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BENCHMARKING AND ASSESSMENT OF GOOD PRACTICES IN PUBLIC TRANSPORT INFORMATION SYSTEMS

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The development of the Public Transport (PT) services in the last decade is characterized by wide implementation of various information systems and technologies, which cover different transport services, such as traffic planning, traffic network monitoring, management of operation of PT fleets, providing information to the passengers, ticketing payment, etc. The article considers the research part of a large EU-funded project POLITE aimed at public transport sector and increasing the awareness of infomobility services and PT attractiveness through the application of identified Good Practices and Best Practices. The objective of this paper is presentation of the methodology of benchmarking and assessment of Good Practices and choice of the best one on the basis of the multi-criteria comparative analysis. For assessment of Good Practices the AHP (Analytic Hierarchy Process) method is applied.

Keywords: public transport, infomobility, Good Practice, benchmarking, multi-criteria analysis, AHP method

1. Introduction

Multimodal integrated travel information, planning and ticketing services could play a significant role in improving modal integration, thus increasing the attractiveness of collective mobility and public transport (PT). One of the principal achievements of the latest decade is expanding direct access to the information services via the internet; the access is provided for all categories of users (passengers, managers, traffic controllers, agents, etc.), and the information services obtain such property as infomobility [2].

The term "infomobility" is not much used in the academic literature. One of the definitions is: "Infomobility systems provide access to information and services for the support of user mobility. Bidirectional communication between the client devices and the system that can travel by several different transportation means, ranging from cars to trains to foot" [3]. Another view was mentioned in T-TRANS report [8]: "Reliable, personalized, and "anytime-anywhere" based real-time travel and traffic information (RTTI) is a key element of intelligent mobility services envisioned for the future… The activities in the InfoMobility sector mainly focus on: Traffic and traveller information; Geo-localization; Freight and logistics, Access and demand management". In the work [7] infomobility is defined as "a theme increasingly debated due to its potentiality of making the mobility system more efficient and effective in meeting users' needs".

Considerable experience of the regional development activities in infomobility in PT has accumulated [1-3]. One of the possible ways of improving PT services is to identify and facilitate the transfer of existing practices that work successfully. Therefore the task of selection and transference of Good Practices (GP) in PT services is a very important and urgent.

This article presents the research part of a large EU-funded project POLITE aimed at public transport sector and increasing the awareness of infomobility services and PT attractiveness through the application of identified Best Practices and other recommendations [5]. The project runs from the beginning of the 2012 until the end of 2014 and focuses on the sub-theme "Energy and Sustainable Transport".

POLITE partners work together in the exchange and transfer of experiences and improvement of policies, knowledge and GP on infomobility services in their regions, with the goal of improving their PT information systems. Due to exchange and transfer knowledge POLITE partners are divided on two groups:

1. *Good Practice Sites:*
   - Province of Ferrara (PoF, Italy);
   - Reading Borough Council (RBC, United Kingdom);
2. *Transfer Sites:*
   - Calabria Regional Administration (CRA, Italy) – Leader partner;
   - Polis (Pol, Belgium);
   - Institute of Logistics and Warehousing (ILIM, Poland);
   - Transport Research Centre (CDV, Czech Republic);
   - Latvian Transport Development and Education Association (LaTDEA, Latvia).

POLITE addresses infomobility, specifically the problem of providing travellers with adequate and complete information on the PT services available in a region at different geographic levels. The project promotes public actions to enhance the awareness of travellers' choice and to increase the use of PT services [5]. The objective of this paper is to present the comparative assessment of GP in PT infomobility developed under project POLITE and presented and discussed with project partners at the May 2013 in Reading (UK).

2. Definition of the Problem

The research is focused on evaluation of GP and choice of the best one in PT information systems. Examples of considered systems are Real Time Passenger Information Systems, Smart Ticketing Payment Systems, Priority at Traffic Signals Systems, etc.

Several interrelated terms are used in the literature to refer to GP. Those terms sometimes overlap in some aspects and differ in others, refer to different things. Let us identify a Good Practice as "an initiative (e.g. methodologies, projects, processes and techniques) undertaken in one of the programme's thematic priorities, which has already proved successful and which has the potential to be transferred to a different geographic area. Proved successful is where the Good Practice has already provided tangible and measurable results in achieving a specific objective" [4].

The problem of searching for the GP and then selection of the best should be performed taking into account the variety of different criteria determining the efficiency of the information services: economic, technological, social, ecological, and so on. In the present article this problem is formulated as the multiple-criteria decision-making task.

As follows from the studies conducted in the project we can compare GP taking in account the number of their measures (or submeasures), which comprehensively cover the overall objectives of PT (see Fig.1).

