RECONCILING STAKEHOLDER INTERESTS REGARDING TRANSPORT INFRASTRUCTURE PROJECTS: LEARNING FROM USING DIFFERENT APPROACHES

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ABSTRACT

This paper discusses the possibilities of applying both qualitative as well as quantitative methods to complex decision-making problems, i.e. problems involving multiple stakeholders with conflicting objectives. The main features of both approaches are discussed, in particular their ability to adequately accommodate stakeholder interests. Both approaches are illustrated using a number of real-life case studies mainly in the field of transport infrastructure and safety. The main idea of this paper is that using both approaches in conjunction with each other provides the most adequate basis for initiating a social learning process. And it is ultimately this social learning process that may eventually make it possible to create momentum for building effective compromises and successfully implementing a decision.

Keywords: stakeholder management, multi-criteria analysis, project evaluation, decision making.

1. INTRODUCTION

The design and implementation of large infrastructure projects or policy measures often constitutes a complex process. Most of the time various stakeholders are involved in the decision-making process and each stakeholder looks at the problem from his/her own particular point of view. Stakeholders are defined here as a group of people who have a stake (financial or other) in the decision-making process, or in terms of Freeman's (1984:86) definition a stakeholder includes 'any individual or group who can affect an organisation's performance or who is affected by the achievement of this organisation's objectives.' For instance, as regards transport infrastructure projects, the logistic sector is interested in the logistic benefits, such as time savings, economies of scale, reduction of the operational cost, etc. Local or regional communities are interested in the economic benefits for the local community e.g. in terms of job creation or increased revenues. People living nearby the infrastructure project are interested in increased or decreased mobility, but also in the reduction or elimination of external effects such as noise and air pollution. Environmental pressure groups are also concerned about these external effects, but rather in a broader or global context, i.e. including external effects such as global warming. Sometimes, the project also impacts on the social relations within a community or on the distribution of income. The particular stakeholder points of view seldom result in one project alternative being preferred by all stakeholders. Hence, the decision-making problem is said to be complex or even conflictual.

In this contribution various techniques to frame and align stakeholder views will be discussed. These will be classified into two broad categories, namely qualitative methods such as framing on the one hand (section 2) and quantitative methods such as multi-criteria analysis on the one hand (section 3). Throughout the paper, both categories will shortly be illustrated by referring to some practical examples. The strengths and weaknesses of both categories will be contrasted and we will also try to identify how the effectiveness of one category of methods can be improved by integrating features from the other category. The fourth section concludes.

The conceptual framework within which this research is carried out is the institutional paradigm in economics, in particular the old institutional view of J. Commons (1934). In Commons' view, society is considered a complex entity of multiple actors with partly conflicting and partly converging interests. The various 'trade or social relations' involving these stakeholders often lead to conflicts, given problems of economic scarcity. The essence of economics is then to solve – or at least manage – these social conflicts so as to make possible the creation of economic welfare. Today, 'economic scarcity' should be broadened to include the ecological component (i.e. the ecological limits of development). Similarly, current alternative conceptual paradigms of multi-actor governance consider society as a complex web of actors that can only be steered by connecting different types of actor networks, an idea which is still consistent with the old institutional view.

2. QUALITATIVE APPROACHES FOR RECONCILING STAKEHOLDER VIEWS

2.1 The essentials of the qualitative approach to project evaluation

The current contexts for policy making are complex. In such contexts there is not one decision maker, but decisions have to be taken in an interplay between many actors. Governments are aware that they don't have the necessary power, legitimacy and knowledge to resolve unilaterally the complex issues with which they are confronted. Multi-actor governance refers precisely to the different complementary roles and functions that have to be fulfilled by governments as well as other actors (private sector, civil society) to steer decisions (Hovelynck et al., 2010; Huxham and Vangen, 2005; Termeer, 2009).

A social process perspective on problem solving and decision making draws the attention to the fact that the effectiveness of decisions depends both on the (technical content) qualities of these decisions as well as on the acceptation and involvement of the actors who have to contribute to the implementation of that decision (Schein, 1969). A 'bad' decision, which is based on a poor understanding of the causal links of the problem to be solved, can not lead to an effective solution. But evenly important is the social process component that is part of the whole decision-making process. The reason is that even the 'best' solutions (i.e. in terms of technical content) lack effectiveness when they do not get implemented by obstruction or lack of support from key stakeholders. In the literature on group dynamics and organisation development, which is at the origin of the social process perspective in organisation studies, the concept social process refers to the quality of the relationships between the actors. When analysing decision making, our attention has to go beyond the content qualities of the proposals and the formal qualities of the procedures.

The main methodological question in decision making is not a choice between qualitative or quantitative methods, but how these methods contribute to better informed decisions. Using these methods in interaction with each other results in more and better information that can be taken into account, better understanding and interpretation of the complex interrelations as well as the involvement of a larger number of stakeholders. Bouwen and Taillieu (2004) describe a social learning process precisely as two parallel but intimately intertwined processes. The first is a content-centred process focusing on the subsequent steps starting from the problem analysis till the implementation of the solution. The second corresponds to a relational process highlighting the challenges in each step to mobilise stakeholders and bring them together, stimulate dialogue and engage them in solutions. Especially when there is a need for social learning, defined concisely as 'learning together among a group of stakeholders to manage an issue together', good quality interactions among stakeholders are required to come up with innovative, inclusive and sustainable solutions.

The relational qualities of the interactions between actors will not only have consequences for the implementation but also for the quality of the content of the decisions. Although the implementation is seen as the last phase of a problem-solving and decision-making process,

the way in which this implementation is conceived has profound implications for the former phases, starting with the analysis and understanding of the problem (Cline, 2000). Traditionally, governments have treated implementation as a management problem. This means that the implementation depends on the (communicative) competencies of the public officers to convince all stakeholders of the superior qualities of the solutions that have been decided. However if we conceive decision making as a multi-actor process, then the attention shifts from the last to the first phase of the process (how do stakeholders understand and connect with the problem to be resolved?), and from one-way to two-way (or even more open) communication and dialogue between actors. This can be considered as a question of framing and dealing with ambiguities.

Framing has received a lot of interest lately in governance and management studies (Dewulf et al., 2009). Frames determine the concepts with which problems and situations are defined, they determine what is relevant, which factors have to be taken into account and which actors are to be considered as legitimate stakeholders. A framing approach conceives the problem solving and stakeholder involvement as mutually constitutive. The specific framing of a problem will define which stakeholders are to be included, while stakeholders define which frames have to be considered and connected. Stakeholders tend to take their frames as 'taken for granted' and have often difficulties to imagine that the world looks different through the frames of other stakeholders.

