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Differences in expertise and values: Comparing community and expert assessments of a transportation project

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ABSTRACT

Transportation projects contain many tradeoffs between environmental, social, and economic benefits and costs that affect different groups of stakeholders, each with different priorities and values. Transportation project sponsors are therefore faced with an incredibly difficult decision making task. Multi-criteria decision analysis (MCDA) provides a flexible framework for considering a wide array of potential impacts that may be used as a supplement of substitute for cost benefit analysis or unstructured decision making. In this study, we evaluate the outcome of two MCDAs, one conducted with input from technical experts and the other with input from a sample of community members for a proposed highway project in Tehran, Iran. We explore how various criteria now commonly considered in urban transportation projects are viewed by these two groups that differ in their technical expertise and values. We find that experts score the project poorly while the community scores it favorably. The results demonstrate that the outcome of seemingly objective analysis tools commonly used in the transportation field depends on who provides critical technical assessments and value judgments and therefore the importance of community involvement.

1. Introduction

Transportation projects are designed to solve a particular problem, providing a broad range of benefits, but they often cause harm too. Congestion reduction, increased safety, infrastructure preservation, and economic development are typical benefits. While harm, or costs, may result from environmental damages due to land development and noise, water and air pollution; visual blight; and greater congestion, reduced safety and economic decline for some individuals or groups. Identifying solutions to transportation problems involve difficult decisions that require tradeoffs between costs and benefits and the accrual of each of these to different locations and populations. Cost benefit analysis (CBA) and multi-criteria decision analysis (MCDA) are the two most common approaches for weighing these tradeoffs (Beria, Maltese, & Mariotti, 2012).

CBA is perhaps the most common approach for weighing the balance of a proposed transportation project's costs and benefits (Beria et al., 2012; Browne & Ryan, 2011; Mouter, Annema, & Wee, 2013; Tudela, Akiki, & Cisternas, 2006). The ubiquity of CBA likely originates from its intuitive appeal and a theoretical foundation that is both uncomplicated and rational. Simply put, CBA is a comprehensive accounting of a project's likely costs and benefits measured on a common scale, which is almost always the present monetary value. Projects in the public interest should at a minimum have benefits that exceed costs. CBA may also be seen as a tool that can offer an objective quantification of a project's merits adding legitimacy to a process that is often highly political (Beria et al., 2012; Browne & Ryan, 2011).

In reality, CBA turns out to be far from simple. A comprehensive accounting requires consideration of all of a project's impacts: direct and indirect, internal and external, tangible or not, now and into the future. Bounding the analysis becomes a challenge as does selecting various parameters. These decisions require analysts, or whoever they answer to, to make subjective choices. What at first may have seemed like a rational and objective tool becomes the manifestation of the expertise, opinions and values of its users. The debate over strategies to control greenhouse gas emissions and climate change illustrates the complexity and subjectivity of CBA.

The Stern Review (Stern, 2007) conducted a CBA that presented a case for strong, early action to control greenhouse gases. While hailed by proponents of strong action to control greenhouse gas emissions, critics questioned a number of key assumptions. Among the most controversial assumptions were the choice of discount rate, the study's time horizon and the consideration of only one alternative to doing nothing at all (Mendelsohn, 2008; Nordhaus,

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2007; Weitzman, 2007). Stern chose a low discount rate (1.4%) and a long time horizon (200 years) which in the view of the study's critics skewed the analysis towards the recommended course of action. The low discount rate and long time horizon caused distant climate damages to balloon relative to the near term costs of controlling greenhouse gas emissions. All else being equal, a larger discount rate or shorter analysis period would increase the attractiveness of a weaker and more gradual phase in of greenhouse gas emission controls. This debate, at its heart, is a disagreement among individuals that have different opinions and values. It is not an issue of expertise but as Dietz and Stern (2008) argue, it is about the ethics of intertemporal equity and level of risk aversion. In this case, there is no correct set of parameters. Many transportation project decisions are similar in that they involve high upfront costs with potentially distant and long lasting effects that are highly uncertain.

MCDA offers an alternative approach to CBA whose main difference is that a common scale of measurement is not required (Beria et al., 2012; Browne & Ryan, 2011; Macharis and Bernardini, 2015). Quantitative and qualitative information are considered within the same analysis. Transportation projects are increasingly evaluated using MCDA, likely in response to requirements to consider a wider array of project impacts, including those that are relatively intangible, difficult to quantify, or not easily transformed to a monetary quantity. For example, the impacts of climate change, air quality and public health, or more generally – sustainability.

