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The application of policy-led multi-criteria analysis to mega transport infrastructure project appraisal

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ABSTRACT

The aims of this paper are twofold. Firstly, to present a review and critical analysis of the varying forms and functions of Multi-Criteria Analysis presented in the literature, and secondly, drawing from this, to introduce methods and processes by which policy leadership can be introduced into such processes for the appraisal of large-scale infrastructure projects to form a policy-led multi-criteria analysis.

Following the discussion in the first paper of this Special Issue, 'Presenting the Case for the Application of Multi-Criteria Analysis to Mega Transport Project Infrastructure Appraisal', this contribution commences by outlining further the generic features and challenges of multi-criteria analysis approaches to project appraisal whilst emphasizing the difference among various frameworks and attendant processes for such approaches. It also highlights the important role/value of the multi-criteria mapping of stakeholder policies and agendas affecting project decision-making as a means of defining and scoping the boundaries of the project exercise under study and the trade-off decision-spaces for stakeholder dialogues and negotiations in their search to arrive at mutually agreed actions and outcomes. The paper discusses how multi-criteria analysis frameworks can be tailor-designed for particular agencies and stakeholders developed around particular problems, challenges and issues. This is done in the acknowledgement that such exercises, especially when applied to mega infrastructure project appraisal, typically attract a multiple-institutional response and where ultimately an institutional leader (or partnership of stakeholders) exists/emerges that impose its/their priorities on others. Alternatively, the approach can be tailor-made for specific institutions with its imbedded hierarchy of policies and priorities that frame the stakeholder decision space within which other parties can participate and trade off interests.

The first part of the paper highlights the important role of scenarios of policy-making contexts and policy leadership indicating the new risks, uncertainties and opportunities these may offer in multi-criteria analysis exercises, indicating that some/many past processes have been conducted outside of any real reference to such matters. In so doing, such applications have them silently and implicitly adopt scenarios and policy assumptions that are not transparent frequently reflecting, it is alleged, 'business as usual' circumstances in contexts when the signs are very much that these trends will not/cannot prevail. The authors contend that without explicit policy leadership there is a danger that certain institutional stakeholder priorities will be imposed over others by the most powerful without adequate dialogue. Understanding that this matters a great deal in contexts when/where project stakeholder powers shifts occur is very significant. Examples of such circumstances are when national governments become, less or more powerful and economically affluent, when relative legislative and regulation powers become less or more binding and powerful, and when a major private sector investor upon which a project depends goes bankrupt.

The second half of the paper builds on these observations to offer a generic multi-criteria analysis framework and attendant processes that imbed policy leadership firmly within multi-stakeholder decision-making (termed Policy-led Multi-criteria Analysis). The framework developed is to be applied to

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mega transport projects *via* the use of suitable appraisal criteria in the pursuit of sustainable development goals, which seek to address both quantitative and qualitative dimensions and concerns of multiple stakeholders, with particular emphasis on the processes required to identify and incorporate suitable policy leadership, including feedback between appraisal and policy.

1. Introduction

Multi-Criteria Analysis (MCA)[1] concerns the making of choices using multiple, and often conflicting, criteria, in efforts to arrive at pre-considered desired outcomes. MCA in particular, looks to deciding on preferences by choosing among options that refer to an explicit set of objectives assigned to the decision-making body or those identified by it. Such criteria (and related indices and targets) represent measures and assessments of the extent to which the objectives of the decision-making exercise have been/can be achieved.

In the case of the appraisal of mega transport projects (MTPs), MCA permits a wide set of objectives, often across different sectors, to be included *within* the decision-making appraisal process. Such objectives relate to a spectrum of economic, environmental, social, cultural, technical, technological and institutional aspects of the project assessed. Criteria may be monetised, non-monetised (but nonetheless quantified *wherever possible*) or qualified (with supporting text and/or proxy indicators). MCA frameworks and their related processes conveniently allow both these quantified and non-quantified criteria of project outputs,[2] outcomes[3] and impacts[4] to be set out together in a common framework – typically a matrix – with the aim of providing decision-makers with a holistic picture of the potential implications across a host of selected possible fields. In this way, MCA provides a structured decision space that assists its users (project stakeholders) to systematically and transparently make trade-offs between costs and benefits when selecting among alternative courses of action that best satisfy the project's objectives.

