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Article

Use of PROMETHEE MCDA Method for Ranking Alternative Measures of Sustainable Urban Mobility Planning

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Abstract: One of the most crucial steps during the implementation of a Sustainable Urban Mobility Plan (SUMP) as well the relevant transportation projects is the final measures and policies' selection that will be realized in order for the plan to achieve the study area targets. There are many methodologies that have been used for a specific purpose, with cost-effective and cost–benefit analysis being the most popular. According to the new specifications of SUMPs, the co-creation and co-planning of the future measures taking into account the opinions of all the relevant stakeholders and groups of citizens is the main parameter that will ensure the success of the planning. For this reason, MCA is the methodology proposed to be used for collecting and analyzing the different opinions. The aim of the current work is to prove, through a targeted Greek survey, the effectiveness of the MCA, not only to merge the different opinions and priorities of the stakeholders but also to highlight and rank realistically the most important sustainable mobility measures that should be implemented in an urban area. The work proposes and tests a specific methodological framework based on the use of the preference ranking organization method for enrichment of evaluations (PROMETHEE) method.

Keywords: multicriteria analysis; PROMETHEE method; sustainable urban mobility planning; measures ranking

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1. Introduction

During the implementation of transportation planning projects, there are many decisions to be taken in a structural way. The selected measures or policies that will be finally proposed should be a result of a multicriteria decision, which will take into account many parameters, such as the cost, the impact on the environment, the applicability and the cooperation of multiple stakeholders.

For many years, the most common form of evaluation in transport-related decisions was the cost-effectiveness analysis (CEA), according to which the cost of alternative ways of providing similar kinds of output are compared. Any differences in output are compared subjectively with the differences in costs. Furthermore, still widely used is the method of cost–benefit analysis (CBA), which is based on the calculation of the total cost of the examined project on one hand and benefits on the other. Both the above-mentioned methods are analytical ways of comparing different forms of input or output, in these cases by giving them money values, and might themselves be regarded as examples of multicriteria analysis [1].

However, the above methods have certain limitations, mostly related to the fact that many impacts due to their nature (such as social, health, safety) cannot objectively be quantified in momentary terms [2].

According to the above limitations and given that the transport infrastructure planning problems can be characterized as structured problems that can be analyzed using multicriteria decision analysis (MCDA) methods. The MCDA methodology is considered the most appropriate method used by many cities during a series of workshops in order to evaluate the different measures/projects and select the most significant ones. Analyses of papers from relevant scientific bases (Table 1) showed that MCDA methods have been used as decision-making tools in the process of planning, design, maintenance, and reconstruction of transport infrastructure and measures in urban areas [3]. This analysis shows that, regardless of the type of issue considered, the analytic hierarchy process.

Table 1. Application of multicriteria decision analysis (MCDA) methods in different phases of transportation projects of urban areas [3].

Phase	Type of Infrastructure/Problem Description	Applied Methods in Making Decisions about Transport Infrastructure										
		AHP	ANP	ELECTRE	PROMETHEE	REGIME	MAVT	SAW	TOPSIS	MCA&GIS	MCA&CBA	DEX
PLANNING	All infrastructure			X				X	X	X		
	Transport infrastructure - in general	X		X	X							
	Transport infrustructure in urban areas/selection of a railway line	X										
	Transport infrastructure in urban areas/selection of city bypass route/investment project appraisal											X
	Transport infrastructure in urban areas/selection of a new metro line route-EU funded project						X					
	Transport infrustructure in urban areas/bicycle facility planning							X		X		
	Transport infrastructure in urban areas/GPF location selection	X										
	Transport infrastructure in urban areas/selection of a location for a port for nautical tourism				X							
	Transport infrastructure in urban areas/selection of an project alternative for improvement of road infrastructure							X				
	Transport infrastructure in urban areas/selection of an optimum transport system	X										
	Transport infrastructure in urban areas/transport planning on neighbourhood level	X	X			X					X	
	Transport infrastructure in urban areas/selection of a GPF location and definition of the GF investment strategy	X			X							
	Transport infrastructure in urban areas/selection of an urban railway transport project	X										
DESIGN	Transport infrastructure design/in-general	X		X	X							
	Transport infrastructure in urban areas/selection of a GPF type on an already defined location	X										

