UC7
Customer Satisfaction and attractiveness of bus systems	Comfort, cleanness and quality feeling/perception	Perceived quality of service	Passengers survey (1-10 scale)	13	5	6		4		
		Perceived comfort level on board			8			25		
		Customer perception of image		16				5		
	Information to passengers, relational and behavioural issues	Accessibility of real time information	%	11		100				
		Availability of information for connecting to other PT services	Passengers survey (1-10 scale)	4		20				
		Drivers situation	Drivers survey (1-10 scale)					10		
		Accessibility to drivers						-3		
Urban environment and integration	Environmental issues	Energy Consumption	Litres*1000/ passkm	3	-17		0	-8	12	0
	Urban development and quality of life	Mobility of inhabitants	Trips/ inhabitant			6				
	Accessibility to vehicles and infrastructures	Accessibility for users with special needs	Seconds						-9	
Productivity of the system	Economic and operation issues	Operating Costs	Euro/km	0	-17					0
		Passengers demand	Pass/month	-4	9	-10			30	
		Passenger capacity	Places*km		3			8	0	
	Pricing and commercial policies	Service efficiency	%	0		-1		9		0
	Maintenance	Technical maintenance of the bus	Days out of service	0	91	0	6	0	0	-52
		Days in Workshop			-75					-60
		Vehicle failure	Number/ 10.000 km		-90		-15			+35
		Ratio of non-working vehicles	%							-26
Quality of the bus service	Safety and security	Customer perception of buses safety	Passengers survey (1-10 scale)		-4			4		
		Drivers level of training	Drivers survey (1-10 scale)					8		
	Service performance	Dwell time	Seconds		-13			-6		
		Bus frequency			-4					
		Commercial Speed	Km/h		4			0	0	0
		Bus punctuality			52	3		6		
	Modal integration and additional/ flexible services	Level of modal integration services	%			-2				
	a) Performance levels improved in all the UCS									
	b) Performance levels which either improved or worsened, or did not vary at all									
	not applicable									

Fig.1. KPIs and ex ante-during comparison of results

2.3. The concepts behind the Transferability Study

Test results of each UC and their evaluation served as a basis to develop the Transferability Exercise (TE), i.e. the assessment of drivers and barriers which can steer the transferability of the measures tested in the UCs to other European contexts, according to the methdological directions previously mentioned.

"Transferability" means the quality of being transferable or exchangeable and the basic assumption behind is: "what proved to be effective in a place may confirm to be useful again, in another place"; but the translation of the concept into practice is more challenging, since transferability is often mistaken for the selection of measures which could fit a given situation, whereas it is actually a process in which the feasibility of implanting measures or technical solutions from an origin case study to a receptor/target one is assessed. Scientific literature provides conclusive directions in this field; from state-of-art reviews (Macario and Marques 2008; Marsden and Stead 2011), transferability clearly relies on a number of issues, the first of which is to have a proper knowledge of factors influencing origin and/or receptor contexts; these belong to three different areas: the institutional domain (i.e. the amount of regulatory tools which authorize the enforcement of a given measure);the funding availability (i.e. the amount of resources, personnel and technical know-how required to implement a given measure);the society (i.e. the conditions which makes a community aware of the need to adopt a given measure; public involvement is essential since many studies on transferability are largely based on consultations according to Buchanan, 2003). The three factors constitute a kind of "environment" where, theoretically, the TE can take place and where all the mutual influences must be equally considered (King 2005). A second aspect to consider is the scale of transferability: the EC-funded project TRANSPLUS - *Transport Planning, Land Use, and Sustainability* developed the Transferability Scope for clusters of measures, i.e. the vertical or horizontal transferability concepts: the former (vertical) implies the possibility of zooming a given measure in or out, while the latter (horizontal) means the opportunity to move such a measure without changing scale (Macario and Marques 2008). Timms (2010) describes two different perspectives for transferability: the "bottom-up" and "the top-down"; the former is the perspective as taken by local administrations, the latter by the European Union point of view. Both reflect the need to achieve a better knowledge of the processes of policy transfer across Europe, within the broader concept of ''Europeanization''. Coherently with such a concept, a number of EC-funded projects, besides TRANSPLUS, have progressively become the very test field to assess the transferability of clusters of measures and their outcomes now constitute a reliable framework. Among these, LEDA - *Legal and regulatory measures for sustainable transport in cities* pioneered a transferability process for specific regulatory measures (Langsaam Verkeer, 1999). Later, the CIVITAS Initiative consolidated a transferability methodology, based on a ten-step algorithm, aimed at providing decision-makers with a univocal process to transfer the CIVITAS experiences to more European urban areas. This transferability methodology was further revised in the CIVITAS GUARD project (Hall et al. 2008) and applied to more CIVITAS case studies (CIVITAS MOBILIS 2009).

Also within EBSF, the TE called for the set-up of a specific methodology developed to find out "what" could be transferable of the UCs experiences, and "where to" (Corazza and Musso 2014), and coherent with the directions provided by the above mentioned studies.

3. The Transferability Exercise within EBSF

The translation of the tests results under the transferability point of view is to compare the effectiveness of all the UCs according to the KPIs results, in order to outline the points of strength achieved by the best performance in each UC. Such points of strength can be considered the drivers which can make each UC experience appealing and worth to be transferred. Same analysis was carried out for what may be considered points of weakness, i.e. innovations whose performance may seem to have played an uncertain role, and therefore worth to be assessed as the possible barriers occurred during the EBSF demonstrations. Thus, as above mentioned, the final task of the evaluation process within EBSF was to perform a Transferability Exercise to outline which are the possible drivers and barriers which could endorse or prevent the transferability of the EBSF measures across Europe.