Methods for problem solving tend to focus on eliminating uncertainty. That means that they attribute a problem to a lack of information. This lack can be solved by expert studies gathering the lacking information. However, uncertainty is almost always interwoven with ambiguity. This means that there is a lack of clarity concerning what is at stake, how a certain problem has to be understood and what has to be taken into account. In other words, different actors frame a situation in a different way. Information always fits into a particular frame and as long as the actors do not agree on this particular way of framing, methods aimed at eliminating uncertainty cannot give satisfactory outcomes for all stakeholders (Brugnach et al., 2011). As a consequence, much more attention has to be given to the interactional process among stakeholders confronted with ambiguities.

2.2 Some examples of the qualitative approach to project evaluation

In her seminal work on multi-party collaboration, Barbara Gray (1989) described a general process approach fostering the interaction among stakeholders confronted with ambiguity. Her ideas were based on case studies related to local environmental problems in the United States. In 2003 she published a book describing and analysing in detail more than a dozen 'intractable environmental conflicts', in which a multi-actor process approach was able to generate a satisfying solution for all stakeholders. These conflicts are situated in the domain of natural resources management, water resources, toxics and growth management. Also in Europe, a multi-actor process approach started to catch the attention of scholars and practitioners from the nineties on. Especially in United Kingdom, public-private partnerships in the domain of public health, urban development and regional reconversion stimulated this trend (Huxham and Vangen, 2005). Case studies from all over Europe, America and to a lesser extent from Asia and Australia, were published in the proceedings of the bi-annual

MOPAN conferences (Multi-Organisational Partnerships, Alliances and Networks). The last 15 years the multi-actor process framework has also successfully been applied for a variety of development related problems in Africa and Latin America (Craps et al., 2004).

Whereas in the beginning multi-party collaboration seemed to be restricted to local natural resource problems, we can observe now a spreading out of the relevance and applicability of the approach. With the increasing complexity of societal challenges and the growing demand for public participation in government, there has been attention for multi-actor processes at and across different scales and domains. These cover local, as well as regional, national and international or global issues (like climate change, biodiversity or food security). Various related concepts, giving attention to multi-actor processes, have been developed, like social learning, transition management, multi-actor governance, etc. Each of these concepts carry different connotations that make possible and stimulate complementary actions and intervention possibilities (Dewulf et al., 2009).

In the domain of large scale mobility and transport projects positive as well as negative experiences with multi-actor processes are reported. This is not surprising because in this domain very powerful elements are in play, both in favour as well as against a process approach. The necessity to involve a variety of stakeholders, belonging to different sectors of society (like government, industry, civil society), with a clear stake in the projects under consideration, is in favour of a process approach. But often the interests and emotional involvement of the stakeholders (such as possible economic gains, environmental and health impact) is so high that a dialogue among them is not possible without a careful process design and facilitation from the start. However, precisely because of the issue under consideration (infrastructure), an engineering mentality has dominated this policy domain which is rather resistant to such a process approach. Schein (1996) describes an 'engineering management culture' as controlling and preferring linear, simple cause-effect and 'people free' solutions, based on quantitative models, which is quite opposite to the competences needed for the social process solutions of complex governance problems.

A typical example of such an engineering approach is the case of the 'Oosterweel Connection' aimed at completing the Ring Road around the city of Antwerp (in the Flemish region of Belgium). This city acts as a main transportation hub in Belgium. The Antwerp Ring Road is faced with heavy congestion due to international transit as well as port-related traffic. In 1995, the Flemish Government initiated a project aimed at extending the present Ring Road by constructing the missing link called 'Oosterweel link'. At present, the Ring Road has more or less the form of a semicircle and the Oosterweel project consists of giving the Ring Road a full circular shape so as to create extra capacity for road transport (see Figure 1). The Flemish government entrusted the project to an engineering group called 'BAM' (Beheersmaatschappij Antwerpen Mobiel) (i.e. the Management Company Mobility Antwerp) that came up with a plan for a prestigious long bridge. A variety of stakeholder groups felt highly involved and threatened by the project, but they were never actively consulted and started a fierce opposition movement against the construction of the bridge. As there was no social process to bring stakeholders together, opinions got gradually more polarised and politicised. Finally the opponents pushed towards a public referendum, which resulted in discarding the original bridge project. An alternative plan has been developed, but still without arriving at a real dialogue among the stakeholders, and as a consequence none of

the actors seems to be happy with the final solution (Van Dooren, 2010). Today (i.e. about 15 years later), the project is still in its preparatory phase, mainly due to the internal discussions and public opposition against the proposals of the Flemish Government as discussed above.

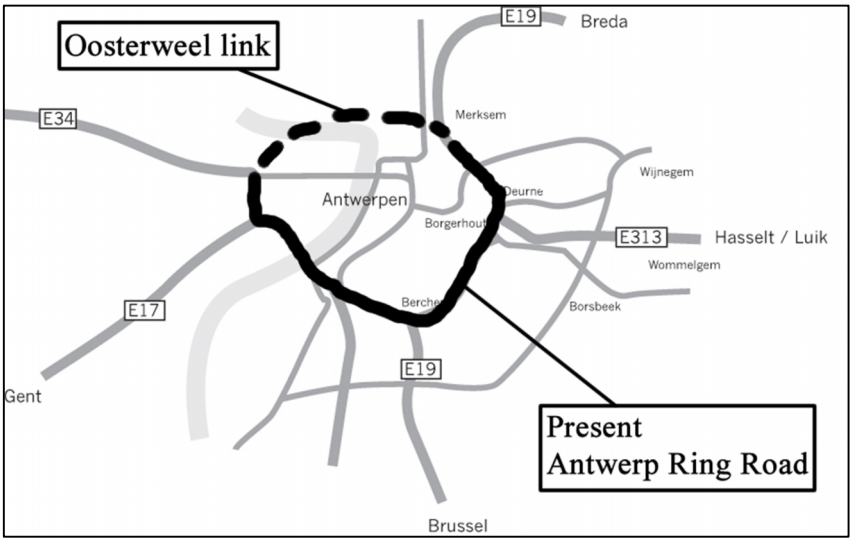

Figure 1 – The Antwerp Ring Road (Source: Google Images)

Although the Antwerp case is not very encouraging, it is not so difficult to find alternative examples in the domain of transport and mobility in which stakeholders have been successfully involved. For instance, for the expansion of the Frankfurt Airport, one of the main airway hubs in Europe, a so-called Regional Dialogue Forum was started, in which more than 150 persons, belonging to 50 different interest groups participated. Also in this case, high economic interests had to be balanced with the environmental and health concerns of the wider neighbourhood. As opposed to the Antwerp case, the Frankfurt project gave careful attention to all stakeholders. Skilled facilitators were hired to support a dialogical process among all stakeholders. The stakeholders engaged in joint fact finding, which was a great learning experience for all of the participants. In this way they succeeded in providing a sound basis for a structured, rational and objective public and political discourse, and a well-grounded counsel for the formal planning procedures (Schreckenberg et al., 2010).