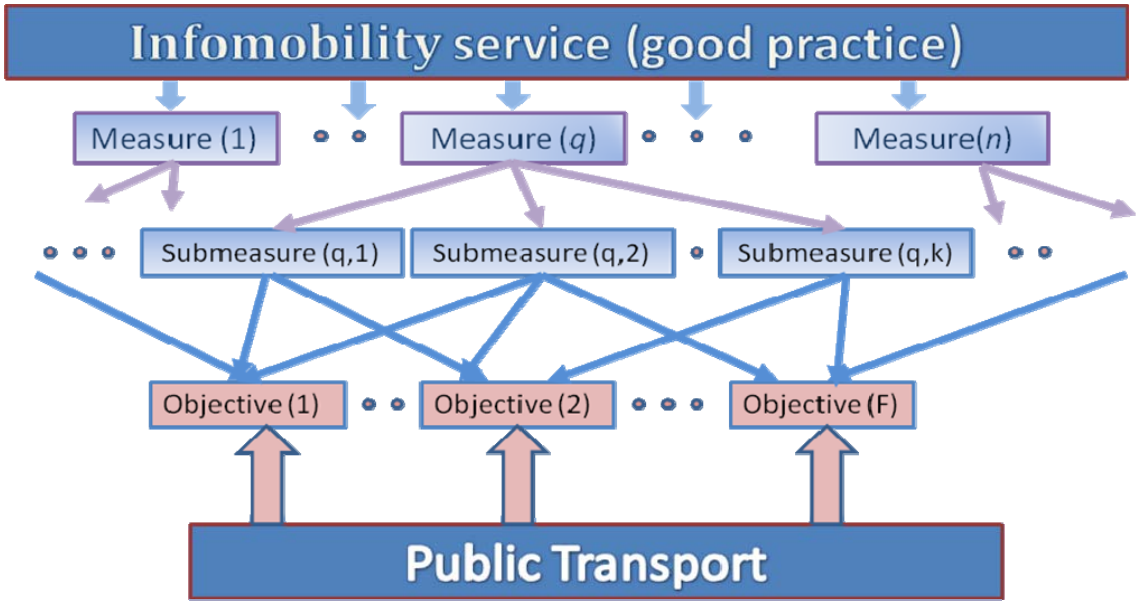

Figure 1. The scheme of infomobility services impact on PT efficiency

The determination of GP efficiency was used on the analysis of the measures, which cover the following objectives:

1. Improving city attractiveness;
2. Improving PT services;
3. Improving PT efficiency;
4. Increasing the PT mode share;
5. Decrease congestion;
6. Emissions and pollution reduction.

GP sites for project POLITE are likely to have implemented a system / systems or services, each of which are likely to cover a range of the 54 detailed submeasures grouped in the following 10 measures:

1. PT legislation and regulation;
2. PT reorganization into multimodal system;
3. Cooperation among administrations;
4. Intelligent transport system (ITS) technical standardization for interoperability;
5. Infrastructural measures;
6. Innovative information and communications technologies (ICT) for PT;
7. Modelling tools and measures;
8. PT traffic management measures;
9. PT information measures;
10. Advanced PT ticketing.

Comparative assessment of GP and choice of the best one are considered as the task of the multi-criteria comparative analysis. As follows from the studies conducted in the project, we can compare GP taking in account the number of measures (or submeasures), which comprehensively cover the overall objectives of PT. It should be noted that a comparative evaluation and choice of GP should be carried out for practices that have the same functional purpose, for example, for Real Time Passenger Information systems.

The suggested methodology of benchmarking and comparative assessment of GP involves the following stages:

Stage 1. Study of GPs descriptions and Questionnaires completed by POLITE partners.
Stage 2. GPs classification based on functional purpose.
Stage 3. Determination of objectives priorities (impotence) for each group of GP.
Stage 4. Choice of indices characterizing GP efficiency.
Stage 5. Comparative analysis of GP and the selection of the better one for each group of GP.

Let us consider these stages more detail.

3. Stage 1: Study of Good Practices

The POLITE project should strive to identify best practices where possible, however it should be recognised that the successful identification of GP fully meets the objectives of the POLITE project. GP were identified from either a desktop study, through a questionnaire, and from site visits. The methodology of identification of potential GP was presented in POLITE report "Definition of Infomobility Policy Themes for Exchange" [5].

The process for identifying the GP has been sub-divided into 7 steps set out below:

- Desktop identification of potential GP;
- Selection of the GP;
- Production of GP Questionnaire;
- Arranging site visits;
- Good Practice Questionnaire completion;
- Site visits;
- Summary report.