3.1. The Transferability methodology

It is clear that with regard to the UCs experiences/measures, outcomes could not be "moved" just from one place to another and that there may be the need to transfer not only the technical knowledge but also some of the relations between institutions and contexts. The methodology for the transferability of the EBSF outcomes was designed to meet all of the above requirements by applying a very comprehensive and flexible tool to run a TE: a six-step algorithm, (similar to that applied within CIVITAS) based on the following sequence:

- Step 1 - Selection of candidate UCs
- Step 2 - Cluster of origin cities
- Step 3- Selection of target cities

- Step 4 - Cluster of target cities
- Step 5 – Transferability exercise
- Step 6 – Assessment of transferability

The main difference with the CIVITAS examples relies on the possibility, within EBSF, to avoid “packaging”. Since CIVITAS projects may deal with very different measures to test in just one given case study (from pricing, to transit and parking management, to awareness campaigns, to the promotion of non-motorized modes, to goods distribution, just to name a few of the most recurring measures) it is necessary their coherent bundling or “packaging” to determine the overall degree of success of the experience (METEOR 2006). On the contrary, within EBSF, being all the measures already part of a single package, that of the “improvement of the bus”, this step can be skipped.

For what concerns EBSF TE, the core of Step 1 was to have a good snapshot of the UCs’ progress and results along with possible barriers occurred during the implementation phase, in order to find out which UCs would be eligible to be transferred. Indeed, usually there is no certainty that all the cases available to transfer may succeed in the same way, and therefore the option that, within EBSF, a given UC could not be transferable had to be contemplated. Although in few cases not optimal performance levels were reached, none of these had to be considered as unfavorable parameters as to prevent the related measure(s) from being transferred. Therefore, all the UCs qualified for being considered transferable examples, becoming “origin cities” in the TE. The cluster of UCs (and related KPIs) as Origin Cities needs to be elaborated in order to have a proper “Characterization” of the cities the UCs belong to; such a “Characterization” is the task of Step 2 and is aimed at defining some local features, i.e. “Variables”, which will be used to identify the context needed by a target city to “receive” a given measure typical of a given Origin City/UC. Variables describe the UCs according to the physical, institutional and the socio economic domains and they have to be common to all the UCs, since the goal of such step is to have a profile of each UC according to common features, so to provide a cluster of comparable Origin Cities.

Step 3 goes in hand with Step 1, as it is aimed at individuating a set of candidate cities which could be eligible to become the transferability receptor contexts, or “target cities”. Cities should be qualitatively close to the Origin Cities (according to the Variables provided, for example: similar area, same dominant transit mode, etc.). The EBSF Evaluation group drafted an initial “wish list” of candidate target cities and more, from the CIVITAS Initiatives, were added later. Once contacted the representatives of each target city and having sent them a description of the Variables of each Origin city, those who agreed to take part in the TE “embodied” the final cluster of target cities (Table 1), ready to perform the TE as planned in Step 4.

Table 1. Cluster of target cities for the TE

UC (Origin cities)	Target cities
1 - Bremerhaven	Cagliari (Italy), Aberdeen (UK), Perugia (Italy), Gorna Oryahovitsa (Bulgaria), Leicester (UK)
2 - Budapest	Vienna (Austria), Kocaeli area (Turkey)
3 - Madrid	Prague (Czech Rep.), Kocaeli area (Turkey), Skopje (Rep. of Macedonia), Szczecin (Poland)
4 - Rome	Lyons (France), Zagreb (Croatia), Szczecin (Poland)
5 - Gothenburg	Barcelona (Spain), Turin (Italy)
6 - Rouen	Malmo (Sweden), Brugge (Belgium), Leicester (UK), Szczezinek (Poland); Gdansk (Poland)
7 - Brunoy	Città di Castello (Italy)

The representatives of the target cities, all high-profile experts being either local administrators or transit companies’ managers, became thus the panel of respondents participating in the next Step 5, the core of which is the filling in of the Complementarity Matrix (CM), described in section 3.2. Respondents could either fill in the CM via phone interview with one of the EBSF Evaluation group members or on-line. As planned in Step 6, results stored in a specific database, were processed by the EBSF Evaluation group and, accordingly, a final assessment of the possibility to transfer the measures provided, as described in section 4.

3.2 The Complementarity Matrix

Within EBSF, Transferability relied also on the concept of “strategic opportunity”, i.e. the knowledge of the target city’s priority which could motivate the transfer of the UCs measures. Respondents, thus, were initially called for “visioning”, meaning by this the creation of scenarios to transfer the EBSF measures, by stating, before filling in the CM, which top priority in the target city could theoretically trigger the transferability process, among four options:

- Vision A – top priority: *Productivity of the system*
- Vision B – top priority: *Customer satisfaction and attractiveness of bus services*
- Vision C – top priority: *Quality of the bus service*
- Vision D – top priority: *Urban environment and social integration*

The proposed top priorities coincided with the KPIs’ evaluation categories (Figure 1). For each vision, KPIs values, which represented the achieved performance levels of a given measure, are considered in terms of the complementarity each of them has against the others, in the CM (Figure 2), and using the following rating scale: 0 – Neutral; 1 – Limited; 2 – Significant; 3 – Crucial. In other words, the panel of respondents had to score how much relevant were the performance achieved within each UC, to successfully transfer the EBSF outcomes to his/her own city. To do this, scores were given by the respondents by replying to a very simple question: “Will the X KPI be Neutral/Limited/Significant/Crucial in relation to the Y KPI to transfer the UC/Origin City experience successfully, according to the top priority you have chosen ?”. Row by row, this question is reiterated per each couple of considered KPIs. This allows to score KPIs in terms of mutual complementary, in sight of the accomplishment of the vision. For each row it is possible to calculate the sum of scores Aj calculated as:

$$A_j = \sum_{i=1}^{n} Sc_{ij} \qquad 1)$$

where Sc is the score provided in each cell, with i-row = 1...n, and j-column = 1...m, to be reported in the column a) in Figure 2 and its average value Bj, to be reported in the column b) in Figure 2, calculated as:

$$B_j = \frac{1}{n} A_j$$

Since to each evaluation category belong a different number of KPIs, scores must be homogenized according to a weight given to each evaluation category, as follows:

- Productivity of the system (n KPIs) each row weight: 1/n
- Customer satisfaction and attractiveness of bus services (m KPIs) each row weight: 1/m
- Quality of the bus service (x KPIs) each row weight: 1/x
- Urban environment and social integration (y KPIs) each row weight: 1/y

Results C (KPI average value x KPI weight) are reported in the column d in Figure 2, being calculated as:

$$C = \sum_{j=1}^{m} B_j \qquad 2)$$

After the calculation of the KPIs according to the related weights, it is possible to resume “visioning”, i.e. to hypothesize what would happen by privileging one goal/vision rather than the others, according to the preference already stated by the respondent. The difference with the previous steps of the assessment is that, thus far, the respondent had to provide the scores considering the chosen vision as a goal, but not forgetting the KPIs results achieved also in the other evaluation areas; now the assessment becomes “mono-focused”, as the leading question behind is: “What would happen if the chosen vision could be considered strong enough to apply the measure(s), not matter pros coming from other areas?". This question is needed because in the target cities the reasons to implement the measures may be not the same, or of not equal priority, as those of the origin city, so it is important to assess whether requirements may be met, also in case of diverging visions. Values Dj can be then re-calculated according to the respondent's chosen vision which is magnified by 2, whereas the others are magnified by 1. Such magnification factors MF are reported in column e) in Figure 2. The recalculation of each KPI according to such magnified factors Fj, calculated as:

$$F_j = MF_j \times D_j \qquad 3)$$

(where Dj is: $D_j = B_j \times \frac{1}{m}$) in column f) in Figure 2 and then summing all the KPIs resulting scores per each vision chosen and evaluation categories, allows to have the final Total Score per vision Gj calculated as:

$$G_j = \sum_{j=1}^{m} F_j \qquad 4)$$

as in column g) in Figure 2, where calculations have been made according to the respondent's chosen vision A – top priority: *Productivity of the system*.

			Quality of the bus service	Urban environment and social integration	Productivity of the system							a) Total per evaluation KPI	b) Average value per KPI	d) KPI weight	e) Magnific. factor	f) Score magnified according to vision	g) Total score per vision
			Service performance	Environmental issues	Economic and operation issues		Maintenance								vision: productivity of the system		
KPI Categories	AREAS OF INVESTIGATION	Name KPI	Commercial speed	Energy consumption	Operatin g costs	Investment for the innovation	Technical maintenanc e of the bus	Vehicle failure	Days in workshop	Ratio of non-working vehicles							
Quality of the bus service	Service performance	Commercial speed		2	3	0	1	3	2	2		13	1,86	1,86	1,00	1,86	1,86
Urban environment and social integration	Environmental issues	Energy consumption	2		3	0	2	0	0	0		7	1,00	1,00	1,00	1,00	1,00
Productivity of the system	Economic and operation issues	Operating costs	3	3		2	2	2	2	2		16	2,29	0,37	2,00	0,73	4,21
		Investment for the innovation	0	0	2		3	3	3	3		16	2,29	0,37		0,73	
	Maintenance	Technical maintenance of the bus	1	2	2	3		3	2	3		16	2,29	0,37		0,73	
		Vehicle failure	3	0	2	3	3		2	2		15	2,14	0,34		0,69	
		Days in workshop	2	0	2	3	2	2		3		14	2,00	0,32		0,64	
		Ratio of non-working vehicles	2	0	2	3	3	2	3			15	2,14	0,34		0,69	

Fig. 2. The Complementarity Matrix (an example: from UC7 Brunoy to Città di Castello TE)

4. . The Transferability results

According to the procedure above described, collected results allowed to assess the leading performance in each UC which could prompt the transfer to the involved target cities (the Site Specific Evaluation), and compare them (the Cross case Evaluation). From such outcomes a further sensitivity analysis was developed to assess how much such performance, (some of them, prerequisites for the transferability of the EBSF measures, actually) are likely to be "conform" or equally replicable in the target contexts.

4.1. Site Specific Evaluation

Site specific results show that no strong barriers seem to prevent the TE respondents from theoretically transferring the EBSF measures to their own context, although with different degrees.

In UC1 Bremerhaven, although for the majority of respondents the priority for the transfer is the *Customer satisfaction and attractiveness of the bus system* area, and results achieved in this field can be considered effective drivers (especially for performance measured by KPIs *Accessibility of Real Time Information* and *Customer perception of the image*), outcomes of the *Productivity of the system* are further elements of interest, not to be neglected, especially in terms of performance related to *Operational and commercial issues*. In a UC such as Bremerhaven where the tested measures were clearly planned to increase the attractiveness and availability of transit, to facilitate the shift from personal motorized transport to public transportation, such a relationship can be interpreted as the need to transfer examples where innovation is not detrimental to the productivity, but plays the role of additional factor of attractiveness.

For UC2 Budapest, the resulting drivers for the transfer rely on the potentials achievable within the *Service performance* area, coherently with *the Quality of the bus service* chosen vision by the respondent from the Vienna TE, but the economic side of operations is a parameter to consider, as well, as stressed not only by the initial scoring (scores without the MF) of the Vienna CM, but also by the TE to Kocaeli (for which *Productivity of the system* is the top priority). Considerable improvements are behind this assessment (for instance, a 17% reduction of *Operating costs*, a more than 50% increase in the *Bus punctuality* and a 13% reduction in *Dwell times*). The striking 75% reduction of *Days in workshop* got a high score but lower than the scores given to a number of other KPIs both in the target cities TEs. This suggests that one interpretation for low scores in spite of considerable improvements (not only in the case of UC2 but also in other UCs), is the respondent's disbelief in the possibility to equally replicate these UC results in the target city.