In this as well as in the many other examples of successful multi-actor process approaches, decision making is not conceived as the result of a rational calculation of an anonymous 'general interest', with which nobody will identify. Rather, it is conceived as a co-creating process giving due attention to the identities and emotions of all the stakeholders as well as to the power relations and trust among them.

3. QUANTITATIVE APPROACHES FOR RECONCILING STAKEHOLDER VIEWS

3.1 Introduction

Within the category of quantitative approaches for reconciling stakeholder views, multi-criteria analysis (MCA) plays an important role. A variety of MCA methods exist. Some MCA

methods have been explicitly geared towards accommodating stakeholder interests. Here, the most known example is the multi-actor multi-criteria analysis (MAMCA). This method consists of seven steps as illustrated in Figure 2. This method will be described very briefly below, for more details we refer to Macharis (2004) who developed this method. For the purpose of this research, however, mainly step No. 6 (i.e. the construction of the multi-actor view) will be most important. As regards this step, several methods aimed at obtaining such a multi-actor view will be discussed in section 3.2.

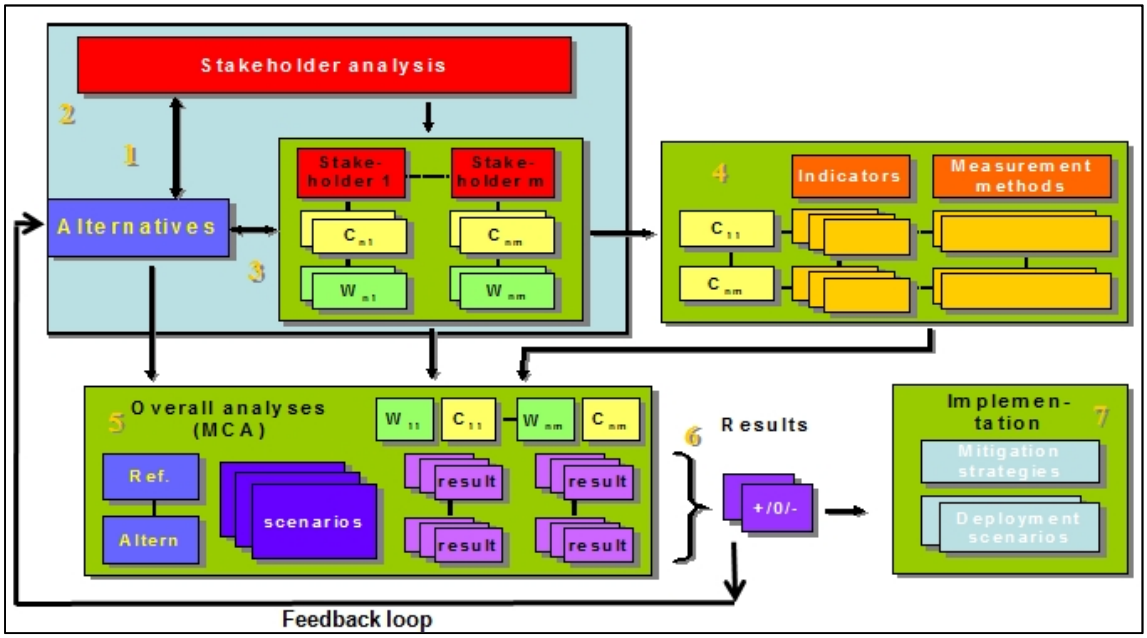

Figure 2 – MAMCA methodology (Macharis et al., 2004)

The first step of MAMCA is the definition of the decision-making problem and the identification of the project alternatives. This step is very important since the framing question is decisive for stakeholder identification. Identification of project alternatives on the one hand and stakeholder identification on the other hand are in fact mutually constitutive elements. In the second step, stakeholders are actually identified. In a third step, each stakeholder's objectives are identified and assigned a relative importance or weight. In the fourth step, for each criterion one or more indicators are constructed, e.g. direct quantitative indicators such as money outlay, the number of lives saved, reductions in CO2 emissions, etc., as well as scores on an ordinal scale such as high/medium/low for criteria for which the values are difficult to express on a metric (i.e. cardinal) scale. Also the measurement method for each indicator is made explicit, e.g. willingness to pay, quantitative scores based on macroscopic computer simulation, or other methods. This makes it possible to measure each alternative's performance in terms of its contribution to the objectives of the various stakeholder groups. The fifth step is the construction of the evaluation matrix. The alternatives are further defined and translated into scenarios which also describe the contexts in which the policy options will be implemented. The different scenarios are then scored in terms of the objectives of each stakeholder group. Then the different points of view are brought together in order to form a multi-actor perspective. MAMCA results in a ranking of the various alternatives which uncovers the strengths and weaknesses of these alternatives (sixth step). The stability of the ranking can be assessed through sensitivity analysis. The seventh and final step of the

methodology includes the actual implementation of the project alternatives. This process is an iterative one as visualised by the feedback loop in Figure 2.

The first three steps (shown in Figure 2) involve the construction of a decision hierarchy or criteria tree as shown in Figure 3 for a generic example with three stakeholders. The first or top level of this tree comprises the focus of the decision-making problem. On the second level are listed the stakeholders and on the fourth level we find the criteria considered relevant by these stakeholders. The lowest level comprises the final project alternatives to be evaluated. The arrows represent causal relationships. The MAMCA results in a ranking of the project alternatives in terms of each stakeholder separately. In fact, separate MCAs are conducted in terms of each stakeholder's objectives. There are several MCA techniques to carry out the evaluation in terms of each stakeholder's objectives separately (such as the method of the analytic hierarchy process of Saaty, 1986, 2005), but we will not go in detail about these. The main aim of this contribution is to identify and discuss different methods to reconcile stakeholder interests. In terms of Figure 3, the issue is how to align the different stakeholders' interests on level 2 so that they share the same focus or so that they are willing to support and implement a project alternative contributing to that focus (shown on level 1). In fact the causal relationship between the stakeholders (level 2) and their criteria (level 3) and between the criteria (level 3) and the project alternatives (level 4) is very straightforward. The relationship between the stakeholders (level 2) and the focus (level 1) is, however, more complex. That is the reason why, in Figure 3, the latter relations are visualised using arrows with dotted lines, while the former are represented using full arrows.

