



Financing urban transportation infrastructure in a multi-actors environment: the role of value capture

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Abstract

Purpose A family of innovative financial mechanisms and tools for urban public transport, based on the value increment caused by enhanced accessibility, are lately gaining much popularity as a solution to the challenges posed by public financial resources' shrinkage: Value Capture Finance (VCF). The effectiveness of applied transport financing policies depends significantly on the level of agreement among stakeholders, making collaboration a prerequisite for success. The research presented herein assesses alternative financing options for urban public transportation which are based on the VCF concept.

Method The Multi - Actor Multi-Criteria Analysis (MAMCA) developed by Macharis [1] is used. The methodology is unique in its field, as it includes in-depth involvement of all relevant stakeholders and reveals their way of thinking.

Results The proposed methodological framework is applied to the real-world case study of the under construction metro system of Thessaloniki, Greece. Three different financing scenarios are tested, and the criteria weight elicitation is performed through personal interviews with 70 stakeholders belonging to six different groups, namely: Government/Local Authorities, Transport Authorities, Universities/Research Institutions, Private Sector, Society and Professional Associations. Noteworthy similarities but also contradictions among stakeholder groups emerged, highlighted by the different criteria used for each group.

Conclusion The paper introduces the MAMCA as an ex - ante evaluation method for different VCF mechanisms for urban transportation infrastructure. MAMCA emerges as a robust methodology for this assessment, as it is proved to be capable of dealing with the VCF complexity and multidisciplinary nature.

Keywords Value capture finance · Urban public transport infrastructure planning · Multi-actor multi-criteria analysis

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1 Introduction

Accessibility is a key factor in the attempt to shape an urban form that is environmentally sustainable, socially equitable and inclusive. Transportation investments characterize the urban tissue; the operation of a new public transport line increases accessibility levels and thus has an impact on locations, intensities, types of development and the value of land. Nowadays, public transport systems worldwide confront severe budgetary challenges due to their reliance on public financial resources, which are constantly shrinking as a result of the economic crisis.

Financing transport infrastructure has been and still is a major decision criterion for the administration (local, national, federal or supranational). The ongoing debate started, by the end of WWII, in the United States where in the Highway Acts, it was mentioned that the Federal government undertakes highway financing only for intra state highways i.e. for transport infrastructure of nationwide interest (Highway Act 1956) [2]. In the '70s, the extension of NY subway failed to get federal support on the grounds that it did not benefit the nation but only New Yorkers. A number of Public Hearings took place, trying to establish the indirect impact to the nation of a city subway system, which is used not only by the locals but by visitors as well (social amenity attitude), but to no avail as far as decision makers were concerned.

The underlying note to this debate was that as long as the taxpayer pays for transport infrastructure he/she should clearly benefit from it. In other words, transport infrastructure as a social amenity should be financed by those who directly benefit from it. The 80's introduced another concept as far as transport in general is concerned. The Thatcher administration considered that transport is an enterprise and it should be viewed that way. It is common knowledge that privatization mania started in this decade, especially in the United Kingdom.

Privatization introduced new financial schemes which were the offspring of common corporate practice together with a change of state philosophy. The 90's in some and the start of the twenty-first century for all European states, are marked by alternate financial schemes; from concessions, to PPPs and finally to VCFs which address the issue of financing in a more flexible way, with the involvement of the private sector both in financing and management, burdening mainly those who benefit from transport infrastructure more than all taxpayers.

Creative and novel ideas are therefore needed; a family of innovative financial mechanisms and tools for urban public transport, based on the value increment caused by enhanced accessibility, are lately gaining much popularity as a solution to the aforementioned fiscal challenges: Value Capture Finance (VCF) [3–6].

Value Capture Financing (VCF) reintroduces a fairer way of splitting transport infrastructure cost among beneficiaries (landowners, commercial outlets, housing developers, etc.)

and the state or private entrepreneurs (public participation is reducing the time horizon in case that concessions are contemplated). It is the aim of this paper to identify the necessary tools and their use in order to reveal the public opinion and acceptance of the VCF economic scenarios. Unfortunately, results as presented in the relevant paragraph are partially inconclusive, mainly due to the volatile economic environment in Greece and the tax pressure exercised by the Economic Adjustment Programs (commonly called “memoranda”), the first being introduced as early as May 2010.

The basic notion of value capture is that the value increment that results from public investment on infrastructure could be “captured” (partially or totally) in order to recover the capital costs of the investment or reinvest in the area [7]. Although initially the term value capture referred to pure “land value capture”, over the years it has been given a broader meaning, including today all the strategies which aim at financing through location – based value [8]. There are numerous variations of financial instruments based on the notion of Value Capture worldwide; often different terminology is used in different countries/regions and by different researchers to describe very similar or even identical methods [9]. Value capture finance (VCF) mechanisms are increasingly used for urban public transportation systems. Some of the most ambitious and large-scale transportation projects recently completed or currently under construction are partially financed through a value capture program.¹

At the same time, the development of affordable, economic viable and people-oriented transport systems in order to promote sustainable urban mobility, requires adopting a comprehensive and integrated approach to policy-making and decision-making. The effectiveness of each applied transport policy depends significantly on the level of agreement among stakeholders, making collaboration a prerequisite for success. The modern approach to ex-ante evaluation of transportation projects and policies, increasingly demonstrates the importance of active stakeholders' participation [10].

This paper is part of a wider research which is being conducted in the context of a PhD dissertation, the overall objective of which is to create a comprehensive ex-ante evaluation framework to assist decision makers in selecting the most suitable VCF mechanism for financing urban public transportation towards the principles of sustainable mobility, taking explicitly into account the multiple actors involved in the decision – making process. The research presented herein uses the Multi - Actor Multi-Criteria Analysis (MAMCA) developed by Macharis [1, 11] to assess alternative financing

¹ Examples include the following: Denver Union Station redevelopment project, Colorado; Atlanta BeltLine project, Atlanta; Washington DC Metro expansion to Dulles Airport, Virginia; Portland's Cascade Station and Light Rail to PDX Airport, Oregon; Red Line, Los Angeles Metro, California (all in the USA); Crossrail project and Northern Line Extension (NLE), London, UK; Mass Transit (MTR), Hong Kong.

options for urban public transportation which are based on the value capture concept. The proposed methodological framework is applied to the real-world case study of the under construction metro system of Thessaloniki, Greece.

2 Literature review

There is no “magic” recipe for success concerning VCF, since each case is unique, and the outcome is strongly affected by local circumstances. Their implementation process is far from straightforward; it is a multifaceted issue and as such, each case requires a multilevel and multi-actor approach. Deciding which VCF mechanism(s) to use, as almost all decisions to be taken in life, is inevitably intertwined with various criteria that more or less have to be taken into account. The decision - making process related to transportation planning issues -and particularly transportation policy issues- is intrinsically complex due to the fact that, in addition to the large number of factors (both quantitative and qualitative) involved, there are usually many alternative scenarios to be examined. These alternative scenarios have to be evaluated, in order to choose the optimal solution for each specific case, according to the established criteria. Moreover, a large number of actors are involved in the decision making process; these actors usually come from different backgrounds and have different objectives, interests and aspirations [12].

The literature review reveals that acceptance and support from stakeholders is repeatedly mentioned in different research studies (e.g. see [7, 13, 14]) as an extremely critical factor when it comes to the successful implementation of value capture financing mechanisms. Regardless their crucial role, stakeholders have not been examined in the context of VCF policies as thoroughly as this important role would justify. Moreover, although there have been some attempts lately in evaluating VCF mechanisms (e.g. GVA [14–16]), they are rather scarce and there is no comprehensive and established research volume in this direction yet.

It is essential to choose wisely, among the large variety of existing methods, the methodology with the aid of which the ex-ante evaluation of financing policies for transportation infrastructure is going to take place. The traditional methods used for the ex-ante evaluation of transport policies, the main of which are: Cost - Benefit Analysis (CBA), Cost - Effectiveness Analysis (CEA), Economic - Effects Analysis (EEA)/ Economic Impact Analysis (EIA), Social - Cost Benefit Analysis (SCBA) are not capable of explicitly incorporating stakeholders’ views and restrict the analysis to specific criteria measured monetary terms [17]. Especially CBA, which has been used and is still used widely all over the world, particularly for decisions related to transportation investments [18, 19], is lately subject to strong criticism regarding many aspects of it, and notably its weakness to effectively include non-quantifiable

criteria to the analysis (e.g. see [20–23]). Iniestra and Gutierrez [24] argue that the limitations of CBA are more obvious in cases where there is strong divergence of opinion among stakeholders about political, socio-economic or/and technological parameters. The real - world transportation - related decision problems are way too complicated to be confronted based strictly on economic criteria and restrictive concepts [25].

In an attempt to find compromising solutions to meet the different (and often conflicting) objectives of the multiple actors involved in the decision making process, flexible methods and tools are needed. Multicriteria Decision Analysis Methods (MCDA) have gained wide acceptance due to the fact that they embody many quantitative and qualitative variables and the characteristics of several scenarios can be assessed simultaneously [26]. The use of MCDA in transportation planning has shown a steadily increasing trend during the last years [12]. There is no single way for conducting a MCDA; there is a large number of methods and techniques with the aid of which it could take place. The suitability of the method strongly depends on the research objectives and the scope of the analysis [27]. It is worth mentioning that the decision - making process is not always strictly designed under the objective of concluding to a definite solution; sometimes it is intended to conclude in the thorough understanding of a problem, the justification of different options and the exchange of opinions among the multiple actors involved. Even the existence of potential intense disagreements and conflicts could be translated into more creative, effective and novel ideas, beneficial for all parts [28, 29]. The result of a MCDA, should not be interpreted as the unique solution to a decision-making problem, but rather as an indication of the possible consequences of choosing a particular set of actions [30].