UC3 Madrid tested an ITS-based measure targeted to increase the *Customer satisfaction and attractiveness of the bus system* and the goals achieved in this field clearly steered the interest for the transferability in this direction, although it is worth reminding that for two of the TE respondents the Madrid case results could be transferable to increase the overall *Quality of the bus service*. This in spite of the economic crisis period in which the measures was tested, which resulted into an unexpected decrease of the local demand, as previously mentioned. If such circumstances, on the one hand, seemed to affect the assessment of all the issues concerning the economic side of the measure, on the other did not prevent respondents from considering as an effective driver the consensus stated by the passengers in Madrid. In addition, the respondents' awareness that the benefits coming from the provision of high quality information can only be observed over longer time periods, not only in terms of increased demand but also in improved management of operations, led to stress the importance of KPI *Service efficiency* which resulted to be a crucial factor in 3 out of 4 target cities.

The TE from UC4 Rome to Lyons, Szczecin and Zagreb differs from all the others, as no comparison ex ante/during was available (being no ex ante data collected, and an estimation for just a few KPIs provided); this makes the filling of the CM a pure theoretical, but useful, exercise, or in other words a transferability assessment based on assumptions that every measure tested in this UC represents a real step ahead, if compared to the ex ante situation. Notwithstanding this, the UC Rome TE can serve as a case in point since it "simulated" the expectations that a target city may have when initially contemplates whether to adopt a given measure successfully applied elsewhere. Under these terms, results achieved especially for the remote maintenance system seem to be consistent with what the vision (*Productivity of the system*) selected by the Lyons respondent may request, if the final goal is to improve maintenance procedures: diminished amount of failures and consequent MTBF rate lowered, which affect also the economic side of operations. For what concerns the new cabin for drivers, the appreciation expressed by the drivers at the end of the test is in line with what requested by Lyons and Szczecin. Furthermore, the Szczecin and Zagreb TEs, both with a different vision from Lyons', stressed that if the transfer of the UC Rome results is aimed at increasing the target city's *Customer satisfaction and attractiveness of bus systems*, then the "import" of the mere bus new layout is not sufficient and also the new drivers' cabin and the remote maintenance system are required.

For UC5 Gothenburg the convincing points to transfer the measures are linked to the opportunity to increase the overall *Quality of the bus service*. But in the different TEs quality was interpreted as related mainly to performance, resulting the main drivers for the transferability those KPIs associated with *Service performance* and *Service* *efficiency*, i.e. *Dwell times*, *Commercial speed* and associated *Bus punctuality* and *Passenger capacity*. Certainly quality is also linked to how passengers perceive the system, but the Gothenburg passengers' favorable assessments of *the Perception of the image* and *Comfort level* onboard seemed to have played a minor role in this TE. That *Accessibility to drivers* and *Driver's situation* were not considered as factors of interest for the TE was not surprising, being the new bus design not fully able to improve the performance of the drivers' driving environment. Nevertheless, it was slightly unexpected that, still for the target cities, *Drivers level of training* was not considered as a key element in a possible transfer, maybe because the local level of training of bus drivers is already very high.

The situation of UC6 Rouen is slightly different. Being tested a very specific solution to increase the bus accessibility for users with special needs, the potentials for the transferability identified by the respondents relied on a mix of performance belonging to the *Economic and operation issues*, *Quality of the system* and *Customer satisfaction and attractiveness of bus systems* areas. These are all coherent with the character of the respondents (local administrators and transit operators), but the question whether users with special needs would have identified the same potentials remains unanswered.

The TE from UC7 Brunoy to Città di Castello is the only example where the small size of both target and origin cities turns out to be an additional element to consider. The UC7 measure was tested on a very modest fleet (just 10 vehicles on a single line) which, even though consistent with the size of the origin city (Brunoy has 26,000 inhabitants), raises the question whether results would have been different with a larger scale of application, and possibly a longer period. This may be particularly relevant for the emphasis, given in the TE, on the economic and operational issues and for the poor assessment of those related to the environment and to the productivity of the system. But the relevance given to the economic issues is, in this case, more than justified also if the small size of the target city is considered, as well. A technologically-advanced measure as the Brunoy's remote maintenance system, at a higher cost of investments and implementation, although operationally feasible, would probably have turned out to be unaffordable for a city of about 40,000 inhabitants such as Città di Castello. This helps to debunk the myth that pure technological measures can be transferred anywhere, but also to consider another aspect: both PT systems of the target and origin cities are part of larger transit networks, of regional relevance; this also means that had been the origin and target operators single local companies, probably the measure would have been too expensive, therefore not viable. Therefore, the Brunoy – Città di Castello TE serves as a case in point to stress that the smaller is the area of application of a given measure, the more important the economic issue becomes, no matter how operationally-efficient the measure in hand might be.

4.2. Cross case Evaluation

The comparison of the different TEs results highlights three main outcomes; they concern the most favored top priories, or visions among the TE respondents, the leading areas of investigations which were considered effective clusters to prompt the transferability, and eventually, some recurring performance binomials common to all the UCs, to be assumed as prerequisite or key elements to control when transferring the measures.