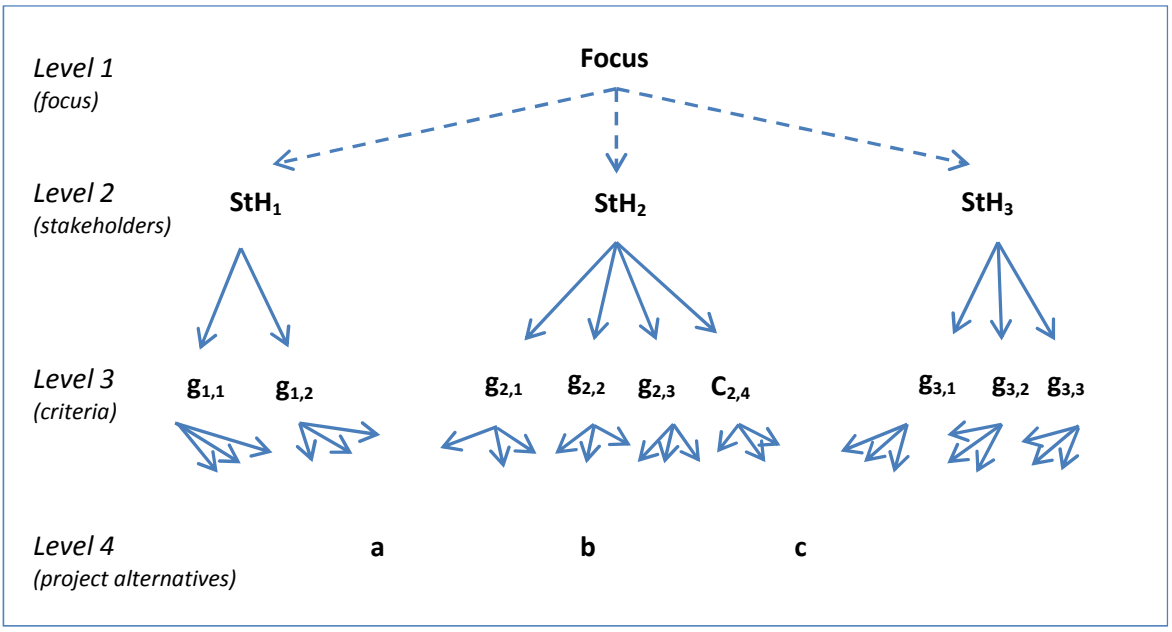

Figure 3 – Decision hierarchy or criteria tree for a generic case

3.2 Different approaches of aligning stakeholder interests in MAMCA

A. Approach No. 1: Giving different weights to the stakeholders

In this case, a global priority (P_g) is calculated using formula (1).

$$P_g(a) = \sum_{k=1}^{K} w_k P_k(a) \qquad (1)$$

Here, $P_g(a)$ ($P_g \in \mathbb{R}^+$) represents the multi-actor (or global) priority of alternative *a*; $P_k(a)$ ($P_k \in \mathbb{R}^+$) refers to the priority of alternative *a* derived from stakeholder group *k*'s objectives (*k*=1,…,*K*); w_k refers to the weight attached to the preferences of stakeholder group *k* (whereby $w_k \in \mathbb{R}^+$ and $\sum_{k=1}^{K} w_k = 1$ and *K* is the number of stakeholder groups).

According to this approach, an inter-stakeholder (i.e. a global) consensus on the priorities of the alternatives is obtained by taking the weighted average of the various actors' priorities. This approachs implies that the weights (w_k) in (1) are different from each other. A global priority (P_g) is calculated using these weights. These weights (w_k) may express the differences in importance and relevance of that stakeholder in the decision-making process and/or the difference and relevance (from a global or public policy point of view) of the underlying criteria set (i.e. the criteria considered relevant by that particular stakeholder).

Obtaining a consensus on the weights to be given to the stakeholders will, however, be a very delicate issue in this case. In addition, the public policy (i.e. the global) point of view cannot simply be considered as the sum of the particular stakeholders' points of view. This is the reason why this approach has seldom been applied up till now.

B. Approach No. 2: Giving equal weights to the stakeholders

This approach implies that the weights (w_k) in (1) all receive the same value. This approach suffers from the same weaknesses as approach No. 1, since (1) not all stakeholders are equally important in the decision-making process and (2) not all the underlying criteria sets – each considered as a whole – are equally important. Sensitivity analysis applied to the stakeholder weights may, however, alleviate this problem. Such a sensitivity analysis makes it possible to check to what extent the final outcome would be different if some stakeholders were given a higher weight. This approach corresponds to the standard approach in MAMCA as developed by Macharis (2000, 2004) and was effectively followed in a number of applications (see section 3.4.1).

C. Approach No. 3: Giving equal weights to the stakeholders but just for benchmarking purposes

This approach is comparable to approach No. 2 but the difference is that the global or overall priorities [i.e. P_g in (*4*)] are not given the status of representing the overall or public policy point of view. These are considered merely as a mathematical construct for benchmarking purposes. Each stakeholder group's priorities are then compared to this benchmark in order to check to what extent this stakeholder's priorities are different from the benchmark, i.e. to determine how big the gap is. In fact, the overall ranking (P_g) should not be seen as the final solution in itself. Rather, it constitutes a good starting point around which discussions among

stakeholders regarding the advantages and disadvantages of specific project alternatives can be structured. This approach clearly integrates the quantitative and qualitative methods and is, therefore, good for learning purposes. It is ultimately on the basis of such a social learning process that momentum can be created to develop and implement a final solution acceptable to all stakeholders.

D. Approach No. 4: Not giving weights to stakeholders

In this approach no formal weights are derived for the separate stakeholder points of view. The rankings in terms of each separate stakeholder's point of view [i.e. P_k in (3)] are presented to the decision maker as separate rankings. No formal tool for synthesising stakeholder rankings into a global point of view (P_g) is provided here. The aim of this approach is merely to inform policy makers. It is then up to the policy makers to make a decision taking into account the stakeholder preferences. This approach is to some extent comparable to the so-called δ-problematique of Roy (1985:88ff). In Roy's δ-problematique relevant information is structured and synthesised into criteria and criterion scores. These are presented to the decision maker as separate scores, i.e. without aggregating them, and it is finally up to the decision maker to make a decision taking into account this structured information. The variant of MAMCA discussed in this section is to some extent comparable to the aforementioned δ-problematique, since criterion scores (and resulting priorities) are not aggregated across the stakeholder points of view (using inter-stakeholder weights), but only internally within each separate stakeholder group (using intra-stakeholder weights).