Table 1. *Cont.*

Phase	Type of Infrastructure/Problem Description	Applied Methods in Making Decisions about Transport Infrastructure										
		AHP	ANP	ELECTRE	PROMETHEE	REGIME	MAVT	SAW	TOPSIS	MCA&GIS	MCA&CBA	DEX
MAINTENANCE/RECONSTRUCTION	Transport infrastructure in urban areas/selection of an alternative for road infrastructure and crossing with railway infrastructure-transport investment	X										
	Transport infrastructure in urban areas/selection of optimum pedestrian crossing on an already defined location	X										
	Transport infrastructure in urban areas/road maintenance management	X			X							
	Transport infrastructure in urban areas/rehabilitation and maintenance of rads	X										

The AHP method (Analytic Hierarchy Process) is the most frequently used compared to other MCDA methods [4–24]. More often used MCDA methods are the PROMETHEE, SAW (Simple Additive Weighting), and then ELECTRE (ELimination Et Choice Translating REality), ANP (Analytic Network Process), REGIME, MAUT (Multiple Attribute Utility Theory) and TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) [25].

MCDM techniques are increasingly used nowadays in transport-related decision-making, offering the following benefits [26].

- MCDM leads to better-considered, justifiable, explained and transparent decisions once it allows the often conflicting and contradictory views to be addressed simultaneously and transparently;
- The use of MCDM helps to organize, manage and in many ways simplify the immense amount of technical information and data, which is often available in transport sector problems;
- The process can be fully controlled: scores and weights are given based on established techniques, the values may also be cross-referenced to other sources of information and the possibility for modifications at a further stage is given, if it is felt that the decision model, the options considered, or the data provided are not adequate.

The comparison of the different MCDM methods was concluded that when choosing the MCDA method, not only the method itself but also the method of normalization and other parameters should be carefully selected. Almost every combination of the method and its parameters may bring us different results [27].

The use of the MCDM methodology to the implementation of a sustainable urban mobility plan presents certain differentiation from the above-mentioned cases. First of all, the main scope of a SUMP is to merge the opinions of many different stakeholders, who may have a different view of sustainability. Second, the criteria and parameters that should be taken into account are not easily quantified as they mainly regard the quality of life, social equity, environment, etc. Additionally, there different aspects that should be taken into account, such as the easiness of applicability, which should be weighted and taken into account in a different way than the other parameters.

The current work aims to create a comprehensive methodological framework for ranking sustainable mobility measures and policies using MCDA and also to assess, through the logical evaluation of a certain pilot case, the effectiveness of this framework.

The next section presents the methods and tools that were used for formulating the framework, while the third section describes the implementation of the framework. Finally, the main results and conclusions are described in the fourth section.

2. Tools and Methods

2.1. The PROMETHEE Method

The preference ranking organization method for enrichment of evaluations (PROMETHEE) method, which is used for the current work, belongs to the outranking family of MCDA methods and is developed by Brans et al. [28] and Brans and Vincke [29]. The method has been later on complemented by geometrical analysis for interactive aid (GAIA), an attempt to represent the decision problem graphically in a two-dimensional plane. This interactive visual module can assist in complicated decision problems.

PROMETHEE results in a ranking of actions (as the alternatives are known in the method's terminology) and is based on preference degrees. Briefly, steps include the pairwise comparison of actions on each criterion, then the computation of unicriterion flows, and finally, the aggregation of the latter into global flows. It has been applied successfully in various application areas; Application domains include nuclear waste management, the productivity of agricultural regions, risk assessment, web site evaluation, renewable energy, environmental assessment, selection of contract type and project designer.