For what concerns the most favored Chosen Top Priorities or Visions, the striking aspect is not that the most recurring priority is *the Customer satisfaction and attractiveness of bus systems* (chosen 11 times out of a total of 20 TEs), but that the environmental issues (*Urban environment and social integration)*were never considered as an option. Reasons can be many. One could argue that, in this field, the selection of KPIs was too poor or the KPIs themselves not so sensitive to detect variations, thus affecting the possibility to properly consider the environmental benefits in the TEs. This may be partly true as, generally speaking, the whole evaluation process could have benefited from a more conspicuous group of environmental indicators. At the same time, KPIs such *as Energy consumption* and *Mobility of inhabitants* are appropriate and sufficient to indicate whether the measures were successful, under the environmental point of view. This shifts the focus to the KPIs results, especially for what concerns the *Energy consumption*, which turned out to be contrasting among the different UCs (Figure 1) and possibly not successful enough to be assumed by the TE respondents as a leading criterion in the transfer process. Again, this could be partly true for those UCs where no reductions in the energy consumption were detected, but not in the others where, on the contrary, the tested measures allowed fuel savings. A third reason, then, to explain the poor estimation of the environmental issues in the whole TE may rely on the respondents' pragmatic approach, which appears to be more oriented towards technical aspects (*Productivity of the system*) or operations optimization

(*Quality of the bus service* and *Customer satisfaction*). It is difficult to say which is the truer, among such three reasons, and maybe a mix of all is behind the lack of options for the environmental issues. But the lesson to be learned is that a real "green" awareness is not fully developed, yet and more in this field has to be done.

The second aspect concerns the assessments of the leading areas of investigations (column b), in Figure 1), i.e. the groups of performance which resulted the most influential. Most convincing performance "packages" (Figure 3) are *Urban development and quality of life*, *Maintenance* and *Modal integration and additional/flexible services*. This is a relevant aspect, considering that, for the first and the third-ranked this assessment relies on a performance achieved in the UC3 Madrid only. For what concerns *Maintenance*, the relevance relies on results which call for more implementation time to consolidate (as stressed when reporting on UC7 Brunoy). An assessment that, in any case, demonstrates the respondents' confidence for prospective benefits, rather than for actual achievements. The fourth and fifth-ranked performance areas are *Economic and operation issues* and *Comfort, cleanness and quality feeling*. The former on its whole is a little underrated if compared to the scores given to some KPIs belonging to it. This can be explained by the poor relevance given to KPIs *Passenger demand* and *Passenger capacity* and to their uncertain outcomes (the former in UC1 Bremerhaven, UC3 Madrid, UC4 Rome and the latter in UC6 Rouen, respectively), if compared to KPIs *Operating costs* and *Investment for the innovation*. On the other hand, for *Comfort, cleanness and quality feeling* suffice it to say that this result relies on the good performance associated to KPIs as *Accessibility of Real Time Information* or *Perceived quality of service*.

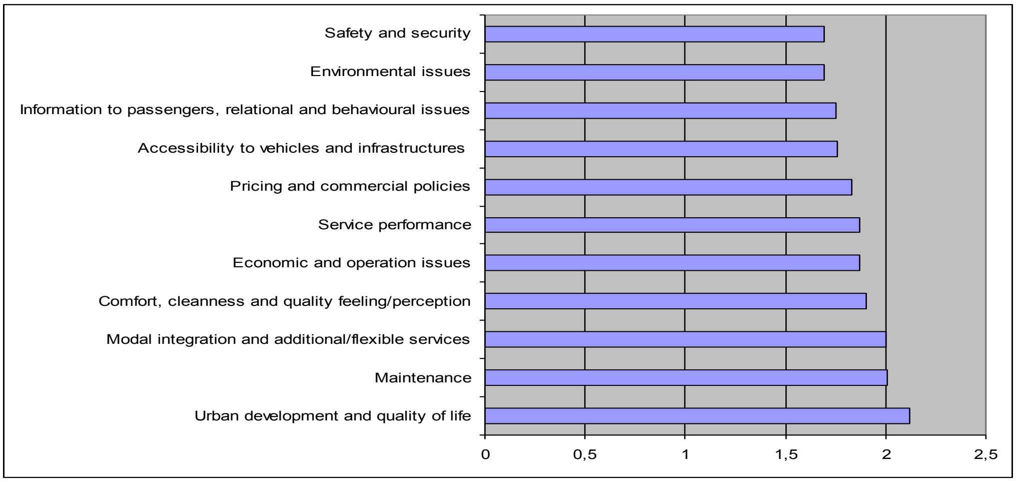

Fig. 3 Scores per investigation areas

A last assessment comes from the observation of some recurring performance binomials, i.e. the couples of KPIs which were scored, by the respondents, as mutually crucial to transfer the UC/Origin City experience successfully. Such leading binomials, recurring in the TEs of two or more Origin Cities, represent interconnections among the KPIs which cannot be disregarded when deciding to import measure as those of EBSF's, or in other words the essential conditions the target cities focuses on when simulating the transfer of the measures; thus, they can be assumed as prerequisite or key elements to control when transferring the measures. Respondents assessed as crucial the reciprocal influence between the performance associated to the following couples of KPIs:

- *Dwell time* and *Commercial Speed*
- *Commercial Speed* and *Bus frequency*
- *Perceived quality of service* and *Bus punctuality*
- *Energy consumption* and *Operating costs*
- *Investment for the innovation* and *Energy consumption*
- *Vehicle failure* and *Operating costs*
- *Service efficiency* and *Investment for the innovation*
- *Technical maintenance of the bus* and *Vehicle failure*.