E. Approach No. 5: Not giving formal weights to stakeholders but identifying (or constructing) a central or virtual stakeholder representing preferences serving the public interest

This approach is quite different from the approaches discussed above and is also different from the standard MAMCA approach as initially developed by Macharis (2000, 2004). In this alternative approach, a central or virtual stakeholder (k^*) is constructed that represents preferences serving the public interest, next to the other (i.e. traditional) stakeholders' points of view. In this virtual stakeholder point of view, a criteria set that represents the overall or public policy point of view is constructed. This implies that this criteria set may include criteria that are already included in the other (i.e. traditional) stakeholders' points of view. In principle such a public policy point of view corresponds to that of society or government. The reason is that this actor is assumed to take into account all relevant aspects of a decision and to give voice and weight to all the constituting elements of a decision (including the ecological elements), even when these cannot be linked to specific stakeholders taking part in the decision-making process or when these stakeholders are not strong enough to voice their concerns. It is the task of government to strengthen the bargaining power of the weak stakeholders (e.g. using countervailing power mechanisms), if necessary (De Brucker, 2013).

In this approach, the central 'stakeholder' is a virtual stakeholder representing the public policy point of view is considered the most important/crucial one when it comes to making/constructing a decision. It is mainly on the basis of this stakeholder's priorities (P_{k^*}) that a decision will be made. However, the rankings in terms of the other (i.e. the traditional) stakeholders' points of view are also very important. The latter rankings are used to check

the compatibility of the public policy priorities with the priorities derived in terms of the other stakeholders' objectives. If the preferences (priorities) derived in terms of the public policy point of view are in accord with those derived from the other stakeholders' points of view, then public policy implementation will be facilitated by the actions (and underlying preferences) of the other stakeholders. In that case we are close to a 'momentum'. When the preferences of the actors are not in accord with each other, then public policy implementation may be hindered by the actions (and preferences) of the other stakeholders. In this case, redesigning the actions or providing extra incentives or conducting a marketing campaign or just resuming the dialogue between actors may be instrumental in changing stakeholder preferences and reducing potential opposition to the decision in the future. By doing so, one may gradually move closer towards a 'momentum' in the future. This way of using stakeholder management as facilitating (or hindering) public policy implementation is fully in line with the actual definition of the concept of 'stakeholder' by Freeman (1984:86) referred to in section 1.

The approach discussed here should be considered as a tool to create momentum both for making a decision, as well as for facilitating the implementation of a decision. Here, in this approach, a decision is 'made' according to an MCA in terms of the public policy point of view (that also includes particular stakeholder criteria insofar as these are relevant within the public policy point of view). The implementation of the decision is 'facilitated' by carrying out separate MCAs for the particular stakeholders or actors and trying to improve the compatibility between these stakeholder priorities on the one hand and public policy priorities on the other hand. This approach is in line with organisation theory, where the effectiveness of a decision is conceived as the product of the quality of a decision (i.e. in terms of its technical content) and the degree of its implementation. If one of these fails (or obtains a score equal to zero), then the final effectiveness score is also equal to zero.

3.3 Accommodating stakeholder interests using eclectic multi-criteria analysis

When large infrastructure projects need to be evaluated, usually several evaluations are carried out, using different evaluation methods, such as social cost-benefit analysis, environmental impact assessment (EIA), macro-economic impact study (MEIS) and also MCA. In that case, decision makers are confronted with a large number of studies, whose results may be conflicting. This, in turn, may paralyse the decision-making process, if no formal procedure was established for integrating these studies. One of the first attempts to integrate the various conflicting evaluation frameworks was made by De Brucker (2000, pp. 245ff, 2007, 2013), who developed an 'eclectic' evaluation framework called 'eclectic multi-criteria analysis' or 'EMCA'. The 'EMCA method' is called 'eclectic', since it extracts from specific existing (and sometimes conflicting) evaluation methods those elements most suitable and sufficiently compatible to form the building blocks of a new, integrative evaluation method. In addition, the EMCA method is also a 'multi-criteria-analysis' since MCA serves as the anchoring framework for the integration of the relevant constituent parts. Within this anchoring framework, the method of the analytic hierarchy process (AHP) of Saaty (1986, 1995 and 2005) plays an important role.

The EMCA method also requires the design of a decision hierarchy or criteria tree (as in Figure 3). However, the main difference with the tree shown in Figure 3 is that the effects and criteria are not clustered according to the stakeholder to whoms objectives these criteria contribute. Rather, in the EMCA, effects and criteria are clustered into homogeneous subgroups, e.g. criteria that can be easily expressed in money terms (resulting from a SCBA), environmental effects not expressed in money terms (resulting from an EIA) and effects resulting from MEIS. Stakeholders are not included as a separate layer in the criteria tree. This method has the advantage that all effects are integrated into one single value system (not split up into subsystems per stakeholder). On the other hand, stakeholder preferences cannot be read off directly from the output of the model. In the EMCA stakeholder analysis is performed using a specific form of sensitivity analysis, called scenario analysis. After performing the overall MCA (i.e. the EMCA) which results in a specific ranking of project alternatives, the effects or criteria (in the criteria tree) are identified which contribute to the objectives of specific stakeholders in the decision-making process. In a next step, the weights of these criteria are increased substantially, just for testing purposes. The result (i.e. the final ranking of project alternatives) is then recalculated. This process is repeated for each separate stakeholder. By doing so, one can investigate whether the rankings in terms of each separate stakeholder's objectives is substantially different or not from the overall ranking in the base scenario.

3.4 Some examples of the application of MCA to project evaluation

The MAMCA methodology has been used in a large number of cases already. A good overview of the use of the methodology and what has been learned during its application to these case studies is given in Macharis et al. (2012).

3.4.1 The Completion of the Antwerp Ring Road

A recent case study (described at length in Macharis and Nijkamp, 2013) and also referred to in section 2.2 is related to the decision to solve the acute and structural mobility problems in and around the city of Antwerp. In order to solve the acute congestion problems in and around the city of Antwerp, a project was formulated to complete the present Ring Road as explained already in section 2.2. At present this Ring Road has a semicircular shape and the project precisely consists of closing (i.e. completing) this Ring Road by constructing the missing link called Oosterweel link so as to give the Ring Road a full circular shape, as shown on Figure 1 (section 2.2). This case study will show how difficult it is to plan and implement megaprojects. The involvement of multiple stakeholders is very clear in this case because of the project's large economic, social, political and environmental effects. This section quickly goes through the different steps of a MAMCA as applied to the Oosterweel Connection. The MAMCA was conducted by the research group MOBI of the Vrije Universiteit Brussel (VUB) on its own initiative (i.e. not commissioned by government or any public body). This means that we describe it here as a laboratory experiment showing how the decision-making problem could have been better structured in practice so as to facilitate

the dialogue between stakeholders and the construction of a solution acceptable to all stakeholders.