According to Brans and Mareschal, PROMETHEE is designed to tackle multicriteria problems, such as the following [30]

$$\max \{g1(a), g2(a), \cdots, gn(a) \mid a \in A\} \tag{1}$$

where A is a finite set of possible alternatives $\{a1, a2, \cdots, am\}$
and

$\{g1(\cdot), g2(\cdot), \cdots, gn(\cdot)\}$ a set of evaluation criteria either to be maximized or minimized.

The decision-maker needs to construct the evaluation table as in Table 2. The second row of this table is about the weights associated with each of the criteria, and as in the previous chapters, Equation (1) holds true:

$$\sum_{j=1}^{n} wj = 1, j = 1, 2, \cdots, n \tag{2}$$

Table 2. Evaluation table.

a g1(·) g2(·) · · · gn(·)
w1 w2 · · · wn
a1 g1(a1) g2(a1) · · · gn(a1)
a2 g1(a2) g2(a2) · · · gn(a2)
...
am g1(am) g2(am) · · · gn(am)

It must be pointed out that MCDA techniques in general place the decision-makers in the center of the process, and different decision-makers can model the problem in different ways, according to their preferences (it also must be mentioned here that the methods assist the decision-maker, they do not make the final decision for him/her; thus, the word "aid" in the MCDA acronym. The responsibility for the final decision rests with the decision-maker alone). In PROMETHEE, a preference degree is an expression of how one action is preferred against another action. For small deviations among the evaluations of a pair of criteria, the decision-maker can allocate a small preference; if the deviation can be considered negligible, then this can be modeled in PROMETHEE too. The exact opposite stands for large deviations where the decision-maker must allocate a large preference of one action over the other; if the deviation exceeds a certain value set by the decision-maker, then there is an absolute preference of one action over the other. This preference degree is a real number always between 0 and 1 [30].

The current work aims to use the PROMETHEE method in order to formulate and implement a methodological framework for ranking sustainable mobility measures and improve decision-making in the sustainable urban mobility planning process. The next section presents the analytical methodology that was applied for formulating the framework, while the third section describes the results of a real pilot test of this framework, while in the final section, the main conclusions are described.

The Questionnaire Survey

The 12 steps methodology of sustainable urban mobility planning (SUMP), as it is presented in the specific European guidelines [31], is based on an approach according to which the future problems of the city and the solutions to the issues are considered through a multiparameter procedure so that experts from the field of transportation engineering become a necessary part of a broader interdisciplinary team. In this team, a substantial role in the decision-making process is given to professionals from other fields and the public.

Ten experts were selected to share their experience and give feedback for the proper development and the test of this framework. They were mainly staff from the municipalities' technical departments and engineers, who had worked as external consultants of the municipalities during the development of the SUMPs to ensure the successful implementation of them and the achievement of their targets.

A relevant questionnaire was formulated after many relevant discussions with the experts regarding specific obstacles and difficulties that they faced during the SUMP development and the knowledge gained during the monitoring phase, and the real implementation of the proposed measures.

2.2. Selection of Evaluation Criteria

There are many decisions and different parameters during the sustainable urban mobility planning process, which should be taken into account. The selected strategy that will be followed to serve the city's vision, the targets of the city's future development, the chosen measures that need to be implemented for achieving these targets, but also the difficulty of their applicability in specified time limits.

In order to address this need and as a first step of the proposed framework, the main criteria for selecting and ranking the measures that should be implemented in an urban area in order to upgrade sustainable mobility were determined. As already mentioned, in the case of a SUMP, these criteria are not easy to be defined. After different discussions with the experts, two main categories were finally included in the methodology. The effectiveness of the measures to the achievement of the SUMP targets and the difficulty of their applicability.

According to the recent review of the different already completed SUMPs, the main targets that were set as more important to be achieved are those that mainly serve the main objectives of sustainable mobility planning and, more precisely, the accessibility and operation of the transport system; the environment; the society; the economy and the transportation system quality, and are presented in the next table (Table 3).

Table 3. Main urban area targets set by the Greek developers of sustainable urban mobility planning (SUMP).