The above listed couples meet two specific requirements: the first three, the need to improve the quality of service by providing better travel conditions; the others, the need to import measures which may help to reduce costs, thus affecting the *Productivity of the system*. More specifically, the first group of binomials suggests that, to transfer successfully measures such as those of Budapest, Gothenburg and Madrid, it is mandatory to guarantee a faster, more frequent, attractive, and reliable travel supply. On the contrary comfort, information accessibility, safety, look and inclusiveness, per se, seem to be not so binding performance. The second group of binomials indicates even clearly that innovative measures can be transferred, if backed from reduced fuel consumption or rewarded by improved service efficiency, but in any case they do not have to increase operating costs (including those for replacing out-of-service vehicles, as stressed in the TE of UCs 2 and 4). The emphasis on the energy consumption is not to be considered contrasting with what stressed about the lack of “green” awareness in the respondents’ visions, but corroborating it. For, energy consumption seems to be not assessed in terms of possible environmental improvement, but as a factor to reduce the operator’s economic efforts.

4.3. The sensitivity analysis

The ex-ante/during assessment ended with the calculation of the Utility Function (UF) of each KPI and of the Social Utility Function (SUF) produced for each Area of Investigation and Evaluation category. Emphasis was placed on social utility since, generally speaking, this means the representation of preferences over some set of goods and services, and in the case of the evaluation within EBSF, represented such preferences over the proposed UC measures and the levels of performance recorded during the project. Another common definition of social utility is: “the utility that accrues to more than one individual”. For example, the individual utility of a bus system’s special rates program may be high to the customers the program has been tailored to and low to the others to whom the program has been not. The social utility, in this case, would relate to issues as the general attractiveness of the bus system to current and potential customers or the productivity of the system for the whole community. The four evaluation categories (as reported in column *a* in Figure 1) represent typical issues which define the social utility of bus systems and variations among the calculated values of the utility function per each UC can be used to assess how much is likely that each of the performance level, represented by each KPI, is likely to “behave” in the same way in other contexts. The assessment was made considering initially the utility values calculated for each common KPI for each UC, according to the data collected in the tests and after an indepth analysis of the scientific literature in this field (Cascajo, Monzon and Hernandez 2012, Cascajo and Monzon 2014).
Then, SUF was calculated as:

$$SUF = \sum_{i=1}^{n} w_i \cdot \alpha_i \qquad 5)$$

where w_i are the weights and $\boldsymbol{\alpha_i}$ the homogeneous values of each of the *n* KPIs (Cascajo, Monzon and Hernandez 2012, Cascajo and Monzon 2014).

The SUF Average values AV, calculated as:

$$AV = \frac{1}{n}\sum_{1}^{n} SUF_i \qquad 6)$$

and the Standard Deviation StDev calculated as:

$$Dev\ St = \sqrt{\sum_{1}^{n} \frac{(SUF_i - AV)^2}{n-1}} \qquad 7)$$

led to determine the SUF Variation Coefficients (VCs) calculated as:

$$VC = \sqrt{\sum_{1}^{n} \frac{(SUF_i - AV)^2}{n-1}} \times \frac{n}{\sum_1^n SUF_i} \quad 8)$$

for the values of all the areas of investigation, of all the UCs (Corazza and Musso 2014). Results (Table 2) showed that the majority of performance associated to KPIs belonging to *Customer satisfaction and attractiveness of the bus system* and *Urban environment and social integration* areas have all modest variations, thus are likely to be conform also outside the EBSF experience, whereas those belonging to *Productivity of the system* and *Quality of the bus service* had a variation trend to be interpreted as unpredictable/unreliable if applied in more contexts.
At the same time, it is worth reminding that the cross case analysis of all the TE results showed a major influence of parameters belonging to the *Productivity of the system* area.

Therefore, results of both analyses, when compared, showed some definite directions for the transferability of the EBSF measures, which can be synthesized according to some keywords: maintenance, customer satisfaction, service performance.

The relevance of performance belonging to the *Maintenance* area of investigation is undisputable. UF trends (Cascajo, Monzon and Hernandez 2012, Corazza and Musso 2014) show that it is predictable that the performance levels achieved within EBSF may be replicated in other contexts, especially in terms of *Technical maintenance of the bus* and *Days in Workshop*. At the same time, respondents assessed this area of investigation as influential for the transferability of the measures, corroborated by the improvements in UC2 Budapest and UC7 Brunoy in the field of the *Technical maintenance of the bus* performance.

The utmost interest for this area is also represented by KPI *Vehicle failure* which, although with unpredictable trends and results uncertain (Figure 1 and Table 2), was assessed as crucial for the transferability of the measures tested in UC2 Budapest, UC4 Rome and UC7 Brunoy. If this is also linked to the importance of the *Technical maintenance of the bus/Vehicle failure* binomial, as a prerequisite for the transferability, it leads to conclude that the *Maintenance* performance achieved by the EBSF measures is definitely a specific driver for the transferability. This and the recurring relevance of binomials involving *Economic and operational issues,* contribute to strengthen the role of the *Productivity of the system* category and to make it a very influential field of interest for the transferability of the measures.

The group of performance belonging to the *Customer satisfaction and attractiveness of the bus system* evaluation category can be considered a general driver for the transferability of the measures, too. The *Comfort, cleanness and quality feeling/perception* area of investigation must be primarily credited for this achievement, but the contribution provided by the *Information to passengers* area of investigation is not negligible. More specifically for what concerns the former, KPIs belonging to the *Comfort, cleanness and quality feeling/perception* area of investigation are likely to be as successful as they have been in the EBSF experience. The TE respondents rated relevant but not crucial aspects such as the perception of comfort/quality, but they assessed the overall area of investigation influential. The emphasis in this assessment is, however, on the results coming from the UF analysis, which in its turn derives from the appreciation passengers showed for the innovations proposed within EBSF. Although with different degrees among the UC, improved levels of comfort, image and service were universally appreciated by patrons. The TE respondents' slightly milder appreciation for a given single KPI did not cast a shadow on the success of such innovations, but on the contrary demonstrates that the goal was fully achieved. Upgraded comfort and service, innovative look were all meant to improve primarily the quality feeling among the customers, whereas the decision-makers acknowledged this area as influential to increase the attractiveness of the mode. To confirm this, it is also worth reminding that *Customer satisfaction and attractiveness of bus systems* was the most favored vision to prompt the transfer among the TE respondents. All of the above can be merged also with the results from the analysis of binomials, which suggests that TE respondents favored the resulting technical improvements in the operations (costs, maintenance, reliability, etc.) rather than the issues linked to the improved travel comfort or image. At the same time, as just mentioned, the results of the questionnaire submitted to the passengers during the EBSF tests clearly show that comfort and cleanness have been aspects largely appreciated. This suggests that "innovative look" and improved ease of travel are not sufficient innovations, if not accompanied by sound technical improvements.