A. Project Alternatives

The first step of the MAMCA methodology consists of identifying and classifying the different project alternatives to be evaluated. In this case, a total of five alternatives were identified, based on their relevance at a particular point in time. Since then, a number other proposals have been formulated, but these could not be included in the analysis. The reason is that our laboratory model was already in its final phase when these proposals were presented in the actual decision-making process.

The first project alternative is the so-called BAM route which was proposed by the 'Beheersmaatschappij Antwerpen Mobiel' (BAM) (i.e. the Management Company Mobility Antwerp). This alternative includes the construction of a highly contested bridge (called 'Lange Wapper'). The second project is the so-called ArupSum alternative, in short the 'AS route'. This was an unsolicited proposal formulated by the consortium of consulting firms ArupUK and SUMResearch at the time they conducted their independent analysis of the Oosterweel Connection. This project alternative consists of a drilled tunnel which will be 4.3 km long, with two cylinders, each having three lanes. The third alternative consists of optimising the current infrastructure (i.e. the present Liefkenshoek Tunnel) so that the existing capacity can be used more efficiently in a short to medium term perspective. The fourth alternative is the optimisation of the road tax in the Kennedy tunnel. Finally, the fifth alternative is the Going Concern scenario which corresponds with the continuation of the current situation.

B. Stakeholders

For this analysis, three stakeholder groups were identified. The first relevant stakeholder group is clearly the Flemish Government. This stakeholder corresponds to the actor who is the real decision-maker in this project. The second stakeholder group in the analysis is the city of Antwerp, comprising its citizens and, in that sense, also the pressure groups. The last stakeholder group is the Port of Antwerp which is an important actor for the economic development of Flanders and Belgium.

C. Criteria and weights

In this step, a predetermined list of criteria was discussed with the members of each stakeholder group (see Table I).

Table I – Criteria and weights for the project of completing the Antwerp Ring Road

Criterion	Weights (in %)
Flemish Government	**Flemish Government**
Financial feasibility	25
Environmental impact	10
Efficiency traffic flows	25
Duration (time to completion)	10
Traffic safety	10
Prestige	20
City of Antwerp	**City of Antwerp**
Air quality	12.5
Mobility	10
Barrier formation and visual hindrance	30
Noise effects	12.5
Nature	30
Prestige	5
Port community	**Port community**
Economic development	32.5
Competitive position	40
Direct access	27.5

In order structure the complex decision-making problem and to get a clear view of it, a criteria tree or hierarchy was constructed to structure the decision-making problem (see Figure 4).

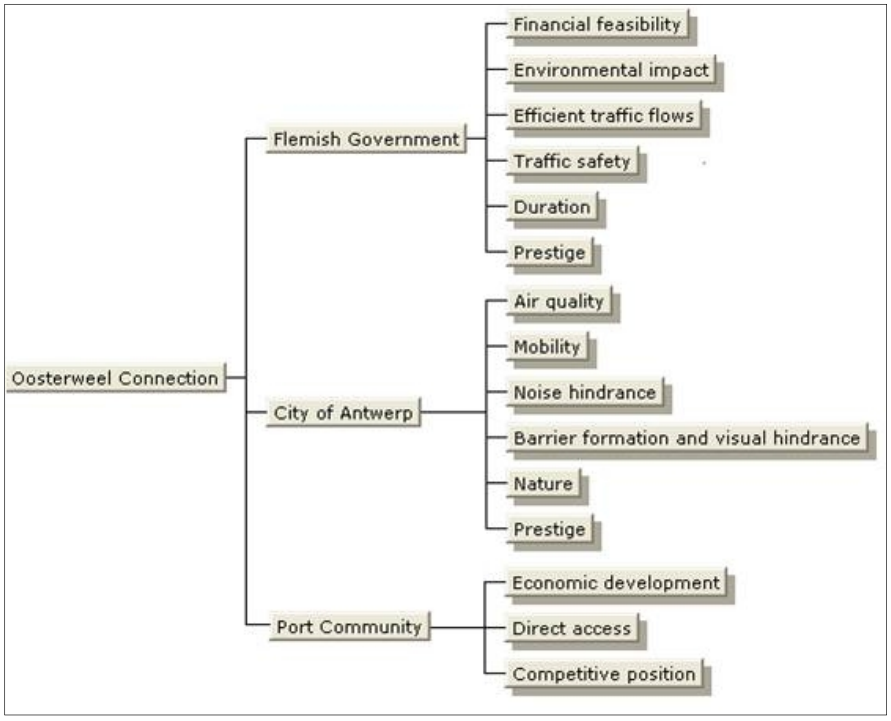

Figure 4 – Criteria tree for the Antwerp Ring Road Project

D. Analysis

The five project alternatives were evaluated using the pairwise comparison mechanism (as well as the aggregation procedure) of the Analytic Hierarchy Process of Saaty (1986, 1995 and 2005). The Decision Support Software ExpertChoice was used to facilitate the pairwise comparisons. The pairwise comparisons were based on data from several separate studies like the Environmental Impact Assessments (EIAs) and the independent evaluation studies made by ArupSum. The main objective of this analysis is in the first place to provide a ranking of the various project alternatives for each single stakeholder based on the preferences of that stakeholder, rather than focusing on an overall ranking aggregating all actors' points of view. By explicitly introducing the stakeholder dimension into the analysis, the positive as well as the negative aspects of each project alternative could be discussed for the different stakeholders. This is a very important advantage, since this discussion can finally lead to the creation of a momentum for reaching a compromise among stakeholders. The real goal of MAMCA is not to provide a ranking to reveal the 'best' alternative, but to provide insights into the pros and cons of each scenario and to foster the discussion between the different stakeholders so as to create momentum for effective project implementation.

E. Discussion of the results

As regards the stakeholder 'Flemish Government', the results of the MAMCA are given in Figure 5. The horizontal axis shows the criteria considered relevant by this actor. The height of the vertical rectangular bars represents the weights of the criteria. The actual value of these weights is shown on the left vertical axis. The intersection of the lines from left to right with the vertical lines starting at the criterion name represents the relative priority of a specific project alternative for that particular criterion. The actual value of these relative priorities is to be read off from the right vertical axis. The intersection of the lines from left to right with the vertical line starting at the label 'OVERALL' (i.e. the vertical line just preceding the right vertical axis or even the right vertical axis itself) represents the global relative priorities of the project alternatives from the Flemish Government's point of view. The actual value of these relative priorities is also to be read off from the right vertical axis.