	SUMP Proposed Targets
1	Increase in the number of kilometers traveled by bicycle
2	Increase in the number of kilometers traveled by public transport
3	Increase in pedestrian kilometers
4	Reduction in time between specific origin–destination pairs traveled on foot.
5	Reduction in the time between specific origin–destination pairs traveled by bicycle.
6	Reduction in the average walking distance to/from bus stops for specific origin–destination pairs.
7	Reduction (%) in dead and seriously injured in road accidents within the urban network
8	Reduction in social exclusion due to low accessibility to transport services of people with mobility problems
9	Reduction (%) in CO2 and NOx emissions caused by traffic
10	Reduction (%) in noise emissions caused by traffic
11	Increase in new jobs
12	Contribution of measures to the various economic sectors of the city (tourism, entrepreneurship, etc.)
13	Upgrading the quality of the public transport system
14	Upgrading the offered quality of bicycle infrastructure
15	Upgrading the quality of infrastructure offered for walking.

For the second criterion, the difficulty of the measures' applicability -regarding the institutional interactions, the SUMP owner's authorization to implement these measures, the existing of legal barriers, the funding opportunities, etc. -the specific parameters that were defined as more important, are presented in Table 4 below.

Table 4. Parameters of the criterion "difficulty of applicability".

	Difficulty of Applicability Parameters
1	The institutional responsibility for the implementation of the measures exclusively belongs to the municipality, or there is a need for cooperation with other bodies.
2	Interaction of the measure with other measures or infrastructure that needs to be implemented.
3	Legal and institutional barriers need to be overcome for implementing the current measure.
4	Total investment cost.
5	Opportunities to include the project in European, national, or regional funding schemes, or capability to be financed by own resources.

2.3. Selection of Sustainable Urban Mobility Measures

As a second step, and based on the selection of measures that so far seem to be mainly proposed and adopted by the Greek authorities, who implement their SUMPS, specific measures were selected to be evaluated, as presented below:

1. Development of a shared system of electric and conventional bicycles as well as small-capacity electric cars;
2. Redesign of the existing public transport system;
3. Introduction of an e-bus line by the operator of the existing public transport system.

4. Development of a new high-frequency municipal e-bus line;
5. Conversion of the city's central commercial axis to a 3 km pedestrian walkway with open spaces for the citizens and infrastructure for biking and recreation areas;
6. Conversion of the central commercial axis into a light traffic road, with exclusive access to buses, taxis, electric vehicles, bicycles, and many open spaces for pedestrians;
7. Conversion of a municipal open space to a central bioclimatic park with recreation areas, cultivation, thematic parks, etc.;
8. Development of an advanced technology traffic and parking monitoring and management center offering real-time traffic information and routing services to the citizens (via the web or mobile app);
9. Implementation of infrastructure and the creation of incentives to promote e-mobility. Installation of electric vehicle charging stations in several axes of the city center's urban network and off-road parking stations. Reduced cost of on-road parking;
10. Implementation of infrastructure for enhancing the mobility of people with disabilities.

The application of the PROMETHEE multicriteria analysis, which will calculate the preference degree of the measures separately for the SUMP targets and the difficulty of applicability parameters, is presented in the next section.

3. Application of the PROMETHEE MCDA Method for Ranking the Selected Sustainable Mobility Measures

3.1. Calculation of Average Weights of the Two Criteria

As it was mentioned, two main criteria were selected for the specific framework, the effectiveness of the measures to the SUMP targets and the difficulty of the measures' applicability. However, are these two criteria equally important for the final selection of the measures? The group of experts was asked to give specific weight to the achievement of SUMP targets and to the ease of applicability. The average weights are presented in Table 5 below.

Table 5. Average weights were given to different criteria of the analysis.

Parameter	Average Weight Given by the Expert Group
SUMP proposed targets	85
Difficulty of applicability parameters	15

3.2. Calculation of Average Weights of the Different Parameters

During the third step of the framework, the experts were asked to allocate a specific weight in each of the proposed SUMP targets and each of the Difficulty of applicability parameters. The average weights were calculated and are presented in the following Tables 6 and 7.

Table 6. Average weights that were given to the sustainable mobility planning targets by the experts group.