An ex-ante evaluation framework for assessing the suitability of different value capture financing mechanisms, should be comprehensive and at the same time flexible, aiming at incorporating stakeholders as extensively as possible in the decision-making process. There are many different ways by which stakeholders could be involved in a MCDA [31]. Nevertheless, in the majority of cases, stakeholders’ participation does not take place in all stages of the analysis, nor it is a main and integral part of it [12]. In order to address this critical gap, a new methodology was developed, which explicitly includes the stakeholders through the whole process. This methodology is the Multi-Actor Multi-Criteria Analysis (MAMCA) and it is explained in the following section.

Although a relatively new methodology, MAMCA has already been used and has proven its usefulness in several applications from its launch until today. In the context of this research, the literature review focuses on transport - related applications. Initially it was used for intermodal terminals’ allocation [1]. Geudens et al. [32] and Macharis and Cromptvoets [33] used MAMCA to assess and compare different Spatial Data Infrastructure (SDI) policy strategies in

Flanders area, Belgium. Focusing on Flanders again, Vermote et al. [34], applied MAMCA under the objective of evaluating alternative freight road network scenarios. The impact of different pedestrian scenarios in Ramallah, Palestine, was assessed in Vermote et al. [35] with the aim of enhancing the quality of short trips within the city and promoting the land use - mobility relationship.

The performance of global cities with respect to various selected criteria was examined by Kourtit et al. [36], who applied MAMCA using a combination of AHP and PROMETHEE. Bergqvist et al. [37] employed MAMCA in order to investigate possible ways for enhancing sustainability in the field of hinterland transport systems. MAMCA was also used in the field of biofuels, to assess stakeholders' interest concerning different biofuel alternatives and opportunities in Belgium [38] and in Canada [39]. Macharis et al. [40] used MAMCA for the strategic evaluation of alternatives regarding a possible extension of DHL hub in Zaventem airport, Brussels, and moreover, in order to allocate intermodal terminals, based on LAMBIT (Location Analysis for Belgian Intermodal Terminals) model, which was introduced in early 00's by Macharis [41] and has been further developed recently by Macharis et al. [42].

Lebeau et al. [43] investigated ways by which European governments could motivate their countries' citizens to replace their typical vehicle with one which incorporates environmental-friendly technology, while Dooms and Macharis [44] developed a MAMCA methodological framework for the sustainable design of inland ports. Gagatsi et al. [45] used MAMCA for assisting policy - making in the field of maritime transport. It has also been used for a study on the choice between waste transport alternatives in the Brussels region (BRUGARWAT case study - Brussels Garbage by Water) and the evaluation of mobility rights [43].

Macharis and Januarius [46] focused on the evaluation of "difficult" transport projects, i.e. projects which are considered controversial and are subject of intense disagreement and source of conflicts among involved stakeholders, having as a case study the Oosterweel connection, a new road link, which has been planned as an extension of the existing ring-road of the city of Antwerp, Belgium. A new urban freight transport evaluation framework, based on the three pillars of sustainability, utilizing the strengths of MAMCA methodology is suggested by Milan et al. [47]. The framework is tested in six demonstrations throughout Europe within the STRAIGHTSOL project. Likewise, Macharis et al. [48] developed a similar framework, with a Greek case study this time: remote real-time cargo control is examined in the city of Thessaloniki, aiming at ameliorating the monitoring of rail freight transport and the management of storage spaces.

Verlinde and Macharis [49] consider MAMCA as a suitable measuring tool of the degree of stakeholders' support of off-hour deliveries to supermarkets. In a similar application,

Macharis et al. [42] examined with MAMCA freight deliveries' process within the urban context, during daytime and night. MAMCA was also selected by Sun et al. [50] for the appraisal of different low-carbon policies in Tianjin, China. Van Raemdonck et al. [51] suggested a MAMCA approach for evaluating road safety measures in the context of achieving sustainable development targets; in order to evaluate road safety measures, MAMCA was also used by Geudens et al. [52]. In addition to that, it was used in the context of INSAFETY (INfrastructure and SAFETY) project, once again under the objective of evaluating a bundle of measures which aimed at increasing road safety [28]. Moreover, MAMCA is one of the main evaluation tools in the EU project STRAIGHTSOL (Strategies and measures for smarter urban freight solutions) of the 7th Framework Programme for Research and Technological Development (FP7 2007–13) and also in NISTO (New Integrated Smart Transport Options) project, in the framework of INTERREG North-West Europe Programme [53].

3 Methodological framework: The multi - actor multi - criteria analysis (MAMCA) and its applications

Multi - Actor Multi - Criteria Analysis (MAMCA) is a decision - making model developed by Macharis [1, 11]. The main characteristic of the methodology, is that it takes stakeholders explicitly into account in all stages of the analysis. MAMCA is suitable for assessing transportation projects, infrastructure, policy measures, technologies, long term strategic options etc. [40] and is particularly useful during an ex-ante decision-making evaluation process [52].

The methodology is unique in its field, as it includes in-depth involvement of all relevant stakeholders and reveals their way of thinking [33]. Some of the classic MCDA methods were extended to support group decision - making, creating hence the so-called "second-generation" MCDA methods or Multicriteria Group Decision Making (MGDM)/ Group Decision Support Methods (Systems) (GDSM(S)). For instance, the Analytic Hierarchy Process (AHP) was extended by Saaty [54] and PROMETHEE (Preference Ranking Organization METHod for Enrichment of Evaluations) by Macharis et al. [55]. A critical aspect of MAMCA that differentiates it from the rest GDSM, is that in MAMCA, every stakeholder group has its own criteria set, which correspond to the groups' objectives, while in most GDSM, all stakeholders have exactly the same criteria [17]. The realization that they are included in a comprehensive evaluation can work as an incentive to the stakeholders, stimulating them to pay more attention to their judgments [56]. In addition to this, MAMCA provides the analyst with the opportunity to elicit different weights in every stakeholder group, with respect to

the importance of that specific group regarding the overall objective of the analysis, notwithstanding the fact that in most cases this is avoided, because the prevailing view is that all groups should be considered equally influential [32]. MAMCA allows analysis per stakeholder group as well as aggregated analysis [12]. Based on all the aforementioned strengths, among the large spectrum of the existing MCDA methods, the Multi - Actor Multi - Criteria Analysis (MAMCA) was selected for the analysis, as it is considered ideal for fulfilling the research objectives.

MAMCA comprises seven distinct steps (Fig. 1) [17]. These steps are the following:

1. Definition of the problem and identification of the alternatives, the form of which depends on the nature of the problem (e.g. different policy measures, different technologies, long term strategic options etc.).
2. Stakeholder analysis: Identification of stakeholders which need to be consulted and whose views should be taken into account in the evaluation process.
3. Definition of criteria and weights: Identification of stakeholders' key objectives (which should correspond to the criteria) and weight assignment. A hierarchical decision tree can be set up. The weights' elicitation is usually performed using the Analytic Hierarchy Process (AHP),
4. Indicators and measurement methods. Selection of suitable indicator(s) for each criterion. These indicators can be either quantitative or qualitative and be measured in an established scale. The measurement method of each indicator is also defined in this step.
5. Overall Analysis and Ranking of the alternative scenarios. In this step every alternative (from step 1) is evaluated on the different criteria by use of the indicators and measurement methods (step 4) and this for each stakeholder group (step 2). Construction of the evaluation matrix.

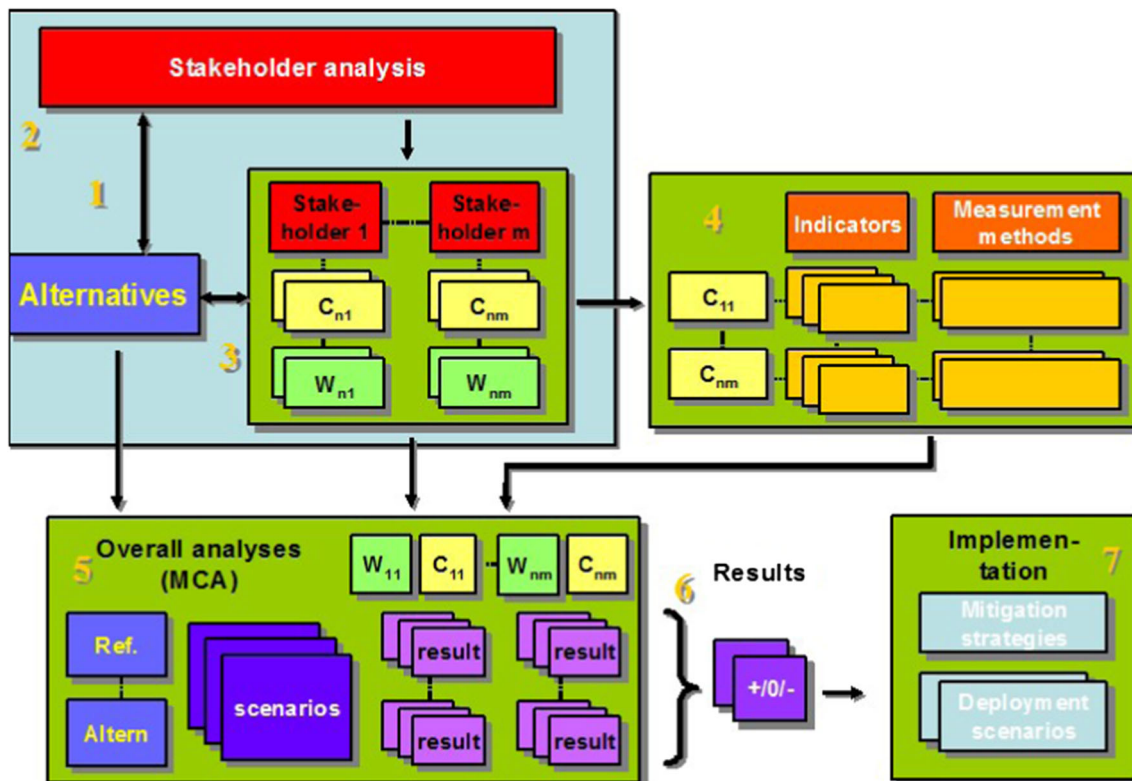


Fig. 1 Methodological steps for the application of Multi – Actor Multi – Criteria Analysis (MAMCA) [17]. $C_{n1} \dots C_{nm}$: Evaluation Criteria. $W_{n1} \dots W_{nm}$: Weights assigned to the Evaluation Criteria