The early development of MCA is widely attributed to the US Military, which used it as a decision-making tool for application to logistical problems during the Second World War. Its subsequent development, mainly in the fields of Operations Research, Computer Science and Mathematics led to the proliferation of a wide variety of related methods and tools (Morgan, 2004). The last 20 years, in particular, have seen a marked acceleration in interest in MCA (Bragge, Korhonen, Wallenius, & Wallenius, 2010) with the result that it is now widely used for both appraising policy *and* project options as a basis for decisions on their adoption or implementation. Particular applications of MCA using a variety of procedures including multicriteria mapping (MCM) (as discussed below) are to be found in the fields of:

- GM crops (Stirling and Mayer, 2001, 2004);
- hydrogen energy futures (McDowall & Eames, 2007);
- agricultural innovation (Thompson, 2010);
- stem cell research policy (Morgan, 2010);
- transport infrastructure appraisal (Macharis, De Witte, & Turcksin, 2010);
- nuclear emergency management (Papamichail & French, 2012); and
- waste management (Chung and Poon, 1996).

MCA has also been adopted by leading international development institutions such as the Asian Development Bank (ADB) for road project appraisal and transport project appraisal more generally (Véron-Okamoto & Sakamoto, 2014) and is being currently used by the European Investment Bank (EIB) in urban project appraisal (OMEGA Centre, 2014).

Building on the opening introduction to MCA in the previous paper, Section 3 of this paper reviews the various generic features of MCA, its frameworks and attendant processes. Many of the MCA methods reviewed contain common elements which, expanding on the work of Triantphyllou and Mann (1989), are presented here as a list of generic characteristics. In Section 4, the paper reviews a number of MCA frameworks and attendant processes identified as particularly applicable to megaproject development in the infrastructure field. These have been derived primarily from recent research undertaken by the Omega Centre (2011). The pros and cons of MCA are reviewed here and on this basis, a number of developments suggested to enhance their application to MTP appraisal. As well as the role of policy leadership in the decision-making process earlier referred to, a particular focus of the paper is on the ability of MCA to identify and manage risks and uncertainties (commonplace in the context of megaprojects decision-making).

Section 5 examines the applicability of MCA to megaproject infrastructure appraisal in particular in light of the OMEGA 2 Project findings concerning what constitutes 'successful' MTPs (OMEGA Centre, 2012). As earlier alluded in the first paper of this Special Issue, this was undertaken with a view to seeking how to operationalise these lessons within the MCA framework by building on the MCA practices reviewed, whilst simultaneously advocating the use of a policy-led (rather than market-led) multi-criteria analysis framework. The Conclusions (see Section 6) contends that whilst MCA aims (*inter alia*) to provide a sound basis for determining project performance and impact (by reference to an explicit set of objectives), it is highly desirable that the formation of these objectives be informed by international, national and local policy guidelines, alongside secondary information sources, as well as stakeholder participation and consultative processes.

2. A review of MCA frameworks and processes

Because, as earlier indicated, MCA is concerned with supporting decision makers when confronted with particular problems that involve multiple (often-conflicting) criteria and considerable uncertainty there is frequently no unique 'optimal' solution. The process instead needs to be considered an outcome of decision makers' preferences to rank a series of possible solutions. A review of MCA frameworks reveals a large variety of processes, tools and techniques, leading the authors to conclude that currently there is *no* single universally adopted MCA method, but instead a range of methods which have been developed for application to particular

[1] For the purposes of this paper, MCA is considered synonymous with Multi-Criteria Decision-making (MCDM) and Multi Criteria Decision Analysis (MCDA).

[2] These are tangible and intangible products result from project activities.

[3] These are benefits that a project or intervention is designed to deliver.

[4] These are higher level strategic goals, such as increased social cohesion or improvements in public safety.

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