Targets	Average Weight (%) Given by the Expert Group (1)
Increase in the number of kilometers traveled by bicycle	5.91
Increase in the number of kilometers traveled by public transport	10.09
Increase in pedestrian kilometers	7.45
Reduction in travel time between specific O–D pairs traveled on foot	8.09
Reduction in the travel time between specific O–D pairs traveled by bicycle	4.18
Reduction in the average walking distance to/from bus stops for specific O–D pairs	6.36
Reduction (%) in dead and seriously injured in road accidents within the urban network	8.36
Reduction in social exclusion due to low accessibility to transport services of people with mobility problems	7.45
Reduction (%) in CO_2 and NO_x emissions caused by traffic	5.64
Reduction (%) in noise emissions caused by traffic	5.09
Increase in new jobs	4.45
Contribution of measures to the various economic sectors of the city (tourism, entrepreneurship, etc.)	5.36
Upgrading the quality of the public transport system	7.00
Upgrading the offered quality of bicycle infrastructure	6.91
Upgrading the quality of infrastructure offered for walking	7.64

Table 7. Average weights that were given to measures' difficulty of applicability parameters.

Difficulty of Applicability Parameters	Average Weights (%)
Legal and institutional barriers that need to be solved before implementing the current measure	23.64
Interaction of the measure with other measures or infrastructure that needs to be implemented	20.91
Opportunities to include the project in European, national, or regional funding schemes or capability to be financed by own resources	20.91
Total investment cost	17.73
The institutional responsibility for the implementation of the measure exclusively belongs to the municipality, or is there a need for cooperation with other bodies	16.82

3.3. Application of the PROMETHEE Methodology for Ranking the Proposed Measures

During the fourth step of the methodology, the effect that each measure could bring to the proposed SUMP targets, as well as the way that the measures' implementation could be affected by the parameters of the "difficulty of applicability" criterion, were assessed by the experts. For both cases, the experts were asked to evaluate on a scale (1/low–5/high). These values/weights were imported into the databases that were developed in the PROMETHEE MCDA software.

The weights calculated in the previous subsection (Tables 6 and 7) were also imported. The respective preference degrees and network diagrams are presented in Tables 8 and 9 and Figure 1 below.

Table 8. Ranking of the measures according to the proposed SUMP targets' preference degrees.

	Measures	Phi	Phi+	Phi-
1	Conversion of a central commercial axis of the city to a 3 km pedestrian walkway	0.2277	0.5139	0.2862
2	Introduction on an e-bus line by the operator of the existing public transport system	0.1677	0.4547	0287
3	Conversion of the main commercial axis into a light traffic road	0.1623	0.4907	0.3284
4	Redesign of the existing public transport system	0.1487	0.4574	0.3087
5	Development of a new high-frequency municipal e-bus line	0.1232	0.4431	0.3199
6	Conversion of a municipal open space to a central bioclimatic park	0.0518	0.4346	0.3828
7	Implementation of infrastructure for enhancing the mobility of people with disabilities	−0.1379	0.3448	0.4828
8	Development of a shared system of electric and conventional bicycles, as well as small-capacity electric cars	−0.1752	0.3374	0.5126
9	Development of a high technology traffic and parking monitoring management center	−0.2187	0.3044	0523
10	Implementation of infrastructure and creation of incentives to promote e-mobility	−0.3496	0.231	0.5806

Table 9. Ranking of the measures according to the "difficulty of applicability" parameters preference degrees.

