



Sustainability assessment methodology of urban mobility projects



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ABSTRACT

In Brazil, the introduction of a national urban mobility policy occurred only in 2012. In this context, the federal government has provided hundreds of millions in investment to improve mobility conditions in urban areas. The main financial institution responsible for analyzing and monitoring developments of this nature considers the following criteria for project assessment: cost, environmental licensing, compatibility, and functionality. However, a project's contribution to sustainable urban mobility is not taken into account. Thus, the work reported herein aimed to develop a method to assess the sustainability of urban mobility projects. This involved indicator selection, and the development of a tool based on sustainability indicators for project assessment. In addition, an Urban Mobility Project Sustainability Index (UMPSI) was proposed to summarize the assessment, which was tested in five urban mobility projects funded in the Curitiba Metropolitan Region (RMC), presented in a companion paper. Environmental, social, and economic aspects of project design and implementation are considered in the assessment. The proposed method consists of 17 sustainability indicators, grouped according to their connection with environmental, social, and economic aspects. Addition of the proposed method to the contracting and monitoring processes of future urban mobility projects supports the sustainable development of the urban landscape.

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1. Introduction

In the context of the National Policy of Urban Mobility (NPUM) in Brazil, which was created in 2012, the federal government has made lines of credit designed to promote urban mobility available to municipalities and states. The proposed infrastructure, including many works designed for the FIFA World Cup host cities in 2014, is expected to improve urban transportation, collective accessibility, and efficiency of service providers (Brazil, 2012).

Financing and monitoring of these projects are performed by a federal financial institution, which considers the following aspects: i) functionality of the projects; ii) reasonableness of costs; iii) compliance with the rules of the government program that incorporates the proposal; and iv) compliance with environmental legislation. However, among the analysis criteria, a project's contribution to sustainability is not included, an NPUM directive. Given this deficiency, the objective of the work reported herein was to develop

a method to assess the sustainability of urban mobility projects. In order to achieve this goal, sustainability indicators have been identified in urban mobility projects of the Metropolitan Region of Curitiba (RMC), which is cited among world-class cities with sustainable solutions for passenger transportation (Diesendorf, 2000), and a sustainability index was developed for the assessment of such projects.

Thus, the work was developed based on three key ideas. First, the concept of urban mobility as an element that combines the characteristics of all modes of transportation and their relationship with land use, environmental quality and urban planning. Second, the concept of sustainability in its environmental, social, and economic dimensions, as defined by Sachs (1993, 2008), focusing on their interrelationships in a systemic view involving all dimensions and even incorporating other dimensions proposed by this same author, such as cultural, political and territorial. Third, the concept of sustainability indicators as a way to materialize the concept of sustainability and at the same time integrate its dimensions (Malheiros et al., 2012). For Agudelo-Vera et al. (2011), this perspective of integration between different dimensions and concepts is needed to assess urban spatial planning.

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The combination of urban mobility and sustainability results in the sustainable urban mobility concept, based mainly on improving mass public transportation, with the help of integrated land use planning and road system (Costa, 2008; Assunção, 2012; Miranda and Rodrigues da Silva, 2012; Morais, 2012; Rodrigues da Silva et al., 2008; Litman, 2013; Wilhelm, 2013).

1.1. The financial system and sustainability

In the context of sustainability, the perception of limited natural resources, and the quality of life for present and future generations, Sachs (2012) reinforces the importance of long-term democratic planning. The author emphasizes that the planning should identify ambitious, yet feasible, social goals, and propose effective models of resource utilization.

The Equator Principles, established in 2003 by the International Finance Corporation (IFC), aim to instill sustainable development into the financial system. These principles set performance standards for assessment and management of environmental and social risks in project financing, in order to propose measures to minimize, mitigate and compensate for negative impacts resulting from the development of a project (The Equator Principles Association, 2014).

The requirements of the global financial system for project approval include poverty and inequality reduction initiatives, efficient use of natural resources in construction, mitigation of climate change, focused on reduction of greenhouse gas emissions, and fostering social benefits (John and Prado, 2010; IDB, 2014; Duguma et al., 2014; World Bank, 2014). Despite the connection between these issues and sustainability, no specific and widely used tools for the assessment of urban mobility projects, were identified in the financial institutions researched, which reinforces the importance of the present work.