In the frame of project 32 GP from 10 EU countries were identified, 6 of them were selected for site visits. The distribution of GP between 10 countries is the following: Italy – 8 practices; UK – 6; Czech Republic – 5; Latvia – 4; Spain – 2; Poland – 2; Denmark – 2; Belgium – 1; Serbia –1; Switzerland – 1. Four leading countries are Italy, United Kingdom, Czech Republic, and Latvia.

The desktop reviews of GP and the detailed GP data through site visiting were described in GP Questionnaires completed by POLITE partners, and were analysed and presented in appropriate charts and tables [5]. The GP overview and their measures are presented in Table 1.

Table 1. Surveyed sites and Good Practices: overview and categories of measures

No	Good Practices	Measures									
		PT Legislation and Regulation	PT Operational Reorganisation into Multimodal Measure	Cooperation among administrations	ITS Technical Standardisation for Interoperability	Infrastructure Measures	Innovative ICT for PT	Modelling Tools and Measures	PT and Traffic Management Measures	PT Information Measures	Advanced PT Ticketing
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	Traffic monitoring and management: Floating Car Data (FCD) as traffic sensors. *Torino/ Italy*			X	X			X	X		
2	Stimer / Mi Muovo Project - Mobility Integrated Fare System in RER (Emilia-Romagna Region) - buses, trains and bike sharing. *Region Emilia-Romagna/ Italy*	X	X	X	X		X	X		X	X
3	Multi-channel Information system on mobility at regional scale. *Campania/ Italy*		X				X		X	X	
4	Sustainable Mobility Plan (SMP). *Santander/ Spain*	X	X	X		X	X	X	X	X	X
5	Traveller Information / Mobilitami. *Marche / Ancona and Senigallia/ Italy*						X				
6	Traffic Management. *Verona/ Italy*				X	X			X		
7	Intermodal infomobility platform and SMS ticketing. *Genova / Liguria/ Italy*		X			X				X	X
8	Traffic Management during big events. *Perugia/ Italy*		X			X			X		
9	SMS ticketing service. *Flanders/ Belgium*				X		X				X
10	Mobility and traffic management in firms. *Valjevo/ Serbia*		X						X		
11	Open Public Transport Data. *London/ UK*	X			X		X			X	
12	Real Time Passenger IS, Bus Priority at Signals, Public Transport mobile apps, City Access Control. Smart Card. *Cambridgeshire County Council/ UK*	X		X		X	X		X	X	X
13	Bus Lane Enforcement. *Reading Borough Council/ UK*	X		X	X		X		X		
14	Real Time Information System & Bus Priority at Signals. *Greater Bristol/ UK*	X		X		X	X	X	X	X	
15	Real Time Passenger Information System, Bus Priority at Signals, Disability Accessibility. *City and County of Swansea/ UK*					X	X		X	X	
16	Mobile travel information. *Aalborg/ Denmark*						X		X		
17	On-board bus travel information. *Aalborg/ Denmark*								X	X	
18	Real Time Passenger Information System (Mezi). *Bern/ Switzerland*									X	
19	Demand responsive transport (Tele-bus). *Kraków/ Poland*								X		
20	Advanced PT Ticketing (Skycash). *Poland*										X

Continuation

1	2	3	4	5	6	7	8	9	10	11	12
21	Multimodal Journey planner for the Czech Republic. *Brno/ Czech Republic*		X		X	X				X	X
22	Integrated public transport system and smart ticketing. *Ostrava and Silesian-Moravian region/ Czech Republic*	X	X	X	X	X	X	X	X	X	
23	Public Transport dispatching under KORDIS integrator/organizer: CED. *Brno and South Moravian region/ Czech Republic*		X	X	X	X	X	X	X	X	
24	Real Time Passenger Information System. *Central Bohemia region/ Czech Republic*		X	X	X	X	X	X	X	X	
25	Multimodal Integrated Transport. *Prague and Central Bohemia / Czech Republic*		X	X	X	X	X	X	X	X	
26	Unified intermodal cargo service. *Riga region/ Latvia*			X		X				X	
27	Interchange Principe Pio. *Madrid/ Spain*		X								
28	Integrated system of selling and reserving tickets. *Riga/ Latvia*	X			X					X	X
29	Atlas Public Transport Ticketing System in Riga. *Riga/ Latvia*										X
30	Interactive passenger service in train traffic. *Riga region/ Latvia*			X					X	X	
31	Premier Route Bus Corridor Network. *UK*			X		X	X		X	X	
32	Gestione Informata Mobilita' – G.I.M. *Province of Ferrara – Emilia Romagna Region/ Italy*		X	X	X	X			X		

Let us characterize the selected set of GP using such important features as objectives support, belonging to the public or the private sector, territorial and political levels. Visual performances of these characteristics are presented below on Figures 2-5.

