



Sustainability of urban mobility projects in the Curitiba metropolitan region



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ABSTRACT

Throughout Brazil as part of the preparations to host the 2014 FIFA World Cup, urban mobility, stadiums, and tourism development projects were proposed. In Curitiba and the surrounding metropolitan area, these mobility works were financed with public resources. A financial institute directly related to the federal government monitors these projects, which are a part of the National Policy of Urban Mobility, instituted in 2012, and yet no criteria to assess their contribution to sustainable development were adopted. Thus, the objective of this study was to identify the sustainability indicators of these projects through a sustainability assessment method. The Urban Mobility Project Sustainability Index (UMPSI) was determined for such projects, as well sub-indices for environmental, social, and economic aspects, in order to verify their contribution in all of the three sustainability dimensions. The values of the UMPSI resulted between 43 and 75%, according to the proposed scale of the index, which has an upper limit of 100%. Finally, minimal benchmarks are suggested to determine the economic viability of mobility enterprises in order to contribute to sustainable urban mobility.

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1. Introduction

In 2009 when the host cities for the 2014 FIFA World Cup (FWC) were selected, the federal government provided lines of credit to finance the development of tourism infrastructure, stadiums, and urban mobility. Urban mobility works, the focus of this work, were included in the National Urban Mobility Policy (Brazil, 2012).

The public investments in infrastructure, in the transportation sector, are related to economic expansion. Yet, according to Sachs (2008), it is necessary to delineate a development strategy that is environmentally sustainable, economically viable, and socially inclusive. Thereby, ideally these investments bring not only economic growth for the country, but also foster efficient policy solutions to mobility projects that promote the quality of life for current and future generations (Meadows, 1998).

In the context of the cities, the social impact of urban mobility projects can include the exchange of goods and services, culture, and knowledge among the population. These benefits are only possible if appropriate mobility conditions are available to individuals in their daily activities such as study, work, and leisure, conforming to an ideal form of sustainable urban mobility (Da Silva et al., 2008; Wilhelm, 2013).

The investments in urban mobility by the Brazilian government in the Curitiba metropolitan region (CMR) represent an example of progress in the country. Although curious, the term progress is pertinent to such projects, since some of the urban mobility initiatives were finished just before the start of the 2014 FWC.

Even before the event took place, and judging by the observed progress, Malhado et al. (2013) pointed out that investment on mobility projects to upgrade Brazil's infrastructure for the 2014 FWC was not in line with political rhetoric, and would not promote sustainability. 44 urban mobility projects were supposed to improve mobility in the 11 host cities, but only 20 were finished before the event. Some will only be finished in 2017, and it is unclear whether sustainability was an issued addressed during project design.

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Thus, the objective of the present study was to identify the sustainability indicators in the urban mobility projects of the CMR. The sustainability assessment methodology of Cavalcanti et al. (2015) for such projects identified their impact. In order to synthesize these results, the Urban Mobility Project Sustainability Index (UMPSI) was defined, in order to serve as reference for future funding analyses of projects' viability (Cavalcanti et al., 2015). Furthermore, the environmental, social, and economic sub-indices were also calculated, allowing to identify the predominant sustainability dimension of the component UMPSI indicators.

Selection of cases for this study consisted of those that were under way in the CMR by 2013 and were directly related to the movement of goods and people in urban areas as part of the wider mobility system. Accordingly, the empirical boundary of this study is composed of various projects that involve paving services, drainage, sidewalks, bike paths, street lighting, signage, and engineering structures (such as tunnels, overpasses, and bridges). Section 2.1, Case studies, presents the projects selected for analysis.

The selection of projects in Curitiba as the subject matter of this study is justified by the work of Miranda and Da Silva (2012), which shows that the city is well known for urban solutions that align public transportation with land use, suggesting that a standard of sustainable mobility for a city is possible. According to Gudmundsson (2004), such a standard is understood as a method to compare the performances of organizations or simple processes in order to learn from the best performers and thus improve the performance of others. Diesendorf (2000) also mentions Curitiba among other cities in the world which developed sustainable passenger transportation solutions.

In order to put the works studied in the wider perspective of Brazilian government urban mobility policies, the next section reviews the progress of legislation on this subject.

1.1. Urban mobility public policies – the inconclusive Brazilian agenda

According to Duarte et al. (2009), the accelerated growth of urban centers in recent years and the growth in the number of individual vehicles disrupt the role of cities. Instead of promoting quality of life and freedom of movement, they intensify conflicts among the different modes of transport in urban centers, leading to vast investments in an attempt to expedite the flow of vehicles.