	Measures	Phi	Phi+	Phi-
1	Implementation of infrastructure and creation of incentives to promote e-mobility	0.12	0.3976	0.2777
2	Development of a shared system of electric and conventional bicycles as well as small-capacity electric cars	0.1167	0.3802	0.2635
3	Conversion of a municipal open space to a central bioclimatic park	0.1027	0.3572	0.2545
4	Conversion of the central commercial axis of the city to a 3 km pedestrian walkway	0.0665	0.3292	0.2627
5	Development of a high technology traffic and parking monitoring management center	0.0614	0.3416	0.2803
6	Introduction of an e-bus line by the operator of the existing public transport system	0.0245	0334	0.3096
7	Development of a new high-frequency municipal e-bus line	−0.0412	0.2941	0.3353
8	Redesign of the existing public transport system	−0.1115	0.2853	0.3968
9	Implementation of infrastructure for enhancing the mobility of people with disabilities	−0.1649	0247	0.4119
10	Conversion of the main commercial axis into a light traffic road	−0.174	0.2329	0.4069

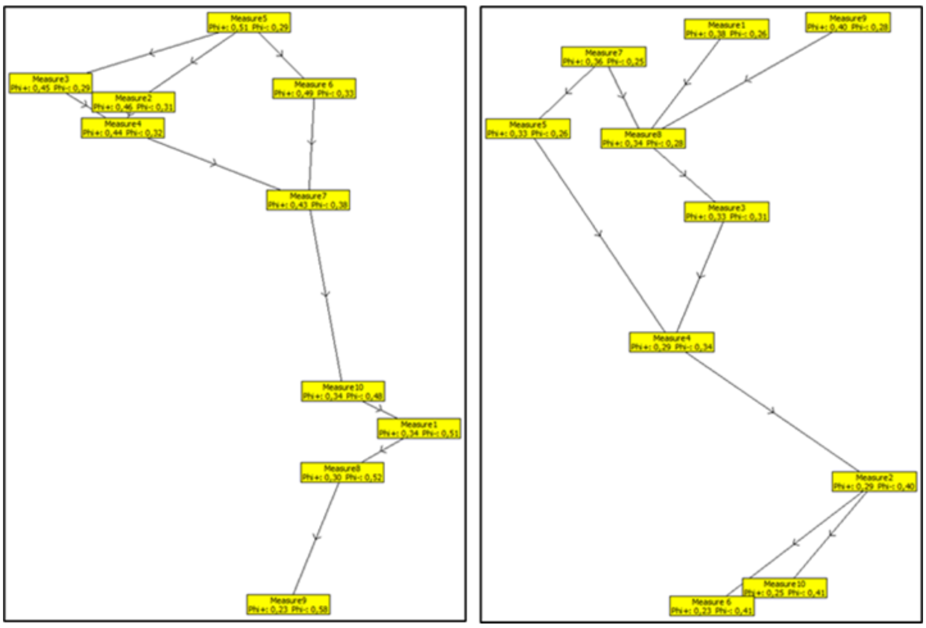

Figure 1. Preference ranking organization method for enrichment of evaluations (PROMETHEE) network display for SUMP targets and "difficulty of applicability" parameters preference degrees.

3.4. Final Ranking of the Proposed Measures

As a fifth step and following the weights that were given by the experts (Table 3) to the two different criteria, a composed preference degree index was calculated and is presented in Table 10 below.

Table 10. Ranking of the measures according to both the SUMP targets and the "difficulty of applicability" parameters preference degrees.

	Measures	Composed Pi (0.85Pi1–0.15Pi2)
1	Conversion of the central commercial axis of the city to a 3 km pedestrian walkway	0.1552
2	Conversion of the main commercial axis into a light traffic road	0.1501
3	Redesign of the existing public transport system	0.3381
4	Introduction of an e-bus line by the operator of the existing public transport system	0.2683
5	Development of a new high-frequency municipal e-bus line	0.1745
6	Conversion of a municipal open space to a central bioclimatic park	−0.0594
7	Implementation of infrastructure for enhancing the mobility of people with disabilities	−0.2587
8	Development of a shared system of electric and conventional bicycles as well as small-capacity electric cars	−0.2961
9	Development of a high technology traffic and parking monitoring management center	−0.2784
10	Implementation of infrastructure and creation of incentives to promote e-mobility	−0.1939

4. Conclusions and Findings

Sustainable Urban Mobility Plans are targeted to create a new culture to the mobility of citizens and visitors, taking as a priority the minimization of the emissions due to traffic, the accessible transport network and modes for all, the development of open spaces for the citizens and generally the "centralized to the people" cities planning. All the above-mentioned principles can be achieved with strong cooperation between the different relevant authorities and stakeholders. For this reason, the methodology that will be used should consider the opinions of different scientific experts (urban planners, transportation engineers, environmental engineers, economists, sociologists, groups of citizens, etc.), ensuring that all the sustainability parameters will be served.