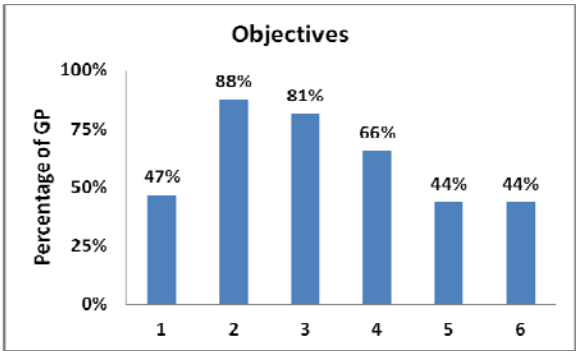

Figure 2. Objectives covering by GP

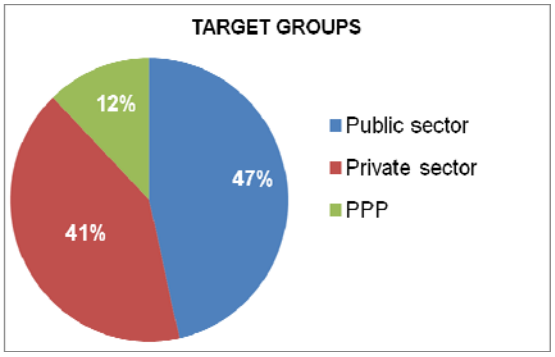

Figure 3. Distribution of GP target groups

As can be seen on Figure 2, the main objectives for considered GP of infomobility services are #2 "Improvement of PT Services" and #3 "Improving PT Efficiency". The objective #4 "Increasing PT Mode Share" is in the third place with 66%. The other three objectives: #1 "Improving City Attractiveness", #5 "Decreasing Congestion" and #6 "Decreasing Congestion" – are covered by a smaller number of GP (from 44% to 47%).

The pie chart "Target Groups", shown on Figure 3, illustrates that private and public sectors have almost the same position in informobility services area.

The pie chart "Policy – Territorial", shown on Figure 4, illustrates territorial level division. Regions and metropolis have the leading position with 30% and with 24%, accordingly. State and local divisions have almost the same value (18 and 20%, accordingly).

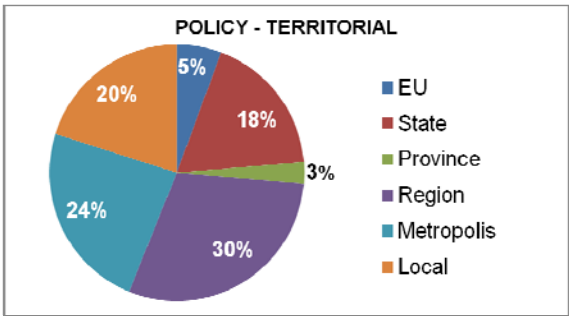

Figure 4. Territorial division of GP

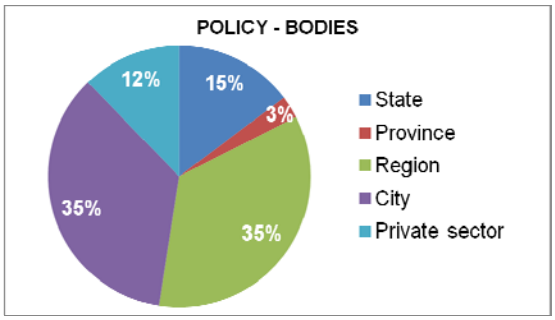

Figure 5. Political division of GP

The pie chart "Policy – Bodies", shown on Figure 5, describes political level of GP. At the first place there are two policy bodies: city level and region level with 35% both. Next policy body is the state (15%); the private sector has 12% and province – just 3%.

4. Stage 2: GP Classification Based on Functional Purpose

In the frame of project GP in informobility services were classified in the following five groups:

1. Public Transport and / or Multimodal Information Systems:
   - Bus Automatic Vehicle Location (AVL);
   - Real Time Passenger Information Systems (RTPI);
   - Real Time Traveller Information systems, bus stops, on bus, in public locations, on web, on mobile devices;
   - Journey Planning Systems (single mode / multimodal).
2. Public Transport Fleet Management Systems.
3. Public Transport Interchanges.
4. Public Transport Priority Systems:
   - Bus priority at signals;
   - Bus Gates / Bus Lanes;
   - Enforcement systems e.g. bus lane enforcement;
   - Access controls.
5. Public Transport Payment Systems
   - Pre Pay Contactless Smart Cards;
   - Innovative Incentive Scheme.

The classification of 32 GP under consideration is presented in Table 2. As can be seen from this table, the most representative group is "PT and/or Multimodal Information Systems", which included 10 practices. The comparative assessment and choice of GP is carried out separately for each group of GP.