6. Results of the MAMCA. The above process finally leads to a classification of the proposed alternatives. In addition to the global ranking, the critical stakeholders and their criteria are revealed in this step.
7. Implementation. The results of the analysis provide the researcher with valuable information which can be used to formulate policy recommendations towards the decision makers (very often public authorities). These recommendations are defined to help the decision makers in the search for a deployment scenario which can be accepted with no severe objections by the most stakeholders involved.

The double – direction arrows between steps one and two and one and three respectively show the interactive nature of these steps. Stakeholders can express their opinion regarding the suggested scenarios, which might lead to adding new scenarios or/and modifying the existing ones. Similarly, new criteria could be added and others could be abandoned after stakeholders' intervention, which may mean that steps one, two and three should be performed from the beginning based on the additional input available, as this new information may trigger the need to include a new group of stakeholders to the analysis.

Regarding potential pitfalls of the MAMCA methodology, first of all, as with all multi – criteria approaches used in a MGDGM context, strategic bias could occur. This means that decision makers might attempt to manipulate the weight elicitation process in favour of their desired outcome [66]. Moreover, the selection of stakeholder groups and the different (and often asymmetric) number of criteria within each group might also act as possible sources of bias. Enhancing transparency throughout the process is a way of diminishing drastically the risk of obtaining biased results. In addition to that, it is preferable to not aim at achieving necessarily an overall global and final result that would satisfy every stakeholder group, but pay more attention to the results of every stakeholder group instead [67].

4 Case analysis: Application of MAMCA, results and discussion

In this paper, the selected methodological approach was tested in a real - world case study: the under construction metro system of Thessaloniki. Thessaloniki is the second-largest city in Greece, the second major economic, industrial, commercial and political center in the country and a transportation hub for southeastern Europe and the Balkans. The metro is an on-going project, started in 2006. After its completion, the basic metro line will run for 9,6 km through the city, having 13 stations.

It is worth mentioning that it is a rather irregular case; the construction of the metro was supposed to be completed years ago (in 2012), but due to several reported issues a large delay on project delivery has occurred. Several completion target - years

were announced after that, which came and go with no real reported progress on the project. The issues that caused this delay were of financial nature, in combination with a debate triggered by important archaeological findings, for which it has not been possible yet to reach a consensus among different parties involved on whether they should be moved from their original location to be placed in a museum or they should go through a restoration process and then be exposed on – situ. Some of the disagreements among the Greek State, the organization which is responsible for the construction and future operation of the metro (ATTIKO METRO S.A.) and the concessionaire were even brought to the court. The construction works “froze” several times within these last years; they started again after a period of 2,5 years in January 2016. Nevertheless, there is still ambiguity concerning the expected opening, with the latest available information placing it on the year 2020.

Regarding the existing financing scheme of the project, the basic metro line has a total portfolio of €1,36b and it has been partially financed in the context of National Strategic Reference Framework (NSRF) (2007–2013) and is now one of the projects that are part of the New Programming Period Partnership Agreement (2014–2020). In a recent research by Sapranidis [68], a questionnaire survey with a focus on investigating public's view regarding this delay was addressed to entrepreneurs within the planned metro line's buffer zone. Over 90% of the interviewees replied that they consider the state (in the broad sense of the term) as the main responsible for the delay.

All steps of MAMCA for this specific case are addressed² and discussed in this section, except from step 7 (implementation of the results), as it is beyond the scope of the paper. This is a research paper aiming at the examination of a potential introduction of VCF policies in Greece – which is not currently in the agenda of transportation projects' financing in Greece. Therefore, the main focus of the paper is the process that should be followed prior to the implementation phase in order to select the most suitable financing scheme based on the VCF concept.

MAMCA Step 1: Definition of the problem and identification of the alternatives

The decision problem in this case is the ex-ante assessment of the suitability of various financing mechanisms for urban transportation infrastructure which belong to the value capture family, for implementation in Greece, a country with no previous experience with VCF tools for this purpose. More specifically,

² It is worth mentioning, that a novel attribute of the research presented herein, is that the whole MAMCA analysis is performed with the aid of the new online MAMCA Software, developed by MOBI (Mobility, Logistics and Automotive Technology) Research Centre of the Free University of Brussels (Vrije Universiteit Brussel), following the identified need in Macharis et al. [17] and Macharis and Bernardini [12], for a software adapted to MAMCA (its beta test version is available and used in the present).

the evaluation of potential VCF variants for the partial financing of the construction and/or operation costs of the Thessaloniki metro project is investigated. As described earlier in the literature review section of the paper, there is a great variety of VCF mechanisms and tools worldwide. This paper examines three alternative urban transportation financing scenarios, each one based on one of the three most widely used value capture tools in the context of urban public transport systems. These alternative scenarios are briefly presented below:

Scenario 1: Betterment tax/Benefit assessment: It refers to a tax/levy on properties which benefit from increased accessibility, by experiencing a rise in their value. Often, but not always, it is applied within a specific geographical zone. It can be directed either to property owners (land - based levy) or businesses (economic prosperity based levy) or both. Moreover, it can be either flat (same for all properties regardless their location) or distance-based [69, 70].

Scenario 2: Tax Increment Financing (TIF): The term TIF refers to a financial instrument that attempts to remove physical blight and encourage economic development. Its implementation includes the creation of a geographical district, where the tax base (i.e. property values) is “frozen” for a long period of time, usually 10 to 25 years, under the assumption that the area would not develop but for the planned intervention and therefore the creation of the TIF district (known as the “but for” requirement). As investments begin to take place within the TIF area, property values increase, and so is the tax revenue. The new property tax minus the tax on the frozen property values (tax increment) is collected by the TIF authority and used either to repay the capital costs of the investments or to support further development [14, 71].

Scenario 3: Joint Development: It refers to the establishment of cooperation between public and private entities, usually public transport authorities and real estate developers, in order to develop an urban project under Transit Oriented Development (TOD) principles. The basic principles of this method are that the private entity is responsible for compensating the public entity through payments or cost sharing agreements and that all parties are involved in the process voluntarily, although the result is a legally binding agreement. A main difference of joint development, in comparison to betterment tax and TIF, is that it does not require identifying the direct and indirect impact of transportation infrastructure in order to be implemented, as in the case of the two aforementioned mechanisms [7, 72].

MAMCA Step 2: Stakeholder Analysis

One of the first definitions of the term “stakeholder” was given by Freeman in his book “Strategic Management: A

Stakeholder Approach”, according to which stakeholder is every individual or group of individuals that can be affected by the achievement of the goals of an organization. With a focus on urban transportation issues, stakeholder is everyone who has a specific interest regarding a policy or measure on the field of transportation. At the beginning of each decision – making process, all stakeholders should be identified and determine who will participate in the process, in which stages and to what extent. The involvement of many different stakeholders leads to the maximization of the volume of available information and helps in taking into account every opinion and point of view.

In this step, the stakeholder analysis took place, under the objective of selecting the most suitable stakeholders to be involved in the decision making processes concerning the implementation of innovative financing tools. Following that, their categorization in six groups was accomplished, trying to achieve the maximum possible homogeneity within the groups, regarding the stakeholders’ objectives.

The selection of the six groups of the stakeholders in the context of this methodological framework was based on an extensive and comprehensive literature review (e.g. [73–77]), as well as on authors’ experience and discussions with experts from all over the world during several International Conferences and Workshops in which the authors have participated.

