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Presenting the case for the application of multi-criteria analysis to mega transport infrastructure appraisal

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ABSTRACT

The paper commences with an overview of mega transport infrastructure decision-making as it relates to the megaproject development cycle and challenges of sustainable development, which are increasingly redefining the criterion for the evaluation of project success. The body of the paper presents a brief critique of various appraisal applications to mega transport infrastructure projects, including: Social Cost Benefit Analysis; Cost Effectiveness Analysis; Goal Achievement Matrix Methods and the Planning Balance Sheet, highlighting the merits and demerits of the outlined approaches. Here particular reference is made to the power of context on decision-making and other lessons from OMEGA Centre research. These include, most importantly, the treatment of risk, uncertainty and complexity of developments *outside* of the project and the challenges of meeting multiple stakeholder aspirations/needs thereby building up the case for the introduction and use of multi-criteria analysis and policy-led multi-criteria analysis to the appraisal of Mega Transport Projects.

1. Introduction

Project appraisal (often referred to as ex-ante project evaluation) may be seen as a process of exploration, review and evaluation of a proposed course of action(s) carried out by a party (or several parties) to determine whether a given proposal is viable. It is typically undertaken on behalf of a decision-maker in pursuit of the interests of project investors in line with a given set of objectives (Rogers & Duffy, 2012). This paper examines this process in some depth as applied generically and, more specifically, to mega infrastructure projects and mega transport projects (MTPs) in particular. This is done with a view to drawing out lessons for MTP decision-making as a basis for presenting the case for the application of Policy-Led Multi-Criteria Analysis (PLMCA)[1] to the appraisal of such projects.

It has been argued that during the last century project appraisal relying on rigorous quantitative and economic methodologies, especially for infrastructure, has become increasingly embedded in notions of the project lifecycle, replacing earlier more classic methods based on 'survey-analysis-plan' (see later discussion and Olivera & Pinho, 2010). The need for more informed advice and guidance on decision-making for major infrastructure investments (especially MTPs) (see Alexander, 2006a; 2006b; Munda, Nijkamp, & Rietveld, 1994) has grown hand in hand with increases in their size and complexity, and their rising importance to global and local economies. The case for more rational informed choices has also been advocated on grounds of decreasing investment resources, high opportunity costs and a growing demand to better understand the impacts of such projects (both negative and positive) to the economies, communities and territories they serve and traverse (OMEGA Centre, 2012; Priemus, 2008).

Numerous project appraisal methods have been proposed and developed for infrastructure developments since the early decades of the twentieth century; many conceived as responses to perceived shortcomings of earlier methodologies (see later discussion and McAllister, 1982; Sager, 2003). Several authors have attempted to group these methods into a variety of different systems of classification (see Guba & Lincoln, 1989; Söderbaum, 1998). One of the simplest classifications distinguishes such

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[1] PLMCA is here defined as an eclectic framework and attendant set of processes for undertaking multiple project stakeholder analysis and trade-offs in decision-making (led by policy guidelines) that facilitate key decision-takers arrive at more integrated and sustainable investments that are more strategic, comprehensive, robust and transparent in character than those primarily reliant on traditional project appraisal methods (Dimitriou, 2013).

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methodologies in two general groups (see Rogers & Duffy, 2012). The first includes methods which primarily attempt a monetary appraisal of all criteria relevant to the decision. Examples here are Cost-Benefit Analysis (CBA) and its common variants, including financial, economic and social cost benefit analysis (SCBA) (see Section 3 below). The second category comprises appraisal methods seeking to take into account multiple dimensions of a decision problem explicitly considering *both* monetary and non-monetary costs and benefits, expressed in quantitative *and* qualitative terms. Methodologies pertaining to the second type include: Cost-Effectiveness Analysis (CEA), the Planning Balance Sheet (PBS) and the Goal Achievement Matrix (GAM) (see Section 4 below). It could be argued that the latter two may be seen to be variants of CBA methods of appraisal or at least can be positioned on the border between the two general classes of methodologies alluded to above. In these terms, these methodologies can be considered as the earliest attempts to reform/inform CBA, even though they all maintain some elements of CBA in their frameworks (Rogers & Duffy, 2012). The main difference between CBA and MCA, including more traditional applications of MCA and PLMCA, is that the former are essentially guided by economic efficiency criteria relying upon the pricing of attributes by the market (albeit with adjustments) while the latter is ultimately led by objectives or policies, the outcomes or impacts of which do not necessarily lend themselves to market pricing and/or monetisation.