Table2. Values of utility functions for the Use Cases

		UC1	UC2	UC3	UC5	UC6	UC7	AV	St Dev	VC
		(Utility Function - UF values)								
KPIs	Customer perception of buses safety		0		0,44			0,22	0,31	1,41
KPIs	Dwell time		1		0,44			0,72	0,40	0,55
KPIs	Commercial Speed		0,28		0	0	0	0,07	0,14	2,00
KPIs	Bus punctuality		1	0,22	0,42			0,55	0,41	0,74
KPIs	Perceived comfort level on board		0,71		1			0,86	0,21	0,24
KPIs	Perceived quality of service	0,98	0,57	0,63	0,51			0,67	0,21	0,31
KPIs	Customer perception of image	1			0,50			1,50	0,35	0,24
KPIs	Accessibility of Real Time Information	0,53	0	1				0,51	0,50	0,98
KPIs	Availability of information for connecting with other PT services	0,19		1				0,60	0,57	0,96
KPIs	Energy consumption	0	0,99		0,49	0	0	0,37	0,44	1,20
KPIs	Operating costs	0	0,98			0	0	0,25	0,49	2,00
KPIs	Passenger demand	0	0,77	0		1		0,44	0,52	1,17
KPIs	Passenger capacity		0,19		0,45	0		0,21	0,23	1,06
KPIs	Service efficiency	0		0	0,54			0,18	0,31	1,73
KPIs	Technical maintenance of the bus		1				0,57	0,79	0,30	0,39
KPIs	Vehicle failure		1				0	0,50	0,71	1,41
KPIs	Days in workshop		0,83				0,66	0,75	0,12	0,16
		(Social Utility Function – SUF values)						AV	St Dev	VC
Areas of investigation	Safety and security		0		0,11			0,06	0,08	1,41
Areas of investigation	Service performance		0,1	0,03	0,05	0	0	0,03	0,05	1,45
Areas of investigation	Comfort, cleanness and quality feeling/perception	0,21	0,09	0,09	0,10			0,12	0,06	0,48
Areas of investigation	Information to passengers, relational and behavioural issues	0,08	0	0,15	0,06			0,07	0,06	0,85
Areas of investigation	Environmental issues	0	0.13	0	0.06	0	0	0,03	0,05	1,70
Areas of investigation	Economic and operational issues	0	0,08	0	0,06	0,08	0	0,04	0,04	1,11
Areas of investigation	Pricing and commercial policies	0		0	0,06		0	0,02	0,03	2,00
Areas of investigation	Maintenance		0,13				0,09	0,11	0,03	0,26
Evaluation Category	Quality of the bus service		0,14	0,003	0,12	0	0	0,06	0,07	1,16
Evaluation Category	Customer satisfaction and attractiveness of bus systems	0,26	0,09	0,24	0,16	0		0,15	0,11	0,72
Evaluation Category	Urban environment and social integration	0	0,21	0,14	0,11	0,12		0,12	0,08	0,65
Evaluation Category	Productivity of the system	0	0,18	0	0,12	0,11	0,1	0,09	0,07	0,84

Accessibility of real time information and *Availability of information for connecting with other PT services*, belonging to the *Information to passengers* area of investigation, were assessed crucial for the transferability of the measures they represent; moreover, *Accessibility of real time information* results are expected to be easily replicable in other contexts too. These successful outcomes make of the *Information to passengers* performance an undisputable driver for the transferability of the real time information systems tested in the UC1 Bremerhaven and UC3 Madrid. Not the same can be said for the other side of this area of investigation, i.e. that on the relational and behavioral issues, which is affected by the poor appreciation for the innovative driving environments tested during EBSF.

One more area of interest for the transferability is represented by what achieved within the *Service performance* area of investigation. As above, the *Service performance* area of investigation was judged by the TE respondents as influential, whereas the single specific KPIs were not. At the same time UF values show that only two KPIs (i.e. *Dwell time* and *Bus punctuality*) are likely to be conform to the EBSF results in other contexts, whereas the third, *Commercial speed*, is unpredictable. Reasons for the relevance of such performance area for the transferability of the EBSF measures must be searched, then, among the outcomes related to the prerequisites. KPIs of this area constitute a group of binomials which commands specific attention when assessing whether a given measure can be successfully transferred or not. Since within EBSF these parameters did not record a full improvement in the field of the *Quality of the bus service*, this means that whatever the innovation to transfer and its improvement recorded in an origin city, its possible influence on local operational priorities as reliability, time-keeping or speed must be carefully assessed ahead of any final decision.

At the same time, there are elements of uncertainty which can be interpreted as gaps or even barriers to the transferability of the EBSF measures. The first element, the poor relevance of the *Environmental issues*, especially linked to the performance associated to the common KPI *Energy consumption* was previously highlighted. Still within the energy issue, the consideration that in UC5 Gothenburg energy saving improvements were due to the green driving training experience shifts the focus to the role played by the drivers. During the evaluation process, KPIs results derived from the questionnaire to drivers have been very valuable resources to assess the innovations tested to provide drivers with more comfortable working environments.