The six groups that were formed are the following (Fig. 2):

- **Group A: Government/Local Authorities.** The critical decision makers in most cases of ex-ante transportation policies’ evaluation worldwide are the country’s elected government. Even when the policy is directed towards a specific city or area, central government is in charge of making the final key decisions, when facing multidimensional and multidisciplinary issues. Value Capture Finance is certainly a multifaceted issue, and its implementation is usually associated with essential institutional and legal settings. Therefore, it is considered necessary to include in the first stakeholders’ group, governmental actors from three policy levels: country, region, city (municipality).
- **Group B: Transport Authorities.** The second group comprises transport authorities responsible for the operation of the different transport modes/lines. It is important to record the views of representatives of as many transport authorities as possible, regardless which mode the VCF policy is planned to affect; their feedback could provide the analyst with crucial information regarding potential expansion of the policy to other modes/target groups.
- **Group C: Universities/Research Institutions.** The literature review has also indicated the importance of including experts with an academic or/and research background in the decision making process for transport-related problems (e.g. see [73, 74, 78, 79]). The inclusion of this stakeholders’ category is also suggested by the EU Guidelines (2013) on Developing and implementing a sustainable

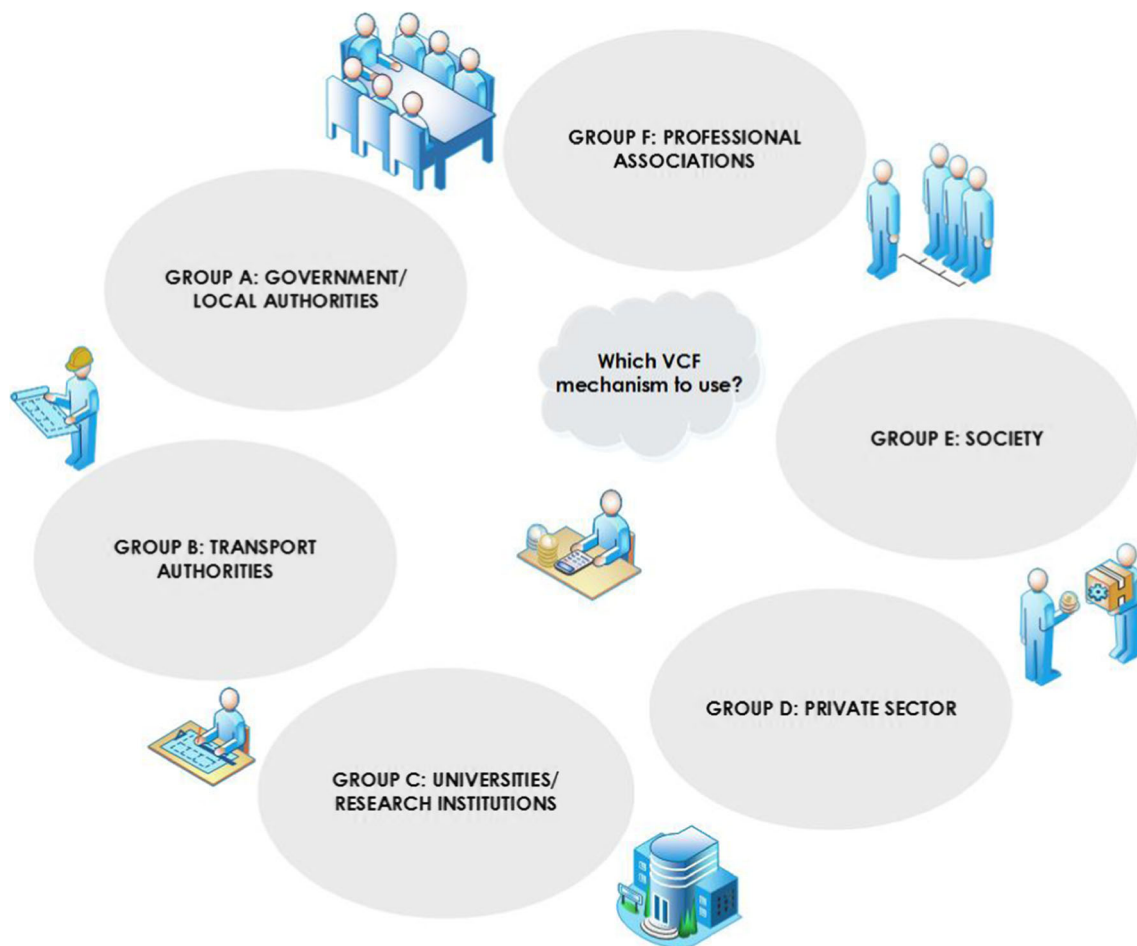


Fig. 2 Stakeholders involved in decision making concerning VCF mechanisms implementation for transportation infrastructure (Own setup)

urban mobility plan [77]. Based on the complex nature of VCF policies, special attention should be paid on selecting actors with diverse academic/research interests, in order to gain insight in many different dimensions of the problem and, through this interdisciplinary approach, reveal aspects that would not be easily perceived if for instance only transportation engineers took part in the analysis. It is thus suggested to include in the third group, in addition to them, urban and regional planners, transportation economists, land use planners, real-estate experts etc.

- Group D: Private Sector. The fourth group consists of representatives of leading transport companies and consultancies, as well of the banks' real - estate departments. Private sector has an indisputably major role in the successful implementation of policies based on the value capture notion, as many variants of the existing VCF tools focus on developers and non-residential properties.
- Group E: Society. Society is a very broad term; here it refers to organized social groups formed by a number of citizens who share common interests/aspirations (e.g. cyclists' community, environmental groups, student associations etc.). In this paper, the approach of the EU Project

CH4LLENGE (Addressing the four Key Challenges of Sustainable Urban Mobility Planning) [80] is followed, according to which the term "stakeholders" refers to organized groups and associations and is different from the term "citizens" which correspond to the wider public opinion. In order to investigate the public perception towards the potential introduction of a financing tool based on the VCF concept to partially finance the Thessaloniki Metro project, a Stated Preference (SP) questionnaire survey was designed and addressed to the citizens living/commuting/working in the proximity of planned metro stations. The SP survey was conducted in order to act in a complementary way to the stakeholders' survey presented herein.

- Group F: Professional Associations. The last group is titled professional associations and includes representatives of associations/chambers of relevant fields such as transportation engineers, civil engineers, urban and regional planners etc.

It might appear rather "peculiar" to the reader that four out of six stakeholders' groups appear to be well briefed and

informed about the topic, which might imply an over-representation of experts in our sample. However, this is not the case in Greece, where the Value Capture concept is still very outside the Greek mentality, even among the experts; this observation is proved by the answers in a question about the degree of familiarization of the interviewee with the VCF concept, which followed the weight elicitation. Only a 3% of the survey's participants claim to have excellent familiarization, followed by a 14% of respondents who characterized their familiarization with the concept as "good". The rest responses were as follows: 30% average, 26% fair and 27% poor degree of familiarization. Therefore, in our case, this cannot be considered as a source of bias, as it could possibly be in the case of applying the methodological framework to a country with a long VCF experience.

MAMCA Step 3: Definition of Criteria and Weight Elicitation

As already mentioned earlier in this paper (in the methodological framework part), one of the main characteristics of the MAMCA methodology is that it uses a different value tree for every stakeholder group, and the criteria comprising each tree should be in line with the objectives and aspirations of that specific group; this is in contrast with the way the criteria are normally formed in typical MCDA methods [32] where the criteria often describe the possible consequences or potential impact of the policy in discussion. In cases when the previous step has been carried out with caution and all the relevant stakeholders have been included in the process, these effects are usually reflected in the stakeholders' goals [56].

The experience from MAMCA applications so far indicates that there is no common recipe that could be used in all cases regarding the identification of stakeholders' objectives and their translation into criteria [53]. Munda [81] argues that the formulation of the criteria is preferable to be performed by the analyst(s)/researcher(s), due to the fact that technical issues such as overlapping or linguistic vagueness should be avoided. An initial list with possible criteria could be formed based on the relevant bibliography and the specific decision problem, and then stakeholders could be given the opportunity to express their opinion on these criteria through an interactive process (e.g. telephone interviews, workshops etc.) in order to validate them, or/and suggest different/additional ones [17].

This process is rational when the examined transport policy, the alternatives of whose are going to be evaluated, is familiar to the majority of stakeholders. Even when some of the alternatives are novel, usually the stakeholders have from the beginning a general idea concerning their attitude towards the policy. Therefore, when investigating VCF policies, the following issue arises: In cases where value capture is well-established as a policy option for financing transportation

infrastructure in national, regional and/or local level, the approach according to which the initial list of criteria is discussed with representatives from all the stakeholder groups can be adopted. In countries/regions where one or more mechanism(s), belonging to the value capture family, has been or is being currently used for financing transportation infrastructure, obviously there would be many stakeholders who have already been involved more or less in the implementation procedure and even more who, regardless if they have not been directly involved yet, are informed in detail about the VCF concept. Contrary to that, in countries/regions with no tradition in such transportation financing practices, Greece being one of them, it is normal and rather expected, for even key actors, to have limited (or not at all) familiarization with these financing techniques. Hence, in these cases, communicating with stakeholders to ask them to define their targets and correspondingly, criteria, would not offer much help to the researcher; it could even further complicate things. In light of this ascertainment, the objectives/criteria in these cases is desirable to be suggested by the analyst/researcher who, after having studied thoroughly the relevant literature is supposed to have comprehensive knowledge on the topic, and to be familiarized with the international experience. Nevertheless, stakeholders should be given the freedom to express their views on the criteria forming their value tree, because this notion is located in the heart of MAMCA: the substantial participation of stakeholders in all stages of the analysis, and this is done by providing them with the option to suggest additional criteria at the end of the questionnaire.

The different criteria that are selected for each stakeholder group comprise the overall decision value tree, which is illustrated in Fig. 3.

The diagram reveals that Group A (Government/Local Authorities) is the one with the biggest number of identified assessment criteria (15). This is rational, due to the fact that this is the main decision-makers' group, including actors from all levels of authority, and hence their objectives are multiple as they are supposed to represent the interests of the society as a whole (see also [34, 67]).

A comprehensive questionnaire survey was designed for the purposes of the weight elicitation, based on pairwise comparisons of the criteria, using the 9-point Saaty's scale. The survey was conducted between October and December, 2015. The preferable method was direct face-to-face interviews with all stakeholders' groups representatives, after arrangement of an appointment. Only in cases where this could not be an option (due to distance reasons or lack of time caused by the stakeholder's tight work schedule), the communication took place through telephone interviews and/or e-mails.