For selecting the most appropriate measures, there are many decisions to be taken in a structural way and many criteria and parameters that should be taken into account. For this reason, the MCDA methods are considered the most appropriate to be used. However still, there are many particularities in the specific decisions that should be carefully taken into account, as the poly-parametric decision should serve the area mobility targets, but also should take into account the difficulty of the selected measures' applicability.

The application of a stepwise framework to the Greek experts of sustainable mobility has proved that MCDA can be used for sustainable mobility planning, giving special attention to the above-mentioned particularities and implemented separated analysis to the different criteria.

If we imprint the preference degrees of the PROMETHEE to the two different criteria and the composed one (Figure 2), it will be easy to understand the differentiation of the measures' ranking that could be brought if we applicate separate application of the PROMETHEE method to the different criteria that affect the final decision and then combine the results, calculating a more composed preference degree.

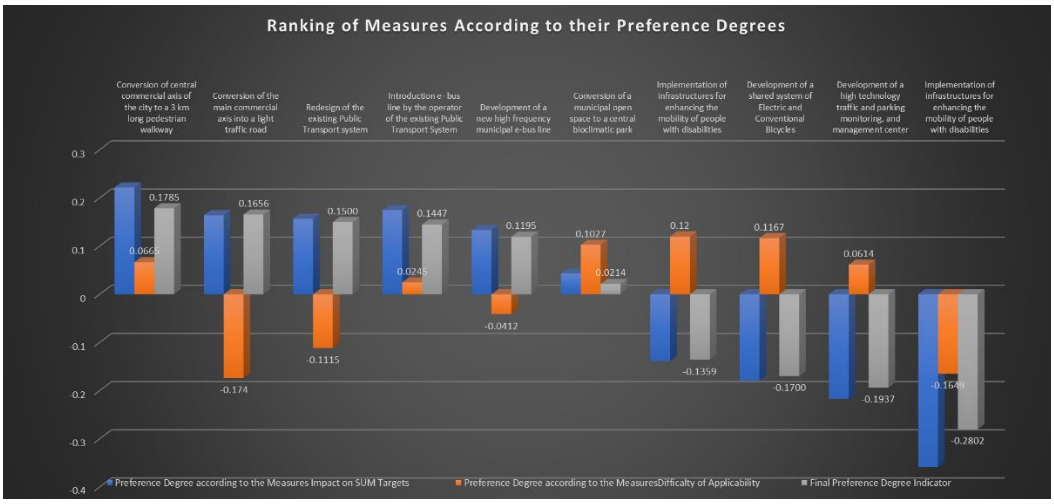

Figure 2. Comparison diagram of measures ranking according to their different preference degrees.

For example, the introduction of an e-bus line by the operator of the existing Public Transport system was ranked as the second important measure when we took into account only the effect on the targets. However, when we also added the criterion of "difficulty of applicability,"; this measure was ranked as fourth.

However, what will be the results if we do not calculate a composed preference degree indicator based on the specific weights that are given to each criterion?

The use of a quadrant analysis can give us a very useful view of the ranking using the two separate PROMETHEE results. Each measure is placed according to its preference degrees (impact to SUM target and difficulty implementation) in a specific quadrant (Figure 3). The first one represents the measures with a high impact on the area's sustainable mobility targets and severe difficulty in their applicability. The second quadrant declares a low result to the sustainable mobility targets, but again the severe difficulty in their applicability. In the third quadrant, the measures with low impact on the area's sustainable mobility targets and also the low difficulty of applicability are placed. Finally, the actions with a high impact on the area's sustainable mobility targets and low difficulty of applicability are placed in the fourth quadrant. These measures should be the priority of the authorities when they are starting to implement their SUMPs.