1.2. Indicators for urban mobility sustainability assessment

The establishment of the NPUM in Brazil is relatively recent, and there is no specific, widespread, tool for the assessment of urban mobility projects (Brazil, 2012). The recent implementation of this policy may be interpreted as a current concern of the federal government regarding sustainable urban mobility, due to increasing urbanization over recent decades (Santos, 1994; Costa, 2008; Gomide and Galindo, 2013).

The establishment of the NPUM is based on the role of the National Government, which, according to Sachs (2008), has a duty to prepare and follow the definitions of strategic planning with respect to the different dimensions of sustainability. This role relates to the pursuit of social, environmental and economic goals harmonization, and the promotion of sustainable development on a local, national, and international scale.

One of the instruments for this harmonization is urban planning, which is not unique to developing a mobility policy, but must also incorporate the concept of sustainability. The purpose of this interrelationship is to encourage the use of public transportation and non-motorized modes of transportation effectively, in a socially inclusive and environmentally sustainable way (Sachs 1993, 2012; Costa, 2008; Assunção, 2012; Miranda and Rodrigues da Silva, 2012; Morais, 2012; Rodrigues da Silva et al., 2008; Litman, 2013; Wilhelm, 2013).

Similarly to other relevant instruments of urban planning, such as the Master Plan, which has been required in Brazil since 2001 with the establishment of the Statute of Cities (Brazil, 2001), the proposed assessment method employs indices and indicators to foster the observation of the NPUM in mobility projects, which includes sustainable development.

Indicator is derived from the Latin *indicare*, which means to point, find, estimate, or advertise (Hammond et al., 1995). According to Meadows (1998), indicators are “supporting points”, and their choice decisively influences the way a system behaves. They usually function as tools of change and learning that contribute to plan actions and decisions. They are also applied in different sectors of civil society, government, non-governmental organizations, and markets (Quiroga, 2001), primarily as monitoring, assessment, and decision-making tools.

The concept of indicator, according to Malheiros et al. (2012), and Winograd and Farrow (2009), is the measure that summarizes relevant information about a particular phenomenon, so that it represents a signal or a reference to a person or a group involved in decision-making. Thus, a piece of data turns into an indicator when its significance exceeds the measure assessed, is no longer just a number, and when there is meaning in the decoded information.

An index, in turn, can be defined as a numerical value for the purpose of interpreting the reality of a simple or complex system (environmental, economic, or social), but with a higher level of information association in relation to the indicator (Shields et al., 2002). Choosing an index for aggregation of information can also lead to better communication of results (Scandar Neto, 2006).

Stemming from these concepts, Table 1 was elaborated showing the sustainability assessment criteria that guided the construction of the method. It is the synthesis obtained from the compilation of the sustainability assessment criteria described in the scientific literature and in national legislation, as well as those used in the preparation of the projects examined, namely the urban mobility projects proposed for the FIFA World Cup in the Metropolitan Region of Curitiba.

2. Methods

2.1. Object of study

The work focuses on urban mobility projects in the Curitiba Metropolitan Region, named A, B, C, D and E, described in detail by Cavalcanti (2015).

2.2. Criteria for selection of indicators

Considering the recurring recommendations in the literature to assess the sustainability in urban mobility projects, criteria were defined to select indicators, so that the resulting method of assessment is synthetic, but with broad significance to sustainable development. According to Meadows (1998), Quiroga (2009), Hardi and Zdan (1997) and Litman (2013), those criteria refer to an indicator's relevance for sustainable development, its relevance to solving problems related to urban mobility policy and statistical feasibility, especially the quality of data available to compute the indicator.

2.3. Procedure

The first step was the compilation of a comparative list with the key themes found in the literature, the NPUM, and in projects for assessment of sustainability in urban mobility, grouped according to the social, environmental, and economic dimensions (Sachs, 1993). The result of this step is shown in Table 1 (section 1.2). The second step consisted of identifying indicators on the key themes present in Step 1, selecting these indicators according to criteria of relevance, appropriateness, and statistical feasibility.

Next (step 3), the indicators identified in the previous step were analyzed regarding spatial suitability, considering their applicability to road projects (i.e., would the indicator remain meaningful after a change in spatial dimension, from an urban territory context to an urban road context?). At this stage, scores were assigned

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