Totally, 70 stakeholders from all six groups participated in the survey. The allocation of them among the groups is presented in Fig. 4a. The majority of interviewees belong to Group C "Universities/Research Institutions" (33%), which is rational

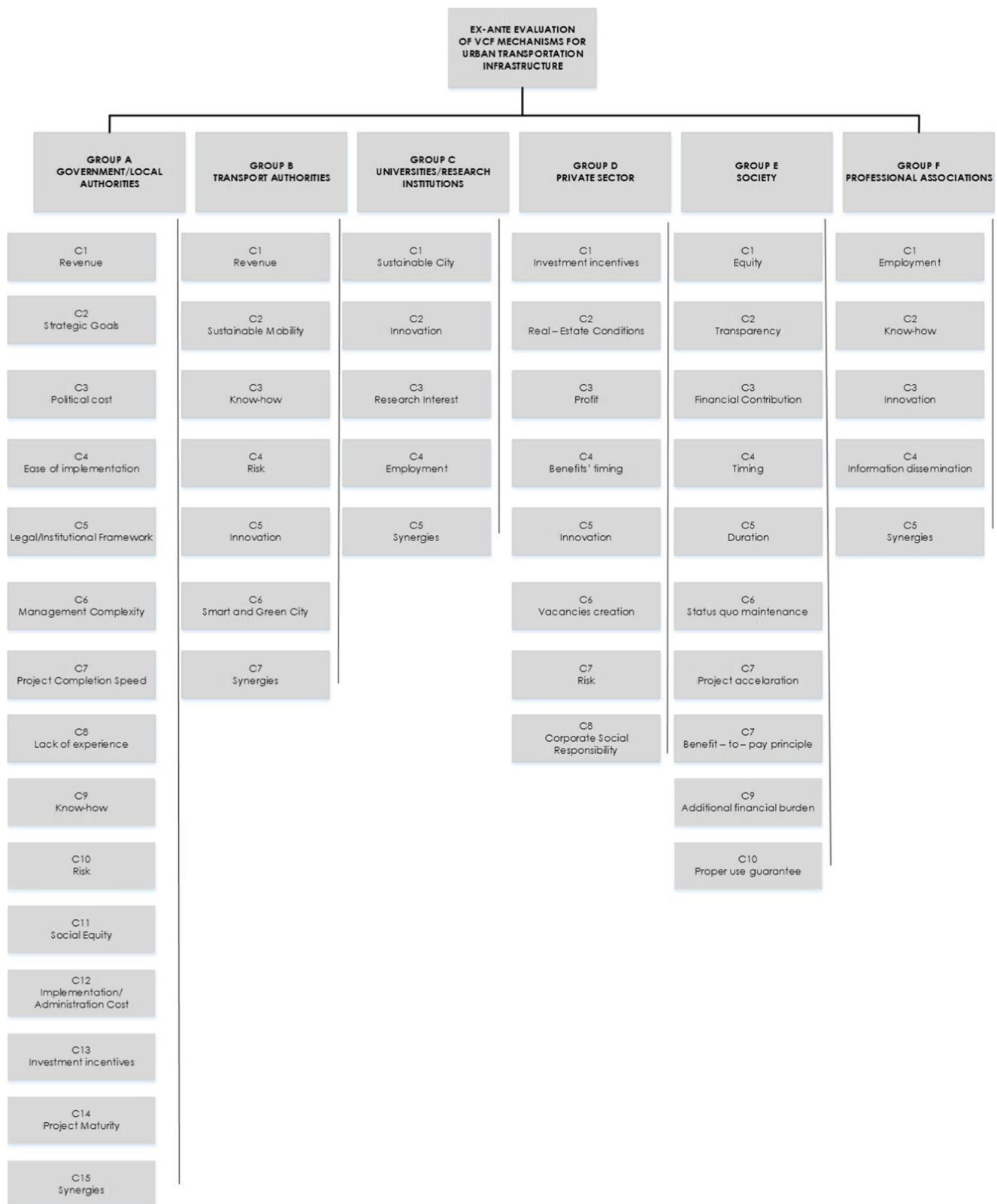


Fig. 3 Decision tree for the ex-ante evaluation of VCF mechanisms for urban transportation infrastructure (Own setup)

because people working in an academic/research environment are used to participating in similar questionnaire surveys and as

a result they are usually more approachable and they are willing to answer. The next biggest group is the one comprising

representatives from the central government and local authorities, covering 1/4 of the sample. The response rates reported are very satisfactory and remarkably high comparing to similar surveys involving stakeholders (Fig. 4b) (e.g. see [81]).

After the collection of the 70 questionnaires, the stakeholders' answers were used to calculate the geometric means per group, and following that, the weights of the criteria per actors' group were calculated. The results are presented diagrammatically in Appendix A (Figures I to VI).

The most important criterion among actors of Group A (Government/Local Authorities) appears to be social equity. At the other end are located criteria as the ease of implementation and lack of experience (which could act as an implementation barrier, and they are keen on avoiding that). Low importance was given by this group's actors to the political cost criterion, which is rather surprising as this category includes amongst others, politicians. It might be explained by an implicit "marketing" strategy; they know that it does not sound very nice to put emphasis on political cost during an interview of any kind and they attempt to shed light on social equity instead. In any case, the motivation behind this result is worth further investigation.

Stakeholders from Group B (Transportation Authorities) believe that the risk associated with each VCF financing mechanism should be a prevailing criterion in the assessment process, slightly more important than the estimated revenue for the authority. The promotion of sustainable mobility follows, whereas the development of synergies between different disciplines and authorities is the least important criterion according to them.

The most significant criterion for Group C (Universities/Research Institutions) is the promotion and enhancement of the sustainable city vision. Synergies are placed relatively high in their value tree as well, almost sharing the second place with the employment creation criterion. The least critical criterion for them is innovation, but with a really slight difference from the remaining one, namely research interest.

For the actors of Group D, Private Sector, three criteria are the most powerful: profit, risk, and benefits' timing, while innovation and corporate social responsibility are weighted

as the least important among the seven criteria used. Societal actors would like to be sure that the revenue from the VCF mechanisms will be used for the decided purpose only, and they want to avoid phenomena of corruption or/and improper use of the collected revenue, making the guarantee for proper use their first choice among the criteria. This way of thinking is supported by the fact that the following important criterion according to them is transparency; equity and benefit - to - pay principle come next. The maintenance of their status quo (usually related to the NIMBY (Not In My Backyard) Syndrome) is the least significant criterion for them.

Stakeholders included in the Professional Associations group (Group F) argue that the know-how acquisition is the most crucial criterion, followed by synergies' creation while employment vacancies' creation comes next. The dissemination of information is the least important criterion in their view, having only a slight lower weight from innovation.

MAMCA Step 4: Indicators and Measurement methods

One of MAMCA strengths is that it can be performed, from the beginning to the end, without using a single quantitative criterion, only with the use of qualitative judgments. This approach might not be preferable when quantitative data is available, however, the possibility offered to draw conclusions even in cases where there is a lack of them, utilizing every kind of available information, is extremely important [32, 52].

In the current analysis, the ratings of the majority of criteria cannot be expressed in quantitative or monetary terms, as VCF policies have a long-term impact and the criteria are of heterogeneous nature. As already mentioned before, Greece is a country which has no experience so far on the topic of financing transportation infrastructure through Value Capture. Due to this fact, the three scenarios that are built for the purposes of this research include hypothetical characteristics – they do not refer to tangible quantities that can be measured in monetary terms. Our aim is to identify the tendency of stakeholders towards the Value Capture in Greece,

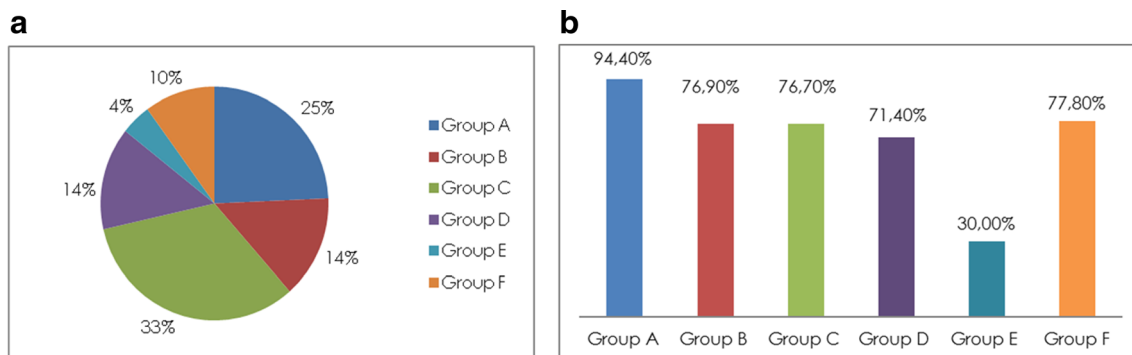


Fig. 4 a Allocation of stakeholders (%) in the six groups, b Response rates (%) per group (Own setup)

and more specifically towards the three different types of it that are most widely used worldwide.

Notwithstanding, the suggested methodological framework offers the flexibility to add values to the quantitative criteria and repeat the analysis in case the realization of a VCF financing scheme moves from theory to practice in the Greek context. But in the present research, similarly with the approach followed by Macharis and Cromptvoets [33] and Dooms and Macharis [44], the measurement methods related to the selected indicators are all qualitative in nature as the considered alternatives are future situations that have not been implemented yet.