Table 2. Distribution of GP

Group No	Name of Group	Membership of Group (GP numbers)
1	PT and / or Multimodal Information Systems	7, 11, 14, 16, 17, 18, 21, 24, 30, 31, 32
2	PT Fleet Management Systems	4, 6, 8, 10, 19, 26
3	PT Interchanges	1, 2, 3, 23, 25, 27
4	PT Priority Systems	5, 12, 13, 15
5	PT Payment Systems	9, 20, 22, 28, 29

5. Stage 3: Determination of Objectives Priorities for Group of GP

Let for the given group of GP the weights of objectives are defined by the vector $\boldsymbol{\beta} = (\beta_1, \beta_2, ..., \beta_6)$, where β_j is the weight of j-th objective; $\beta_j \geq 0$, $j = 1,2,...,6$ and $\sum_{j=1}^{6} \beta_j = 1$. Notice that for equal weights of all objectives we have: $\beta_j = 0.167$ for $j = 1,2,...,6$.

In this research to perform the calculations of the weights of objectives the pairwise comparison scale 1-9, proposed by T. Saaty in AHP method [6], is offered. This scale has the following weights *w*1 and *w*2 for two objectives (alternatives) A1 and A2:

*w*1=1; *w*2=1, if two objectives A1 and A2 are equal in importance;
*w*1=3; *w*2=1/3, if A1 is weakly more important than A2;
*w*1=5; *w*2=1/5, if A1 is strongly more important than A2;
*w*1=7; *w*2=1/7, if A1 is very strongly more important than A2;
*w*1=9; *w*2=1/9, if A1 is absolutely more important than A2,

and 2, 4, 6, and 8 are intermediate values between the two adjacent judgments. The importance of the objectives is evident from the evaluation of the priority vector [6].

The example of objectives weights for the group "PT Payment Systems", estimated by experts, is presented in Table 3. It is easy to notice that objectives "Improving PT Efficiency" with the weight 0.4368 and "Increasing the PT Mode Share" with the weight 0.2162 are more important for GP group "PT Payment Systems" than other four.

Table 3. Paired comparison matrix for objectives and results of priority vector calculation for the group "PT Payment Systems"

Group of measures	Improving city attractiveness	Improving PT services	Improving PT efficiency	Increasing the PT mode share	Decrease congestion	Emissions and pollution reduction	**Priority vector (weights)**
Improving city attractiveness	1	1/3	1/7	1/5	3	5	0.0794
Improving PT services	3	1	1/3	1	5	7	0.1985
Improving PT efficiency	7	3	1	3	7	9	0.4368
Increasing the PT mode share	5	1	1/3	1	5	7	0.2162
Decrease congestion	1/3	1/5	1/7	1/5	1	1	0.0387
Emissions and pollution reduction	1/5	1/7	1/9	1/7	1	1	0.0304

6. Stage 4: Choice of Indices Characterizing Efficiency GP

The set of indices, characterized the degree of the GP objectives covering by 10 practice measures, is used as criteria of GP efficiency. The method of GP efficiency calculation is considered below.

Let *n* is the number of submeasures in the *l*-th measure;

m_j is the number of submeasures which cover *j*-th objective; $m_j = \sum_{i=1}^{n} k_{i,j}$; $j = 1,2,...,6$,

where $k_{i,j} = \begin{cases} 1, & \text{if } i-\text{th submeasure covers } j-\text{th objective}, \\ 0, & \text{if } i-\text{th submeasure does not cover } j-\text{th objective} \end{cases}$ $i = 1,2,...,n$; $j = 1,2,...,6$.

Coefficient r_j characterizes proportion of measure's submeasures, which cover *j*-th objective

$$r_j = \frac{m_j}{n} ; \; j = 1,2,...,6 .$$

Index p_j characterizes the degree of *j*-th objective covering by considered measure and is calculated by the following formulae:

$$p_j = \begin{cases} 0.5 + 0.5\dfrac{m_j - 1}{n-1}, & \text{if } m_j > 0; \\ 0, & \text{if } m_j = 0. \end{cases} \quad (1)$$

The criterion P_l of *l*-th measure efficiency characterizes the degree of all 6 objectives covering by the measure with number *l*, and is determined by formulae:

$$P_l = \sum_{j=1}^{6} \beta_j p_j, \quad l = 1,2,...,10. \quad (2)$$

Vector $\mathbf{P} = (P_1, P_2, ..., P_l, ..., P_{10})$ is the criteria of GP efficiency and is used in GP comparative assessment process.