The fourth quadrant in the specific case that is examined includes the measures that were ranked as a second, third and fifth priority, but not the first one as it has slightly higher evaluation as regards the difficulty of implementation. The results can be considered as a preliminary view of the experts' preference, but they certainly differ from their final decisions. It must also be highlighted that the result could be much more difficult to be imprinted if the weight of the difficulty of applicability was bigger than 15% or if the criteria were more than two.

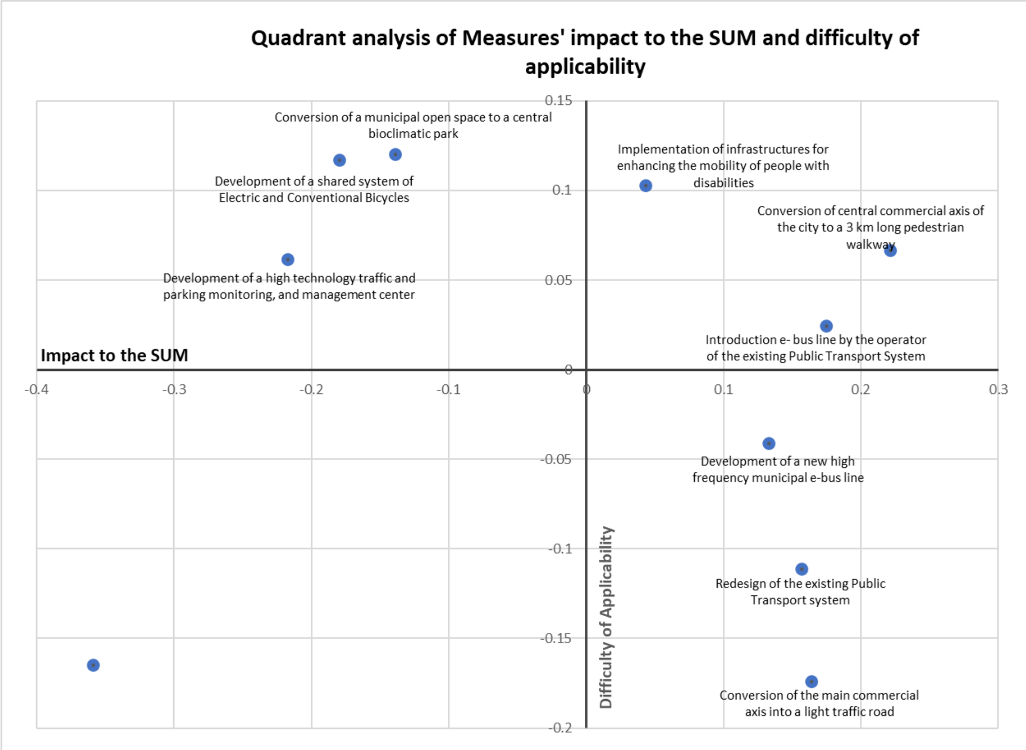

Figure 3. Quadrant analysis of measures preference degrees.

In order to conclude the evaluation of the PROMETHEE method for the ranking of sustainable urban mobility measures, some logical checks should be realized mainly under the perspective of traffic planning. According to the prioritization, the main measures to be implemented is the conversion of a central commercial axis to a pedestrian walkway or alternatively to a light traffic road, which undoubtedly is a common strategic infrastructure of most of the Greek cities as it gives a strong message in favor of shifting to sustainable means of transport.

Measures that aim to redesign and upgrade the public transport system, as well as the development of open spaces for citizens and visitors, hold the next positions in the specific ranking. According to the European practice of SUMPs, these measures and policies constitute critical interventions, but they demand strong support and cooperation between the public transport authorities or the land-use planners, legal modifications, large investments, etc.

Conclusively, it is confirmed that the PROMETHEE methodology and the methodological framework that is presented can be proposed as an efficient methodology that would be transferred to the municipalities who implement their SUMPs.

The application of this work to different Greek cities and stakeholders, but also the inclusions of more criteria and parameters, could further improve the final results of this methodology.

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