MAMCA Step 5: Overall Analysis and Ranking

In this step every alternative (from step 1) is evaluated with respect to the different criteria for each stakeholder group (step 2). There are three main approaches by which the evaluation of each scenario on the criteria can take place, namely the analysts' approach, the experts' approach and the stakeholders' approach. Usually, a combination of the first and the second approach is the advisable way to perform the evaluation; the analysts should use their experience on the examined topic and the knowledge obtained by years of relevant research and then discuss their views with a multidisciplinary team of experts; this way, a non-subjective and robust basis for the analysis is provided. The third approach could be a possible source of strategic bias, as the stakeholders have already been given the chance to prioritize their objectives, and an additional inclusion of their opinion on the evaluation of the scenarios, could possibly affect the final outcome in favor of their own interests [17]. The evaluation can be done with the aid of any MCDA method. Usually AHP or PROMETHEE - GDSS are selected, due to the fact that they are both user-

friendly and they are supported by robust bibliography in transport-related applications [17].

In this case, similarly to the weight elicitation in step 3, the AHP method is used for the evaluation of the different scenarios. The authors evaluated the different scenarios with the aid of pairwise comparisons on the 9point Saaty's scale. This evaluation was based on the authors experience based on multi-year research on the topic, and was also supported by key experts' consultation combined with an in depth literature study (this approach was also followed by [33, 37]).

MAMCA Step 6: Results

The multi-actor view which is the global outcome of the MAMCA is illustrated in Fig. 5. The left vertical axis corresponds to the evaluation score of each one of three alternative scenarios, while the six different stakeholders' groups are displayed in the horizontal axis. The orange line represents Scenario 1 (Betterment tax), while Scenario 2 (TIF) is shown with the blue line and the last one, Scenario 3 (Joint Development), is illustrated using the green line. Scenario 1 appears to have obtained high scores only in Group A, Government/Local Authorities, and its score is lower, but remains quite stable in the other five actors' groups. In contrast to that, Scenario 2 has the lowest evaluation score among the three alternatives in Group A and the highest in the last group, Professional Associations. Joint Development (Scenario 3) gets its highest score when the Private Sector is concerned (Group D).

Group A (Government/Local Authorities) and Group B (Transport Authorities) appear positive towards the implementation of a Betterment levy scheme, which means that according to their opinion it is preferable to share the burden among the citizens (indirect beneficiaries) of the area and not

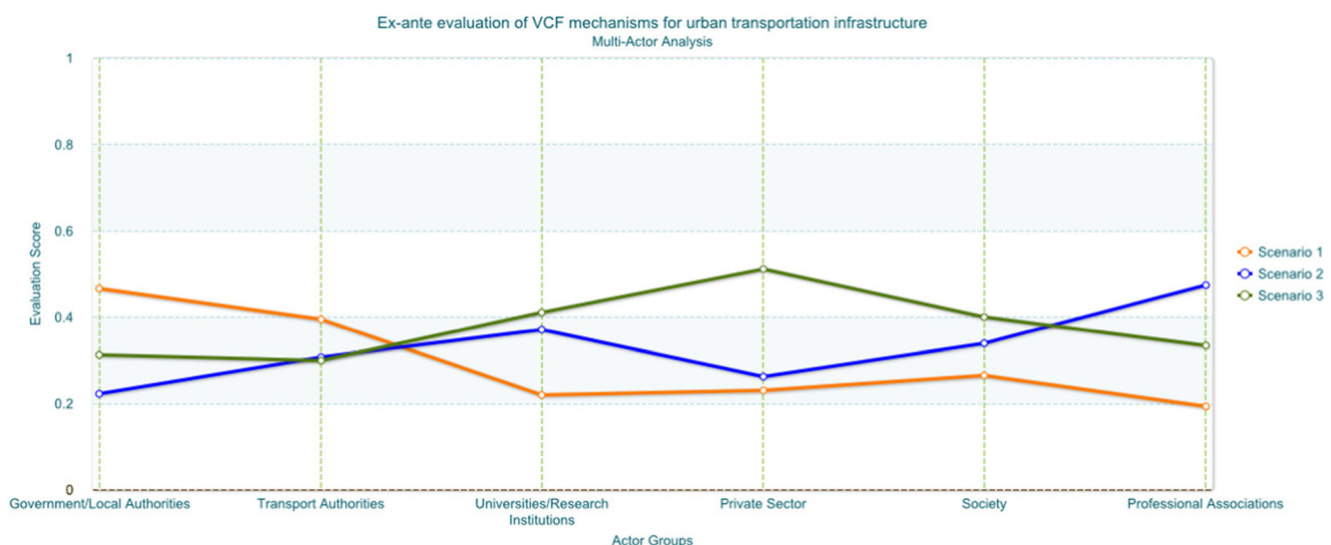


Fig. 5 Multi - Actor Line Chart (MAMCA Software, own setup)

include the developers to the financing scheme of the metro. On the contrary, the following three groups (Universities/Research Institutions, Private Sector and Society) tend to prefer the scenario which calls for a wide developers' participation. The Professional Associations (Group F) support the Tax Increment Financing, which stands somewhere in between the other two scenarios, as it involves both citizens' and developers' engagement. Overall in the global ranking, Scenario 3 (Joint Development) is first, followed by Scenario 2 (Tax Increment Financing – TIF), while Scenario 1 (Betterment tax/levy) is the least preferable solution.

But despite the fact that this multi-actor view allows a clear comparison between the preferences of the stakeholder categories, more important than the overall ranking is to gain insight in the strong and weak aspects of each alternative for the different stakeholder groups. This can be done through the production of single-actor view diagrams [37, 38]. The straight line within each diagram represents the mean value for every scenario, taking into account the score of all the criteria for this specific scenario.

Figure 6 presents the evaluation of the three different scenarios from the view of the governmental and local authorities' actors. It is noteworthy that Scenario 1 gets a remarkably high score in many criteria that are related to implementation issues (e.g. ease of implementation and the existence of a supportive legal/institutional framework), while at the same time in others such as the political cost and the provision of investment incentives scores particularly low. The score on revenue and risk criteria is also high with regard to Scenario 1. Group A appears to associate more the introduction of TIF mechanism with potential political cost, whereas at the same time the lack of experience on this specific financing tool seem to worry them more, comparing to the other two

scenarios. Joint development is considered the financing option which is capable to accelerate the project construction more than the others, while stimulating investment in the area. This is not a surprise as investments' motivation is inherently connected with the notion of joint development mechanisms. Furthermore, the actors of this group appear to prefer Scenario 3, also in terms of synergies' promotion; nevertheless, in terms of social equity (which is a particularly important criterion for this group, as revealed by the step 3 of the analysis), this option gets the last place and Scenario 1 has an indisputable precedence.

Actors belonging to the transport authorities' group (Group B), believe that the introduction of a betterment tax would be capable of bringing more revenue to their treasury, but they do not consider this mechanism very innovative, as a TIF scheme could be. Apart from novelty, TIF policy gets a higher evaluation score on the know-how criterion as well, but it is associated with the highest risk among the three alternatives as well. In terms of sustainable mobility, for this stakeholders' group, joint development appears to be the VCF policy more likely to achieve it. This might be related to the beneficial role of joint development in supporting TOD, which was mentioned earlier in this paper. In terms of synergies, Scenario 3 is on the first place again, while Scenario 1 scores notably low on this criterion (Fig. 7).

Group C, which includes actors from Universities/Research Institutions, is in favor of Scenario 2, in terms of research interest, innovation and synergies. Scenario 3 appears the most promising regarding potential job vacancies' creation, and does not have a very low score in none of the criteria. Sustainable city is the criterion with the highest score in Scenario 1, but this seems to be outbalanced by the low scores the other criteria obtain (Fig. 8).

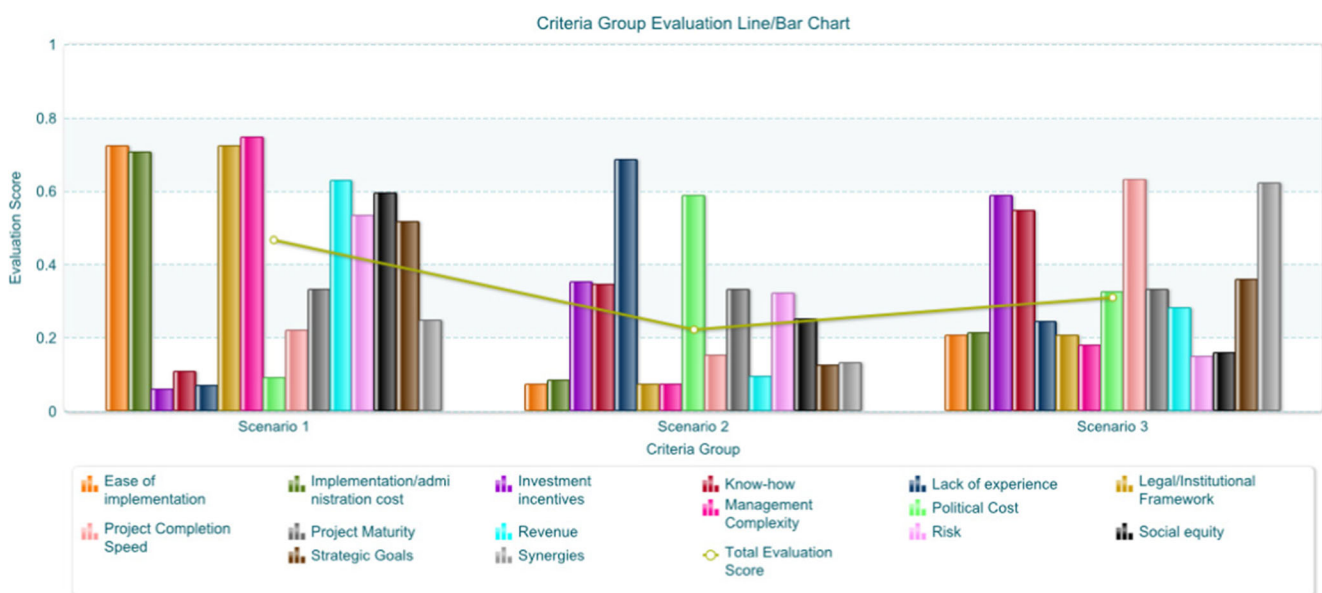


Fig. 6 Criteria Group A Evaluation Line/Bar Chart (MAMCA Software, own setup)