A typical MCDA begins by defining criteria for evaluating a project and its alternatives. A variety of approaches can then be used to score, weight and aggregate individual criteria to arrive at a final decision or ranking of alternatives (Kiker, Bridges, Varghese, Seager & Linkov, 2005). Simple approaches choose the alternative that scores the highest on the most criteria while more sophisticated approaches weight and aggregate individual criteria using various schemes. There is little illusion of objectivity in this process as the choice of criteria, their scores, and weighting scheme directly influence the results. The process is inherently subjective and dependent on the values and expertise of the appraiser (Beria et al., 2012; Browne & Ryan, 2011; Kiker et al., 2005; Macharis & Bernardini, 2015). This is the main weakness of MCDA. The strength of MCDA, therefore, is not in greater objectivity, but is its potential transparency and flexibility.

Realizing these limitations in MCDA, some have suggested that MCDA be used as a process for creating an alternative that achieves broad consensus among disparate stakeholders (Beria et al., 2012; Kiker et al., 2005; Macharis & Bernardini, 2015). Different groups of stakeholders complete a MCDA. The MCDA completed by different groups is then used to identify differences and continuously refine the project or its alternatives rather than identifying a preferred project alternative from a set of several static, predefined, options. Macharis and Bernardini (2015) advocate for a variation on traditional MCDA that also aims to more fully account for the differences of different groups of stakeholders. In their process referred to as multi-actor multi-criteria analysis (MAMCA), different groups of stakeholders define their own goals and objectives and then select relevant criteria for completing independent multi-criteria analyses (MCA). This differs from MCDA where all stakeholders evaluate the same set of project outcomes using the same criteria. In the final stage of MAMCA, the analyses completed by each stakeholder group are aggregated using weights to arrive at a final ranking of alternatives. In most applications equal weights are used since it is unclear how to justify weighing one group more than another (Macharis, Turcksin, & Lebeau, 2012). These methods demonstrate some ways in which MCDA can provide a framework for exposing differences, adding transparency to the decision making process.

MCDA, more so than CBA, requires the explicit judgement of an individual or group of appraisers to score and weight various criteria or to even define the criteria. This requirement raises an important question. How does the outcome of the analysis vary when different individuals or groups perform the scoring and weighting? MCDA is usually based on expert opinion (Kiker et al., 2005); however, many of the judgements required pertain to values and not necessarily technical knowledge. It therefore seems logical that the outcome of a MCDA will depend on the technical knowledge and values held by its appraisers. While there is a large literature documenting the conflict and disagreement among stakeholders that plagues most environmental decision making (e.g., Beierle, 1998; Petts & Brooks, 2006), few studies have considered these issues with respect to MCDA and in particular for transportation projects where alternatives analysis is often required by regulation (e.g., the Nation Environmental Policy Act in the United States).

Tudela et al. (2006) compare the outcome of a CBA and MCDA for a highway congestion relief project where the CBA was conducted by experts and the MCDA was conducted by community members. The two groups, using the two different methods, result in different rankings of project alternatives. Tudela et al. (2006) conclude that the wider set of criteria considered in the MCDA made the difference. However, the different expertise and values held by each group of appraisers offer another possible explanation. Several applications of the MAMCA method find that different groups of stakeholders rank transportation projects and policies differently (Macharis, de Witte, & Ampe, 2009; Macharis, De Witte, & Turcksin, 2010). For example, residents living near an airport under consideration for becoming a major logistics hub for a logistics company preferred an alternative where another airport would become the logistics hub (Macharis et al., 2009). Apparently, concerns about environmental quality outweighed potential employment opportunities. The airport operator, predictably, and the logistics company preferred alternatives that would make the airport a logistics hub. The government ranked each alternative about equal. Making the airport a logistics hub ranks first when the assessments of each stakeholder group are aggregated using equal weights. This reveals an important limitation in MAMCA as a method for selecting an alternative. Not only does the weighting scheme affect the ranking as the study's authors conclude, so does the number and type of stakeholder groups included. If multiple types of community groups were included, for example, environmental and public health advocates, then the aggregate rankings may have been different. And while the studies by Macharis et al. (Macharis et al., 2009, 2010, 2012) provide evidence that different groups of stakeholders are likely to reach different end points when conducting a MCDA, it is unclear how different the end points would be if each group evaluated the same criteria and not their own unique criteria, as is the usual case in MCDA.

Based on our review of the literature an important question remains unanswered. Who should complete a MCDA analysis to arrive at a valid end point? We cannot answer that question yet; however, we explore in this study how two groups of appraisers rank a common type of urban transportation project using a MCDA framework; a group of technical experts and a representative sample of the most directly affected community members. These two groups seem most relevant in providing expertise and value judgements, respectively. Our objective is to understand how various criteria now commonly considered in urban transportation projects are viewed by the two groups and how that affects the analysis outcome. To this end, we also investigate how concerns held by community members as well as their socioeconomic conditions affect their appraisals. In summary, we find that the two groups have very different perceptions about the proposed project along several dimensions that likely reflect differences in technical knowledge and values. We conclude that a valid MCDA cannot rely on appraisals by either group alone but it remains unclear how they can be combined.