The origins of the development and application of MCA lie in the fact that whilst CBA and other traditional monetary-based appraisal techniques have had a long history of application to infrastructure projects, especially transport projects, they have in many cases (some argue too many) proven to be less than satisfactory (see Hook, 2011; Litmam, 2008 and 2013). Their failure to properly take account the distributional consequences of projects is one of the most serious deficiencies of conventional CBA (OECD, 2006). This has especially been the case for large-scale infrastructure projects which typically entail complex decision-making and encounter numerous problems associated with the need to address multiple (sometimes conflicting) objectives of numerous project stakeholders (van Wee & Tavasszy, 2008). Here the work of Stirling (2008a) concerning stakeholder participation in the social appraisal of technology projects offers some interesting insights and parallels for the infrastructure field into how participatory project decision-making could be introduced.

On account of recent experiences associated with the global credit crises and the growing acknowledgement of broader sustainable development challenges, major infrastructure projects have gained additional attention in relation to their ecological, spatial and social (including austerity) impacts, as compared to more conventional economic concerns. This has led to a reconsideration of the validity of the premise that all significant costs and benefits of project outcomes should be (and can be) monetised and/or quantified, especially in the context of MTPs. It has also highlighted yet again equity concerns regarding the 'winners' and 'losers' of such projects, and whether project gains and losses can be adequately appraised by the use of monetised values. This *déjà vu* perspective has us returning to many arguments first raised in the 1960s, if not earlier, associated with notions of the limits to growth and questions of the legitimacy of pursuing economic growth *at any cost* (see Meadows, Meadows, Randers, & Behrens, 1972; Mishan, 1967; respectively). These developments also revisit earlier appraisal concerns regarding the distribution of benefits, notions of welfare economics and the role of the market (see Litte, 1950; Peters, 1968; Dobb, 1970), more recently elaborated on by Adams (1995) and Kay (2003) among others (see later discussion in Section 3.1).

In seeking to ultimately explain why MCA (especially PLMCA) approaches to infrastructure project appraisal and MTPs in particular have been developed, what their merits are, and what are the relationships they retain with CBA plus other techniques that have emerged to broaden project appraisal beyond CBA's economic focus, the discussion which follows commences with an explanation of the role of appraisal in the project cycle. It then alludes to a number of challenges encountered in appraisal exercises for mega infrastructure projects. It subsequently provides a brief account of the rationale of CBA and its procedures, culminating in offering an overview of its main assets and limitations as a basis for the search and development for broader project appraisal methods that may be applied to MTPs especially. The strengths and weaknesses of each type of appraisal methodology are briefly presented with a view to presenting the case for the application of MCA, more particularly PLMCA, as a more suitable approach for the 21st Century practice of megaproject infrastructure appraisal both generically, but more especially for the transport sector.

2. The project cycle and the role of appraisal

2.1. The appraisal and evaluation cycle

The project cycle (sometimes referred to as the 'project life-cycle') irrespective of the project's size, cost and sector, consists of sequences of phases through which a project evolves from an initial idea to a completely structured and implemented scheme (Patel & Morris, 1999). Both the number and the labelling of these stages vary depending upon which particular discipline/field is being considered (Wideman, 2004). It is however possible, more generally, to assimilate eight phases (see Fig. 1) to a project cycle consisting of: project conception, project planning, project ex-ante evaluation (otherwise referred to as appraisal), project implementation, project operation, project ex-post evaluation, project monitoring and project closure (Chapman & Ward, 2011). Within each of these, elements of decision-making take place in the form

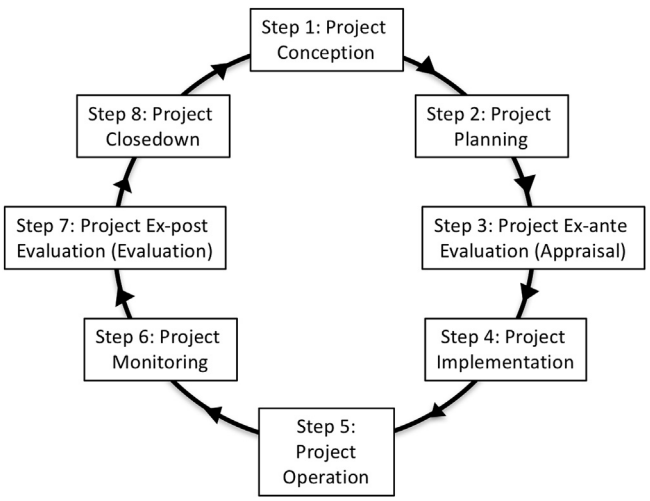

Fig. 1. The project life cycle (adapted from HM Treasury (2003)).

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