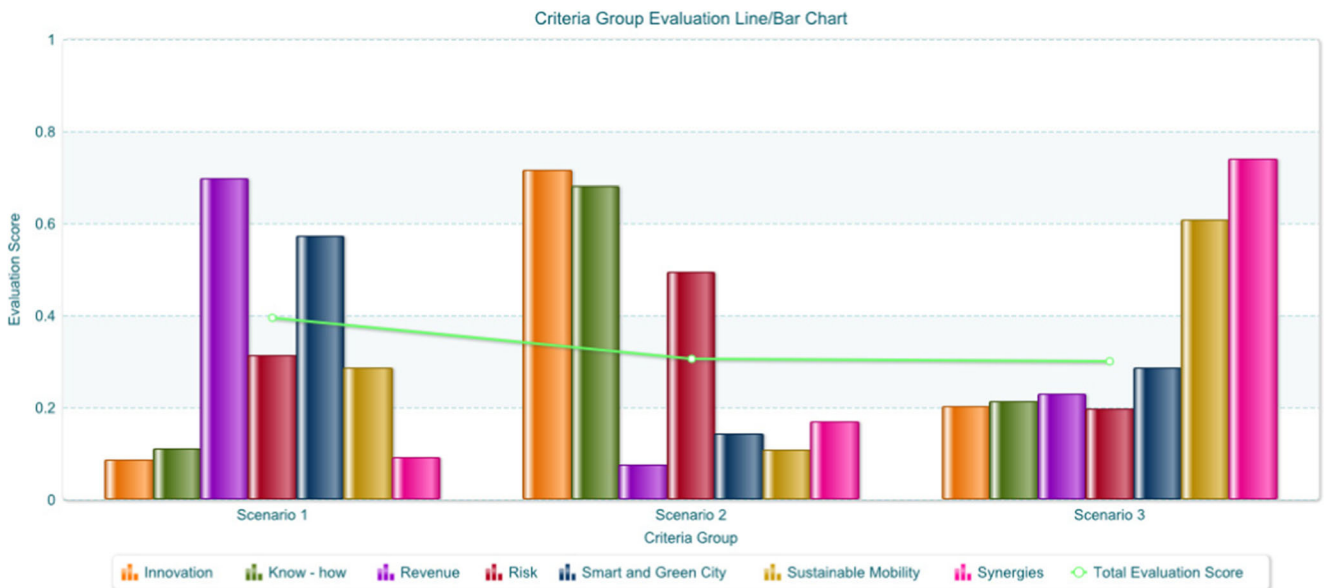


Fig. 7 Criteria Group B Evaluation Line/Bar Chart (MAMCA Software, own setup)

Scenario 3 scores remarkably high in almost all the criteria of Group D, Private Sector, and actors seem to relate joint development policies to a low risk percentage. Scenario 2 presents a more balanced image, with investment incentives and real-estate conditions having the highest values in the evaluation. In contrary, Scenario 1 is considered rather risky and probably as a consequence to that, its score on all remaining criteria is low (Fig. 9).

Societal actors (Group E) appear rather indecisive, as their bar chart (Fig. 10) indicates: There is large divergence among criteria scores regarding all three alternative scenarios. Scenario 1 gets a high score on the benefit - to - pay principle

and equity criterion, in reverse with Scenario 3, while Scenario 2 is considered way more transparent.

They think that joint development is more likely to prevent them from drastic changes, as the status quo maintenance criterion gets its higher score in the evaluation of Scenario 3; the least convenient mechanism in terms of this criterion is the betterment tax of Scenario 1. Group F comprises actors from Professional Associations. Figure 11 reveals that they tend to be in favor of Scenario 2, as it comes first in four out of five of the established criteria, with the employment opportunities' creation being the only exception. The highest score towards this criterion is obtained by Scenario 3 .

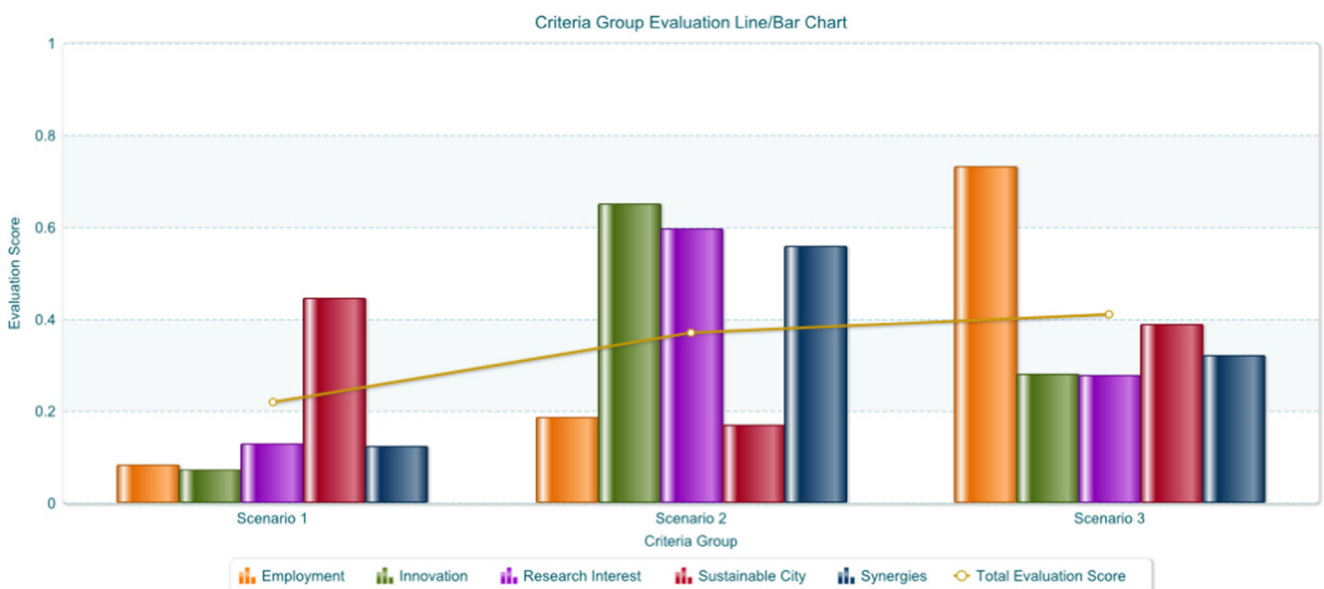


Fig. 8 Criteria Group C Evaluation Line/Bar Chart (MAMCA Software, own setup)

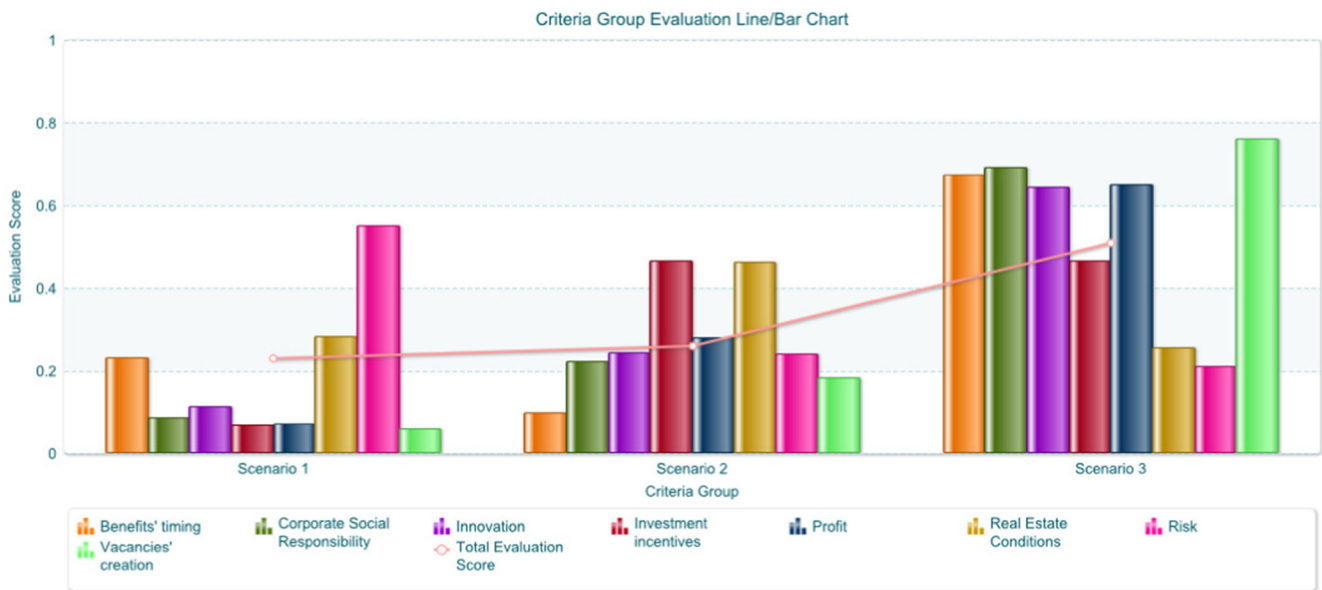


Fig. 9 Criteria Group D Evaluation Line/Bar Chart (MAMCA Software, own setup)

5 Conclusions and perspectives

This paper introduces the MAMCA as an ex - ante evaluation method for different VCF mechanisms for urban transportation infrastructure. MAMCA emerges as a robust methodology for this assessment and it appears to be capable of dealing with the VCF complexity and multidisciplinary nature. The analysis and synthesis of the obtained results revealed very interesting observations concerning the degree of acceptability of innovative financing policies based on the value capture concept and highlighted the benefits as well as the limitations through the eyes of those who will have an impact on (or be affected by) a potential future implementation of those

policies. Furthermore, noteworthy similarities but also contradictions among stakeholder groups emerged, highlighted by the different criteria used for each group.