The distribution of the Brazilian population between urban and rural areas is shown in Fig. 1, which shows the intensification of urban occupation in the country over time.

According to Santos (1994), from 1940 to 1950, particularly after the Second World War, there was a shift in the economic base of the country from agriculture to industry. This shift led to the formation of a national market, the expansion of consumption in various forms, and the beginning of urbanization, which slowly transformed Brazil's landscape into its present form. Since there was no orderly control of this situation, the urban areas were not prepared to receive this population swing. This stressed each city's infrastructure and was further exacerbated by public investments that lacked prioritization on social services.

This situation deteriorated the urban environment, and became a way to redirect the social function of the city towards questions of urban mobility in the review of a master plan. Such plans are defined as the urban policy instruments by the Statute of Cities (Brazil, 2001), seeking to prioritize pedestrians and collective transportation over individual and also revitalize public spaces.

In this context, Duarte et al. (2009) define urban mobility as an element that combines the characteristics of all modes of transportation in regards to their relations with land use, environmental quality, and urban planning. It can also be defined as the flow of goods and people in urban spaces (Brazil, 2012), having the chal-

lenge of promoting social inclusion as a measurement that provides broad and equal access to urban spaces (Duarte et al., 2009).

Reviewing the importance of the Statute of Cities for urban planning, instituted by federal law no. 10.257/2001, which does not constitute the first regulation referring to public transportation in Brazil, since this topic is regulated under articles 182 and 183 of the Federal Constitution (Brazil, 1988). These articles allude to the development of a city's social functions with the guarantee of the well-being of the population through urban development policies executed by municipal level governance.

Gomide and Galindo (2013) highlight that prior to the ratification of the 1988 Constitution, the enactment of federal law no. 6.261/1975 (Brazil, 1975) established the Urban Transportation Development Fund (FDTU, *Fundo de Desenvolvimento dos Transportes Urbanos*) and the Brazilian Company of Urban Transportation (EBTU, *Empresa Brasileira de Transportes Urbanos*). This company would be responsible for planning, financing, and technology development of the sector, while the fund promotes new investments in medium and high capacity transportation systems. During this period, the federal government also assisted, both technically and financially, the municipalities to elaborate transportation plans and projects, promoting the creation of metropolitan management entities. Among these entities is the Coordination of the Metropolitan Region of Curitiba (COMEC, *Coordenação da Região Metropolitana de Curitiba*), responsible for proposing part of the mobility projects that form the subject matter of this study.

The 1990s mark the transfer of responsibility for urban transportation from the federal government to the municipalities, as proposed by the 1988 Constitution, with the extinction of the EBTU (Gomide and Galindo, 2013).

The early years of the 21st Century have seen the passage of the Statute of Cities, already discussed in this section, the formation of the Ministry of Cities (Brazil, 2003), directly linked to urban development, and the creation of the Pro-Transportation Program in 2010, and the National Policy of Urban Mobility through federal law no. 12.587/2012.

The guidelines of this policy are: (i) integration of urban development policy with sectorial policies on housing, basic sanitation, land use planning and management under federal entities; (ii) prioritization of non-motorized over motorized means of transportation and public transportation services over individual modes of transportation; (iii) integration among the means and services of urban transportation; (iv) mitigation of environmental, social, and economic costs from the movement of goods and people in the city; (v) incentives to develop technologies and use of renewable energies that are less pollutant; (vi) prioritization of structured public transportation projects encouraging integrated urban development; and (vii) integration among cities located along international borders with their respective neighbors.

At this point, the National Policy of Urban Mobility is validated by the role of the nation-state, which, according to Sachs (2008), has the responsibility to elaborate and follow the definitions of strategic planning with respect to the different dimensions of sustainability. This role necessitates the pursuit of harmonizing social, environmental, and economic goals, as well as the promotion of sustainable development at local, national, and global scales.

This historical account helps contextualize the mobility projects of this study, which are financed by public funds from the federal government's Pro-Transportation Program, and developed by the city of Curitiba through COMEC.

In order to measure the success of this initiative with respect to the improvement of public transportation, indicators were sought that could serve to evaluate these projects' sustainability. According to Hezri (2004), the combination of indicators and political processes, such as those that culminated in financing the projects

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