The conclusion here is that the BAM route obtains a high overall score due to its high performance on traffic safety and the efficiency of the traffic flows. The latter criterion is a particularly important to this stakeholder. The environmental impact of this alternative is also limited to a minimum (together with the AS route) when compared to the other alternatives. In addition, it is also part of a much larger Master Plan for the Antwerp Region. The Going Concern scenario also obtains a high overall score, because of its financial feasibility. However, it performs much less on the other criteria, which indicates that this alternative is not a realistic option for the Flemish Government. The AS route shows similar results compared to the BAM route as far as the first two criteria are concerned (financial feasibility and environmental impact), but performs less than the BAM route on the other criteria. The Kennedy tunnel performs even slightly better than the AS route, but this result is due to a better performance on the criteria duration and financial feasibility. The reasoning is similar for the Liefkenshoek tunnel alternative, which comes right after the AS route in the overall ranking from the Flemish Government's point of view.

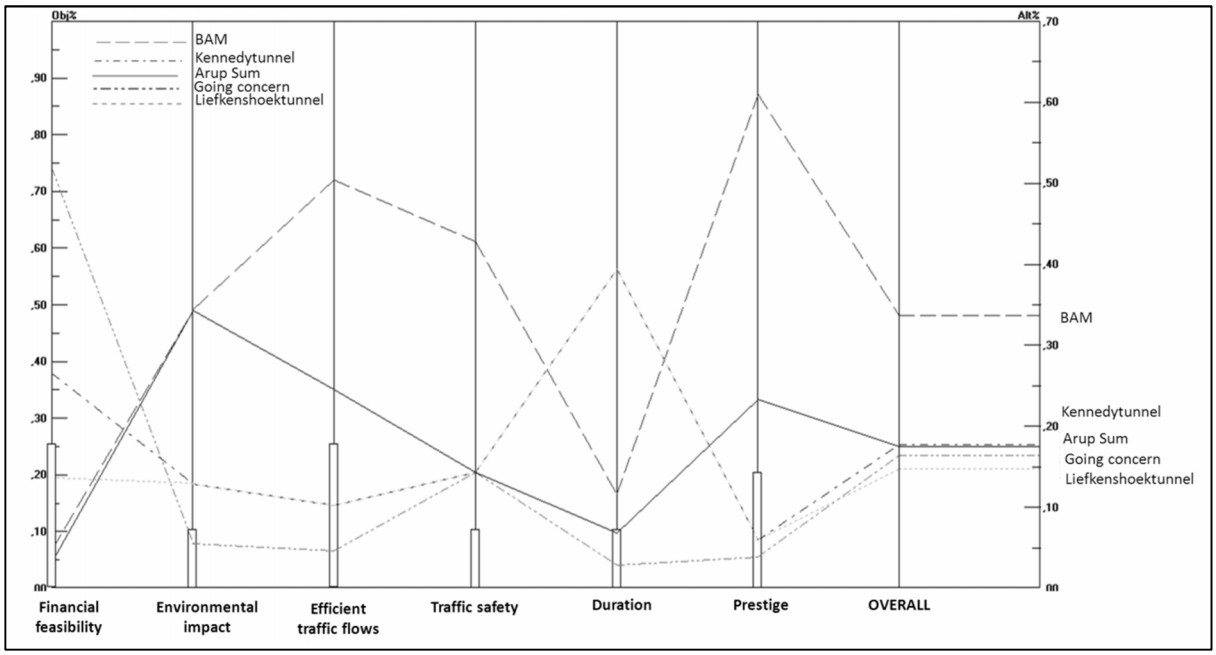

Figure 5 – Evaluation of the Antwerp Ring Road from the Flemish Government point of view

A similar analysis was made for the two other stakeholders (not shown here). For instance, for the city of Antwerp the result was very different. Here, the alternatives scored more or less ex aequo in overall terms (i.e. subaggregating the criteria of this stakeholder), but there were huge differences in terms of the separate criteria.

Finally, the previous analyses can be summarised into a unique multi-actor view, which is presented in Figure 6. In this figure, the three actors are shown on the horizontal axis, each with a similar weight to show that their points of view have been equally taken into account. The right vertical axis shows the weighted sum of the rankings of the different stakeholders. In fact, the different stakeholder views are aligned using approach No. 3 (from section 3.2). This means that the ranking obtained should not be seen as the end result of the MAMCA, but rather as a starting base for further discussions among stakeholders. The multi-actor view shows that he BAM route is ranked first, with a firm lead over the AS route. The two short-term alternatives (Liefkenshoek and Kennedy tunnel) are ranked third and fourth respectively, and the Going Concern scenario is ranked last. However, it is precisely the insights into the reasons behind this point of view that led to the crucial input for the implementation path. The Flemish government might be willing to implement their BAM route, at least in the first period, being supported up by the Port of Antwerp, but in reality it becomes clear that it will not be possible to realise this alternative without taking into account the points of view of the Antwerp citizens.