An innovative feature of this research is that although the critical role of stakeholders in the successful introduction of a financing mechanism which is based on the VCF concept is often mentioned in the literature, to the best of our knowledge, there are not any comprehensive attempts so far to integrate them to the VCF decision making process. The approach presented herein provides valuable insight into the extremely critical and sensitive issue of transportation financing through Value Capture and it is expected to stimulate and enhance interaction between actors on policy level in Greece regarding

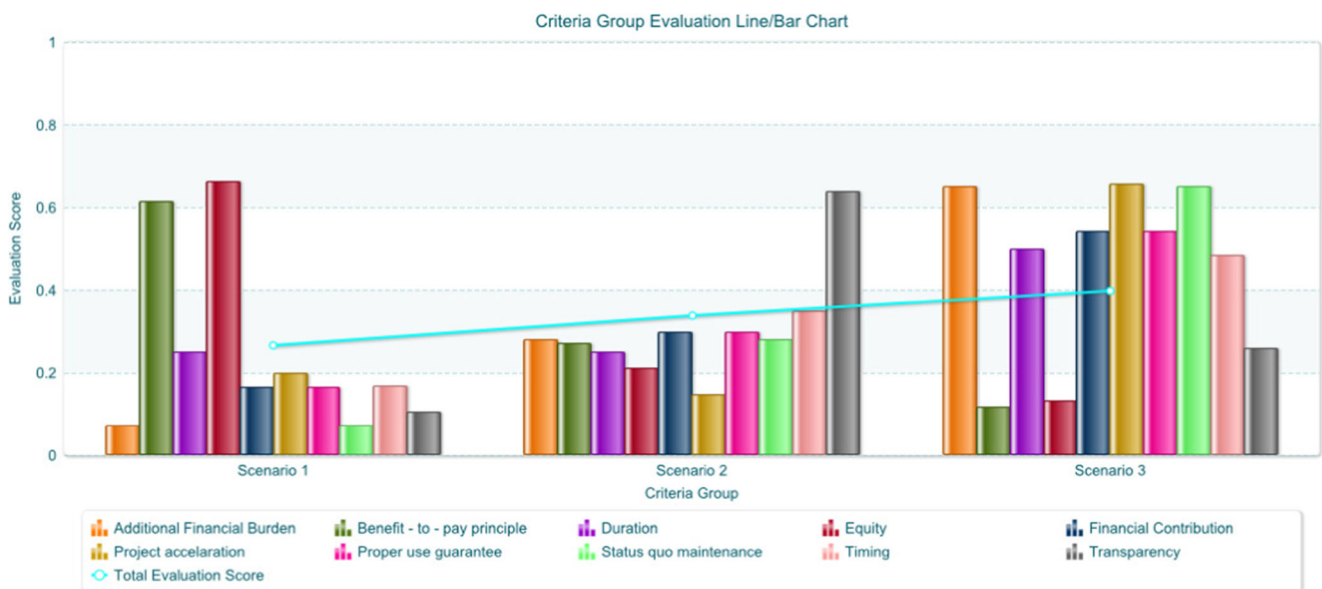


Fig. 10 Criteria Group E Evaluation Line/Bar Chart (MAMCA Software, own setup)

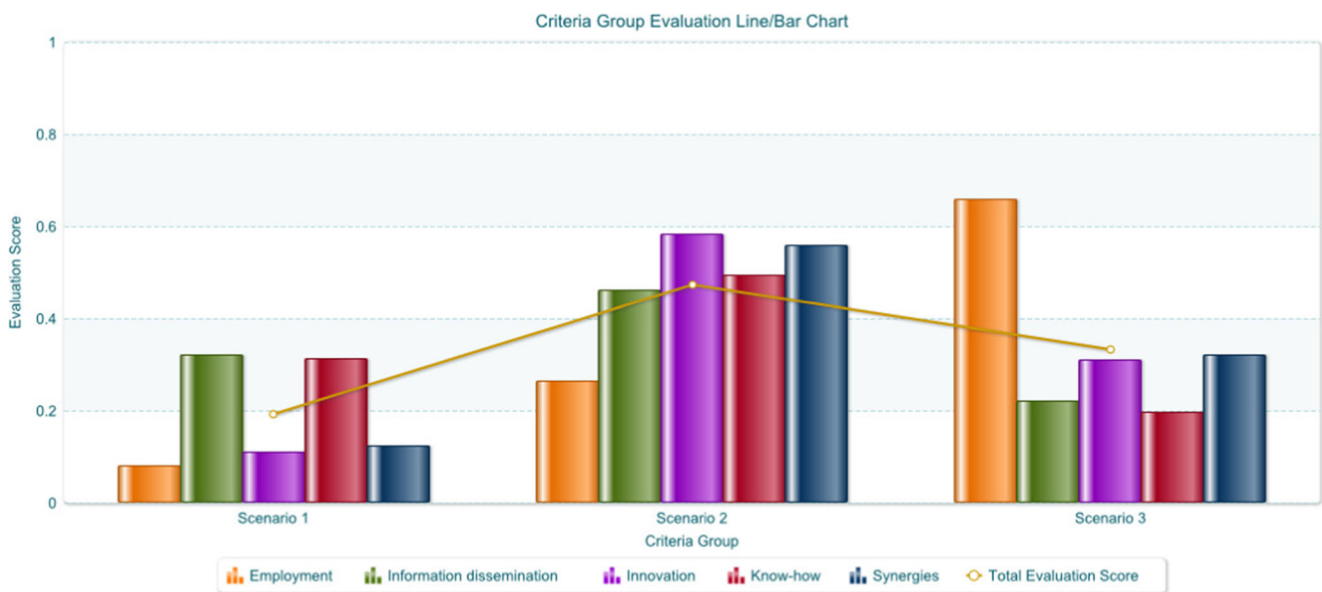


Fig. 11 Criteria Group F Evaluation Line/Bar Chart (MAMCA Software, own setup)

this topic. This view is strengthened by the fact that all the stakeholders that have participated in the survey were interested to learn details about when the results of the survey are expected to be published and the great majority of them expressed their willingness to participate in a potential future consultation process regarding the introduction of VCF mechanisms in Greece. Moreover, it demonstrates that, in order to achieve the challenging task of planning sustainable cities, a broad and in depth dialogue with all involved stakeholders is needed before the introduction of new financial mechanisms for transportation infrastructure.

The generally positive attitude of stakeholders towards the value capture concept is a remarkable outcome, due to the fact that the results of two other questionnaire-based surveys which had taken place earlier, in the context of the same overall PhD research objective, and were addressed to citizens of Thessaloniki and to business - commercial owners of areas adjacent to the planned metro stations' location had a very different outcome. According to the first survey, most citizens consider that the new metro line would have a very positive impact on urban quality of living and property values of surrounding areas; however, the vast majority of them is strongly opposed to a potential monetary contribution to the project. Likewise, the second survey concluded that although the majority claims that an increase in value of metro stations' surrounding properties is a very probable future scenario, the positive climate is all of a sudden reversed when the VCF concept is introduced in the discussion. The question about whether they are willing to contribute financially by a special tax/tariff to the metro financing process gets a resounding "no".

Another interesting outcome of the present analysis is that all stakeholders' groups placed "social equity" in a high rank in

their preference scale. A very intriguing outcome is also that three groups that one would expect to share only a few (or even none) common aspirations, namely Group C: Universities/ Research Institutions, Group D: Private Sector and Group E: Society, chose Scenario C: Joint Development as the most suitable for the financing of the Thessaloniki metro project. All three of them appear to support the involvement of developers on the financing of the metro, while only one (Group D) could actually claim a profit of this involvement. On the other hand, the investigation of Government/Local Authorities (Group A) and Transport Authorities (Group B) gives a more expected result, as it is kind of "traditional" in Greece lately for the authorities to consider the charging of citizens (through special taxes/levies) as the most rational process to follow.

Ideas for future research include using PROMETHEE method instead of AHP for the evaluation of the alternatives and comparing the results with those presented herein, performing a sensitivity analysis to check the consistency of the outcome and eliciting different weights to the stakeholders' groups to investigate the impact of this action on the alternatives' ranking. Furthermore, the survey that took place in Thessaloniki could be used as a pilot for similar researches in other cities, possibly with a broader sample of participants as well. Last but not least, the two predominant VCF scenarios (Joint Development and Betterment tax) should be further analyzed together with potential implications of the possibility of their introduction.

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