On the contrary, within the TE, respondents seemed to show a minor interest in this issue. More specifically, the CM scores of UC Gothenburg showed that KPI *Driver situation* was considered totally neutral in terms of transferability and issues concerning the drivers' training and working situations were poorly assessed, too. In terms of transferability, this suggests that although the possibility to import the new cabins tested within EBSF is technically viable, the lack of testing them directly in the target contexts may lead to underestimate the potential of advanced/specific training sessions and the possible resulting benefits. A last but not least point concerns the respondent's evaluation of safety and security issues which cannot be certainly considered among the drivers to support the EBSF measure transferability. The KPIs representing such performance are *Drivers level of training* and *Customer perception of buses safety*, both poorly rated. To the poor assessment of the former contribute the reasons just above mentioned. To the modest appreciation of the latter, again, can be ascribed the contrasting results achieved during the EBSF.

Conclusions

All in all, results above reported suggest two specific directions for the transferability of the EBSF experiences: a) to successfully transfer measures, even very different one from the others, the priority is to ensure a faster, more frequent, attractive, and reliable travel supply, whereas issues as comfort, information accessibility, safety, look and inclusiveness may come after, b) innovative measures can be transferred provided not to raise the overall costs, in fact, they should be compensated by benefits as the improved service efficiency or the reduced fuel consumption.

The comparison between UCs which tested just one measure and those which tested more innovations stresses that, in terms of transferability the latter seem to be more appealing rather than the former; UCs with just a trial of a single measure appeared to be focused on the specificity of the measure itself, thus making made the measure "branded" specifically for one scope, and potentials due the synergy with performance from other investigation areas did not come into sight.

It is also to consider the more modest acknowledgment of the environmental issues if compared to the relevance given to other performance. The above mentioned need to develop a greener awareness among the decision-makers becomes, then, even more urgent, if the risks of a diminished attention to the environmental issues is to be avoided. Not to mention that such poor care can turn into a barrier for the transfer to all those contexts which, on the contrary, focus on environmental-friendly aspects to increase the attractiveness of transit.

The success of issues as comfort, quality, cleanness, according to the patrons' assessments during the evaluation phase, may be increased by the perception of innovations. One more factor to consider is, then, whether innovation *per se* could be considered a more appealing factor than effective but well-known technical measures. The analysis of binomials stressed that innovation of single components is not a sufficient condition to start a transfer, and that innovative factors to import do have to affect costs in a modest way and guarantee reliability of operations. The last point is on the observation that measures affecting aspects such as commercial policies, economic and operational issues call for long time and wider scale of implementation to be real effective; this could turn into barrier for all those contexts that look for fast solutions to improve the transit overall productivity. It has been largely observed that for some EBSF experiences more lasting tests or enlarged test conditions would have provided more consolidated and/or comprehensive data and therefore less contrasting results. There is no doubt that in some TEs, uncertainty of results was behind the assessment of one or more KPIs and that this could have affected the theoretical exportability of the measures.

Acknowledgements

The authors wish to thanks the EBSF Project Director U. Guida (UITP) and all the EBSF Evaluation Group members: R. Cascajo and A. Monzon (Transyt - Universidad Politécnica de Madrid), M. Faltenbacher and S. Lundie (PE International), M. A. Karlsson and S. Franzen (Chalmers University), M. Giorgetti (FIT Consulting).

References

Buchanan C. 2003. *Transferability of best practice in transport policy delivery*. Scottish Executive, Edinburgh.

Cascajo, R., Monzon, A. and Hernandez, S. (Ed.) 2012. *EBSF Deliverable 4.2.3 - Evaluation report of Use Cases;* http://www.chalmers.se/en/staff/Pages/mak.aspx

Cascajo, R., and Monzon, A. 2014. Assessment of innovative measures implemented in European bus systems using key performance indicators. *Public Transport*. Volume 4, April, pp. 257-282

CIVITAS MOBILIS. 2009. *Final transferability Report*. http://civitas.eu/downloadcenter.phtml?top=77&pro_id=2&rows=35

Corazza, M. V. and Musso, A. 2014. *The EBSF European dimension: drivers and barriers to transfer innovative bus systems across Europe.* Proceedings of TRA 2014 Transportation Research Arena. http://www.traconference.eu/papers/pdfs/TRA2014_Fpaper_17452.pdf

EBSF. 2013. *EBSF Final Report*. http://cordis.europa.eu/docs/results/218647/final1-ebsf-final-report.pdf

Hall, R., et al. 2008. *Transferability of measures*. Transportation Research Group, University of Southampton.

Karlsson, M.A. (Ed.). 2010. *Del. 4.2.1 EBSF - Assessment Framework*

King, M. J. 2005.*Case studies of the transfer of road safety knowledge and expertise from Western countries to Thailand and Vietnam, using an ecological 'road safety space' model*. http://eprints.qut.edu.au/16191/

Langazaam Verkeer, (Ed.) 1999. LEDA - *Legal and regulatory measures for a sustainable transport in cities. Best practice – Transferability of measures*. Graz

Macario, R. and Marques, C. F. 2008. Transferability of sustainable urban mobility measures. *Research in Transportation Economics*, Vol. 22, Issue 1, 2008, pp. 146-156

Macario, R. 2011. *Managing Urban Mobility Systems*. Emerald Group Publshing, Bingley.

METEOR. 2006. *Deliverable 6 – Cross Site Evaluation*. Rijswijk

Marsden, G. and Stead, D. 2011.Policy transfer and learning in the field of transport: A review of concepts and evidence. *Transport Policy*, Volume 18, Issue 3, May, pp. 492-500

Timms, P. 2011. Urban transport policy transfer: ''bottom-up'' and ''top-down'' perspectives. *Transport Policy*, Volume 18, Issue 3, May, pp. 513-521