The paired comparison of GP with numbers *i* and *j* for the measure with number *l* is determined by index $\delta_l = P_l^{(i)} - P_l^{(j)}$. The values of paired comparison criterion are determined for the scale 1-9 using the value of index δ_l according Table 4.

Table 4. The scale for criterion of measure calculation in the paired comparison of PT

Difference $\delta_l = P_l^{(i)} - P_l^{(j)}$	**Values of criterion of the measure with –**	
	greater coefficient of efficiency $P_l^{(i)}$	**smaller coefficient of efficiency** $P_l^{(j)}$
$\delta_l < 0.1$	1	1
$0.1 \le \delta_l < 0.2$	2	1/2
$0.2 \le \delta_l < 0.3$	3	1/3
$0.3 \le \delta_l < 0.4$	4	1/4
$0.4 \le \delta_l < 0.5$	5	1/5
$0.5 \le \delta_l < 0.6$	6	1/6
$0.6 \le \delta_l < 0.7$	7	1/7
$0.7 \le \delta_l < 0.8$	8	1/8
$\delta_l \ge 0.8$	9	1/9

The considered approach fulfils the evaluation of the efficiency of GP in different groups with the account of the groups' specific.

7. Stage 5: Comparative Analysis of Good Practices and the Selection of the Better One for Each Group of GP

The Good Practices' measures used in criteria of efficiency **P** (2) are distributed in four groups: Organization and Legislation; Infrastructural Actions; Information Actions; Modelling. The created hierarchical structure of the criteria is shown on Figure 6. This structure has two levels of the hierarchy. The results of testing different methods of the multi-criteria analysis [9] make it possible to determine the Analytic Hierarchy Process (AHP) [6] as the most suitable one for comparative evaluation of GP and choice the Best Practice. The AHP method allows arranging the GP in the order of their efficiency and showing their difference in the given vector of criteria **P**.

Using AHP method we estimated the efficiency of GP in each group of infomobility services. As an example of GP comparative assessment let us consider the evaluation of GP of the group "PT Payment Systems". This group contains five practices for assessment presented in Table 5.

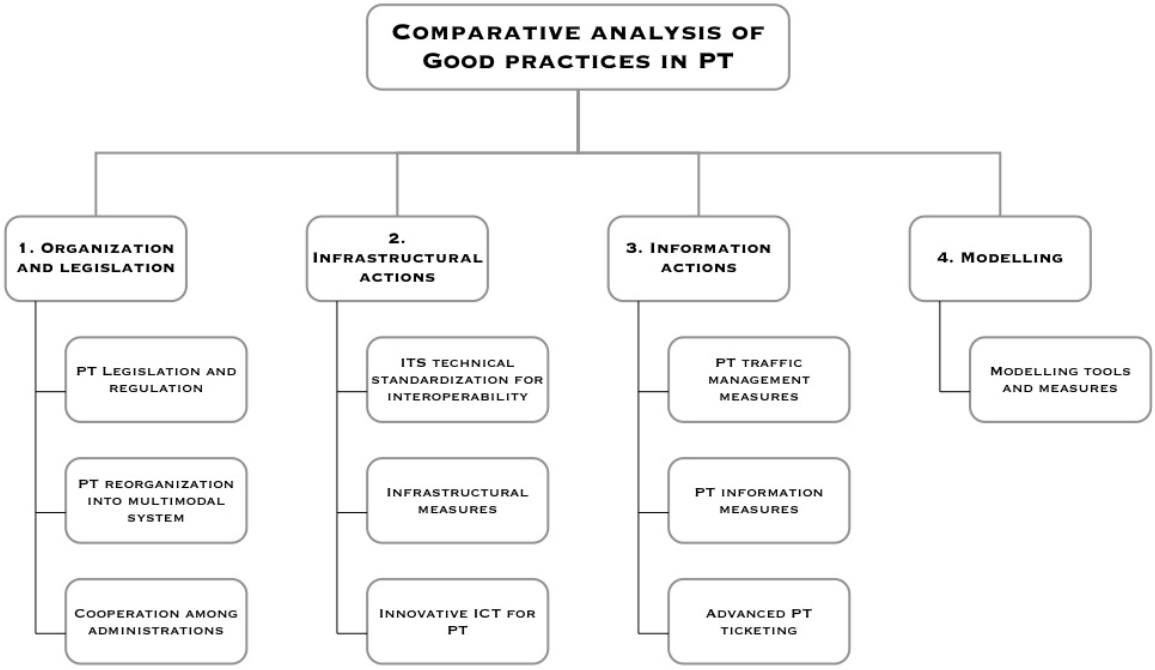

Figure 6. Hierarchical structure of the criteria (indices of measures)

Table 5. Description of GP in group "PT Payment Systems"

