

XII Conference on Transport Engineering, CIT 2016, 7-9 June 2016, Valencia, Spain

## Feasibility study for waterway infrastructure: international overview and methodological recommendations

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### Abstract

The context in which the waterway transportation is in Brazil makes clear the development need of specific methodologies for the sector planning. This paper aims to compare the methods of analysis of technical, economic and environmental viability, adopted in Europe, United States and Brazil, listing the best practices and possible improvements of the method adopted in Brazil. The analysis of the documents was based on comparative method, seeking the common elements from its attributes. Each document was analysed in terms of: its structure; type of impacts; required indicators on each impact analysis; reference values for classification of indicators; and the form of integrated analysis of different impacts. The study suggests the inclusion of certain changes in the methodology of calculation and in its combination of tools and parameters used in the measurement of fiscal impacts on the comparative analysis of standard models usually adopted in the United States, Europe and the World Bank.

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Peer-review under responsibility of the organizing committee of CIT 2016

*Keywords:* feasibility study; waterway infrastructure

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### 1. Introduction

Brazil presents great potential for river navigation use, with about 63,000 km of rivers, lakes and ponds. Of that, more than 40,000 km are potentially navigable. However, commercial navigation occurs in little more than 13,000 km, with the Amazonian Region hosting a significant amount of the river area (Brasil, 2010).

Despite the vast navigability possibilities, infrastructure bottlenecks within this transportation mean require the execution of suitability construction work, improvement, and especially maintenance of the waterways. These interventions and the waterway operation itself might generate environmental impacts that need to be well studied. At this juncture, the National Environmental Policy instruments are applied in feasibility and environmental impact assessment studies, and environmental licensing.

As defined by Dalbem *et al.* (2010), on the private sector point of view a project feasibility is proven by a monetary analysis comparing the expected revenues and the investment and operation costs, where the first is predominant. Also, the project must be financially attractive in face of other investment options. From society's point of view, however, other factors other than revenue generation might be considered to be beneficial in a project implantation, such as sector or regional economic development, life quality improvement, transportation time and accident reduction benefits, among others. Thereby, in an economic assessment context, even if a project does not generate the financial return required by the private investor, it can still be interesting society wise. The first studies regarding feasibility assessment methodologies were started in Europe and the U.S. in the 1950s. In Brazil they are a little more recent and remarkably inspired by the precursor's models.

The context on which the Brazilian water transport is inserted highlights the necessity for the development of specific methodologies for the sector planning. This article aims to compare technical, economic and environmental feasibility analysis methods adopted in Europe, the U.S. and Brazil, listing best practices and possible improvements in the Brazilian method.

## 2. The waterway dilemma and feasibility studies

Analyzing the national scenario of the Brazilian waterway system, Pompermayer *et al.* (2014) indicates that, despite not fully explored in regards to its potential and few financial resources effectively applied, at the federal level, there is the simultaneous presence of seven plans and programs under the coordination or direct responsibility of eight institutions. In this context of overlapping of responsibilities, the basic tools that allow access to information and knowledge necessary for the preparation of planning documents, Technical, Economic and Environmental Feasibility Studies (EVTEAs), are still in preparation.

In terms of infrastructure and operation, the waterway system incurs specific risks that are distinct from terrestrial systems, for example the water crisis. The implementation, operation and revenue forecast costs directly associated with the demand and profile of the transported load must also be carefully analyzed. On Valente's point of view (2013), "the main challenge in waterway transportation is to assert the construction of locks in reservoirs and dams to allow total navigability in the most important rivers of the country." The author also points out the divergence of interests within the electricity sector, which refuses to pay lock construction costs that might enable waterway use.

Besides this conflict, Carvalho (2008) presents possible impacts arisen from implementation activities, not very common in terrestrial systems, which are already consolidated in the country. As regards to the aquatic environment, deforestation, excavation and dragging operations might generate temporary or permanent animal disturbance, deaths by burial and/or sedimentation. It may occur material suspension, which increases water turbidity consequently reducing light penetration followed by alterations in the aquatic biota. Weir's construction modifies flowing river conditions and has influence on the flood in adjacent areas which, by its turn, affects the animal and human population there installed. Waterway course adjustment and channel construction might increase the flowing water velocity, sediment disaggregation in riverbeds and banks, sudden volume variations of transported sediments and elevation in silting and turbidity levels. Moreover, vessel traffic turns around suspended sediment load from the bottom of fluvial channels and increases erosion rates of river margins in more critical areas, not to mention the higher emission of atmospheric pollutants and possibility of contamination in the aquatic media because of ballast waters waste or inadequacy in loads handling.

The waterway specificity highlights the necessity of involving different knowledge areas on project assessments and expanding out the support analysis to the decision makers. Like Pompermayer *et al.* (2014) emphasize, the waterway sector is relatively unknown by the public and private sectors, in Brazil. Therefore, it cannot draw attention to more powerful authorities to decide on its favor in terms of the establishment of public politics and resources allocations.

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