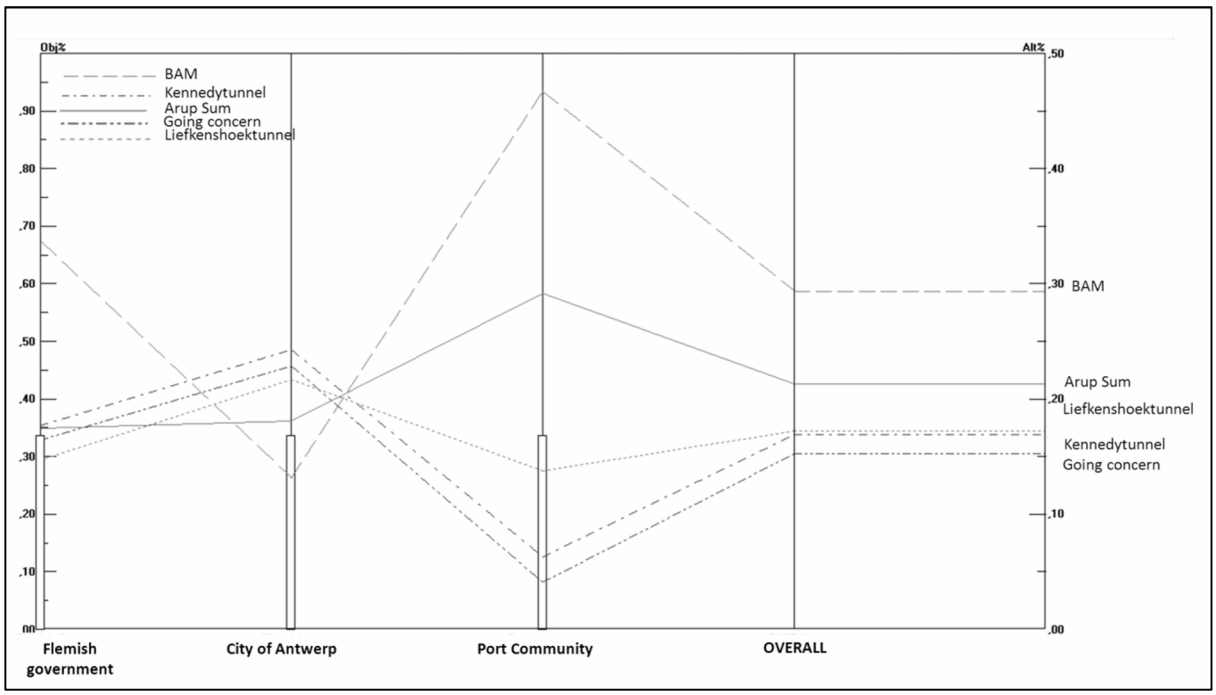

Figure 6 – Evaluation of the Antwerp Ring Road from the Flemish Government point of view

3.4.2 The IN-SAFETY Project regarding road safety

An example where stakeholder views were aligned using a different approach, namely approach No. 5 (from section 3.2) is the IN-SAFETY project. This project consisted of evaluating and prioritising a number of potential measures aimed at increasing road safety by creating a more forgiving road[1] (FOR) (i.e. designed so as to interfere with or block the development of driving errors) and a more self-explanatory road[2] (SER) environment (i.e. designed to evoke correct expectations from road users). A value or criteria tree representing the various criteria and the stakeholders' interests was constructed, as shown in Figure 7.

In this case study, the second 'stakeholder' group ('Society') in Figure 7 performs the role of a virtual stakeholder representing preferences serving the public interest (i.e. a public policy point of view). The two remaining stakeholders were included in the criteria tree in order to be able to check to what extent the priorities derived in terms of these stakeholders' points of view are in accord with – or at least compatible with – the priorities derived in terms of the public policy point of view. More information about this case study can be found in De Brucker and Macharis (2011).

[1] A 'forgiving road' (FOR) is defined as a road that is designed and built in such a way as to interfere with or block the development of driving errors or to avoid or mitigate negative consequences of driving errors, once started (Bekiaris and Gaitanidou, 2011:17). Examples include e.g. lane departure warning systems, advanced cruise control, etc.

[2] A 'self-explaining road' (SER) is defined as a road which is designed and constructed to evoke correct expectations from road users (Bekiaris and Gaitanidou, 2011:19), eliciting proper driving behaviour, in this way reducing the likelihood of driver errors (and accidents) and enhancing driving comfort. Examples include fog detection warning systems, warnings given through variable message signs, etc.

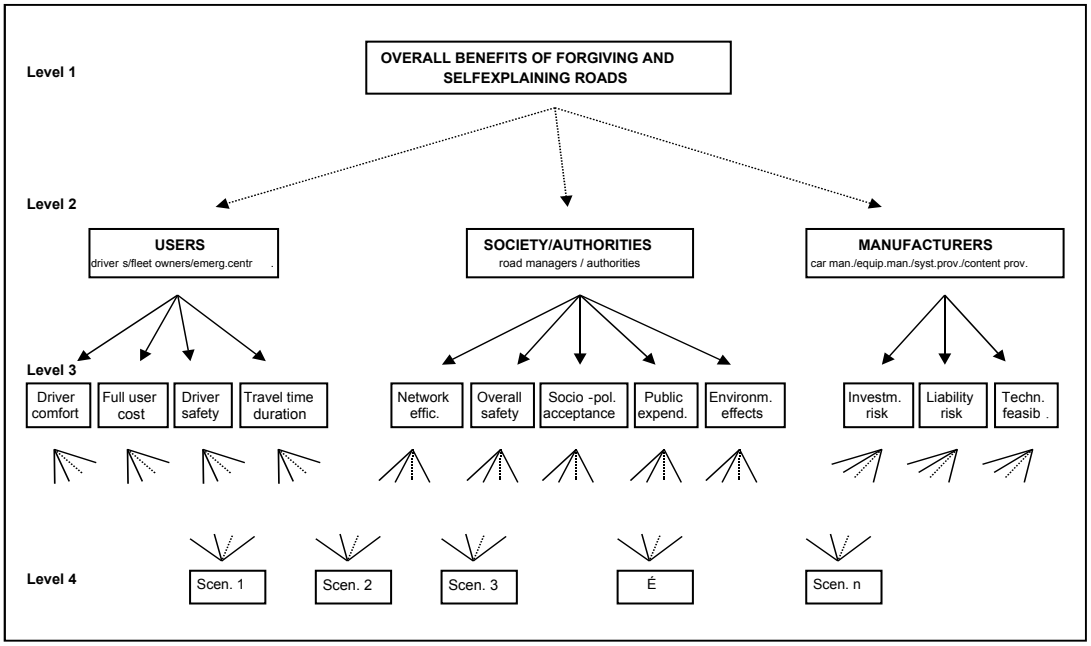

Figure 7 – Criteria tree FOR/SER scenarios (De Brucker and Macharis, 2011)

4. CONCLUSIONS

This paper discussed the possibilities of applying both qualitative as well as quantitative methods to complex decision making problems involving multiple stakeholders with conflicting objectives. As regards the qualitative approaches, the formulation of adequate frames turned out to be a key element to successfully implementing such methods. Also understanding each other's frames was shown to be crucial for fostering stakeholder discussions and compromise building. The quantitative approaches based on multi-criteria include a sequence of steps and provide a rational procedure for effective decision making. However, in the latter methods, the focus should not solely be on rigidly following these subsequent steps, but rather on the benefits that can be obtained by following such a procedure in terms of compromise building. Actually, the main question in decision making is not the choice between qualitative or quantitative methods, but how these methods can contribute together, in interaction with each other, to construct better decisions. Combining both qualitative and quantitative approaches makes it possible to initiate a social learning process. It is this social learning process that may eventually make it possible to create momentum for building effective compromises and successfully implementing a decision acceptable to all stakeholders.

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