No	Name of Partner	Description of Good Practice
9	PoF	SMS ticketing service, *Flanders, Belgium, (Questioner)*
20	ILIM	Advanced PT Ticketing (SkyCash), *Warszawa, Poland, (Questioner)*
22	CDV	Integrated public transport system and smart ticketing, *Ostrava and Silesian-Moravian region, Czech Republic, (Site visit)*
28	LaTDEA	Integrated system of selling and reserving tickets, *Riga, Latvia, (Questioner)*
29	LaTDEA	Atlas Public Transport Ticketing System in Riga, *Riga, Latvia, (Questioner)*

The results of calculation of the criteria of each GP measures efficiency (the degree of all objectives covering by each measure) P_l, $l = 1,2,...,10$, using formulas (1), (2), are presented in Table 6.

Table 6. The criteria of each GP measures efficiency, $P_l, l = 1,2,...,10$

GP No	PT Legislation and regulation	PT reorganization into multimodal system	Cooperation among administrations	ITS technical standardization for interoperability	Infrastructural measures	Innovative ICT for PT	Modelling tools and measures	PT traffic management measures	PT information measures	Advanced PT ticketing
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25
22	0.66	0.89	0.72	0.71	0.60	0.85	0.81	0.52	0.53	0.85
28	0.50	0.57	0.43	0.43	0.51	0.67	0.45	0.46	0.55	0.64
29	0.37	0.39	0.00	0.00	0.00	0.40	0.34	0.38	0.00	0.85

Paired comparison matrix for the groups of measures (an upper level) estimated by experts and results of priority vector calculation are shown in Table 7.

Table 7. Paired comparison matrix for groups of measures and results of priority vector calculation, GP group "PT Payment Systems"

Group of measures	Organization and legislation	Infrastructural actions	Information actions	Modelling	**Priority vector (weights)**
Organization and legislation	1	1/5	1/7	1	0.0685
Infrastructural actions	5	1	1/3	5	0.2830
Information actions	7	3	1	7	0.5800
Modelling	1	1/5	1/7	1	0.0685

Paired comparison matrices estimated by experts and results of priority vectors calculation for measures of the each group (a second level) are presented in Tables 8-10.

Table 8. Paired comparison matrix and priority vector for measures of the group "Organization and Legislation"

Measure	PT Legislation and regulation	PT reorganization into multimodal system	Cooperation among administrations	**Priority vector (weights)**
PT Legislation and regulation	1	1/5	1/7	0.0719
PT reorganization into multimodal system	5	1	1/3	0.2790
Cooperation among administrations	7	3	1	0.6491

Table 9. Paired comparison matrix and priority vector for measures of the group "Infrastructural Actions"

Measure	ITS technical standardization for interoperability	Infrastructural measures	Innovative ICT for PT	**Priority vector (weights)**
ITS technical standardization for interoperability	1	5	3	0.6586
Infrastructural measures	1/5	1	1	0.1562
Innovative ICT for PT	1/3	1	1	0.1852

Table 10. Paired comparison matrix and priority vector for measures of the group "Information Actions"

Measure	PT traffic management measures	PT information measures	Advanced PT ticketing	**Priority vector (weights)**
PT traffic management measures.	1	1/7	1/9	0.0592
PT information measures	7	1	1	0.4507
Advanced PT ticketing	9	1	1	0.4901

The paired comparison of GP with numbers *i* and *j* for the measure with number *l* is determined by index: $\delta_l = P_l^{(i)} - P_l^{(j)}$. The values of paired comparison criterion are determined for the scale 1-9 using the value of index δ_l according the Table 4. Table 11 gives an example of the results of pairwise comparisons and a normalised evaluation of the measure "PT Legislation and Regulation" from the measures' group "Organization and Legislation". Similar calculations were made for each of 10 measures.

Table 11. Matrix of measure "PT Legislation and Regulation" evaluations

GP No	9	20	22	28	29	Priority vector
9	1	1	1/7	1/5	1/4	0.0533
20	1	1	1/7	1/5	1/4	0.0533
22	7	7	1	2	3	0.4464
28	5	5	1/2	1	2	0.2727
29	4	4	1/3	1/2	1	0.1743

Proceeding from the received evaluations of the priority vectors of two levels of the criteria hierarchy, we have calculated the final matrix of the evaluation of the global priority vector for the GP in the group "PT Payment Systems" shown in Table 12 and on Figure 7.

The results of the evaluations allow the GP to be arranged in the order of their efficiency, and show their difference in the given set of criteria. Practice No 22 "Integrated Public Transport System and Smart Ticketing (CDV)" has the highest value of priority 0.4417 and will be selected as the better one from the considered five practices. This practice has the highest values of priorities vectors for all groups of measures. Practice No 29 takes the second place, and practice No 28 is on the third place.

Table 12. Results of GP evaluations for the group of practices "PT Payment Systems"

	Organization and legislation	Infrastructural actions	Information actions	Modelling	**Priority vector**
Weights / **GP No**	**0.0685**	**0.2830**	**0.5800**	**0.0685**	
9	0.0552	0.0575	0.0789	0.0451	0.0689
20	0.0552	0.0575	0.0539	0.0451	0.0544
22	0.5433	0.5189	0.3782	0.5587	0.4417
28	0.2558	0.2924	0.2686	0.2112	0.2706
29	0.0905	0.0736	0.2204	0.1400	0.1645

8. Conclusions

The considered research is focused on the application of Information Technologies for Public Transport. Good Practice sites for POLITE are likely to have implemented a system/systems or services each of which are likely to cover a range of the 54 detailed measures. Examples of such systems are a Real Time Passenger Information system, a Smart ticketing payment system or Public Transport priority at traffic signals.

Present article solves the issue of benchmarking and assessment of the GP on infomobility services. This problem has been formulated as the multiple-criteria decision-making task. For assessment of GP the AHP (Analytic Hierarchy Process) method is applied. The AHP method allows arranging the GP in the order of their efficiency and showing their difference in the suggested set of criteria.

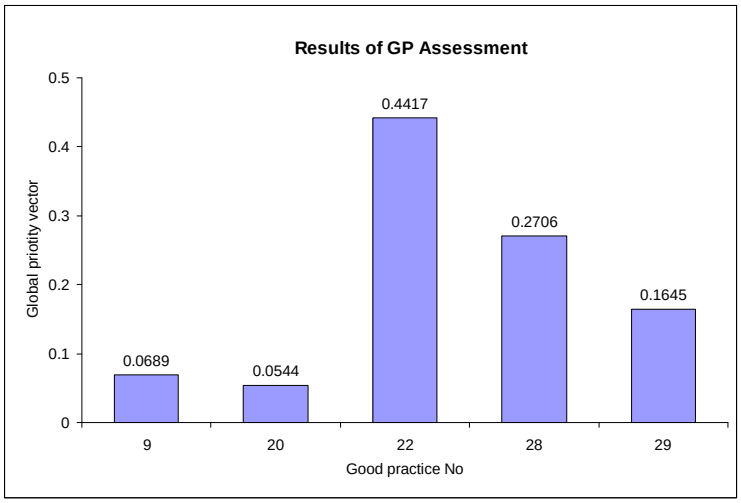

Figure 7. Results of GP evaluations for the group of practices "PT Payment Systems"

Results of GP assessment presented in this article are used as input to Transfer-oriented sessions in which project participants together with authorities, in a 3 steps path, mutually learn on how to improve infomobility policies. As well the results will be discussed during Good Practice Round Tables in 2014. At the end POLITE will result in improved policies, plans and programmes regarding Public Transport information systems in partners' sites, through experiences exchange and strengthening of competencies.

References

1. Ambrosino, G., Boero, M., Nelson, J.D., Romanazzo, M. (2010). *Infomobility Systems and Sustainable Transport services*. Italian National Agency for New Technologies, Energy and Sustainable Economic Development**:** ENEA.
2. Arena, M., Azzone, G., Franchi, F., Malpezzi, S. (2012). An Integrated Framework for Infomobility. In Proceedings of the Third International Engineering Systems Symposium, CESUN 2012, June 2012. Netherlands, Delft: Delft University of Technology.
3. Canali, C., Lancellotti, R. (2006). *A distributed architecture to support infomobility services*. ACM Digital library.
4. INTERREG IVC. Glossary. Available at – http://www.interreg4c.eu/glossary/#g
5. POLITE Project. (2012-2013). *Policy Learning in Information Technologies for Public Transport Enhancement*. Available at – http://www.polite-project.eu/polite-project
6. Saaty, T.L. (2001). *Decision Making for Leaders: The Analytic Hierarchy Process for Decisions in a Complex World*, New Edition 2001 (Analytic Hierarchy Process Series, Vol. 2), RWS Publications.
7. Sterle, C. (2009). *Location-Routing models and methods for freight distribution and infomobility in city logistics*, PhD Thesis. Università degli Studi di Napoli 'Federico II', Napoli, Italy.
8. T-TRANS Project. (2013). Report *Deliverable 3.1 – ITS state of the art assessment*. Available at – http://www.ttransnetwork.eu/ttrans/wp-content/uploads/2013/05/D3_1_TTRANS_ITS_state_of_the_art_assessment.pdf
9. Triantaphyllou, E. (2000). *Multi-criteria decision making methods: A comparative study*. London: Kluwer Academic Publishers.