Chapter 21
Greener Transportation Infrastructure:
Theoretical Concepts for the Environmental Evaluation of Airports

Jean-Christophe Fann
Université Libre de Bruxelles, Belgium & University of California, Berkeley, USA

Jasenka Rakas
University of California, Berkeley, USA

ABSTRACT

The adoption of greener construction practices occurs mostly in the realm of building projects. Existing environmental evaluations are often generic, and hence, unable to manage the complexity of larger infrastructure systems such as airports. To respond to this need, the authors of this chapter developed the theoretical grounds for the evaluation of greener airport systems. The proposed concepts demonstrate how to implement greener practices from the early stages of a transportation infrastructure project in an economically rational and stakeholder-focused manner.

The presented methodology has two fundamental goals: first, to foster greener design practices among airport managers, planners, and designers, and second, to establish a dynamic dialogue between all airport stakeholders, while overcoming the shortcomings of traditional environmental impact assessments and thus ensuring capacity enhancement. The innovative aspects of the methodology are the combination of a flexible implementation strategy, the use of Multi-Criteria Decision Making (MCDM) with cost and utility functions, and a structured definition of environmental sustainability with customized evaluation parameters.

DOI: 10.4018/978-1-60960-531-5.ch021

INTRODUCTION

Transportation infrastructure is a key strategic asset for economic development but it also has a major impact on the environment. In recent years, the adoption of green practices has been mostly occurring in the case of individual building projects and there is a lack of environmental assessment tools capable of handling complex infrastructure systems such as airports. To address these needs, this chapter introduces theoretical concepts for an environmental evaluation of airport systems. The development of a new methodology demonstrates how to implement greener practices from the early stages of a transportation infrastructure project in an economically rational and stakeholder-focused manner. The concepts presented here also remain valid and applicable to other types of infrastructure systems.

Airport development is facing growing concerns from direct stakeholders and the general public as a result of its significant adverse impacts on local communities and the environment. There is widespread recognition of the environmental repercussions of airport construction and operation at both the local and global levels (Janic, 1999). Such concerns consistently constrain airport development, despite its crucial role in the economic growth of a region. Although many airports implement programs that address a variety of daily operational issues such as the use of alternative fuels and improved air traffic management procedures (ACI, 2009b; GRI, 2009), there is currently no uniform or structured approach in place to improve the planning and design of airport development. This study seeks to specifically address the environmental aspect under consideration at these life-cycle stages since decisions made at the beginning of a project have considerable long-term environmental impact.

The development of an evaluation methodology has two fundamental objectives: first, to foster greener design practices among airport managers, planners, and designers, and second, to establish a dynamic dialogue between all airport stakeholders, while overcoming the shortcomings of traditional environmental impact assessments and thus ensuring capacity enhancement. This chapter contributes to the state of the knowledge in airport environmental management by proposing the combination of five distinct considerations: (1) the evaluation of environmental sustainability with a focus on the planning and design stages of airport facilities, (2) a procedure for screening and ranking alternatives, (3) examples of applicable performance criteria, objectives and indicators with sample scoring procedures, (4) a Multi-Criteria Decision Making (MCDM) approach combined with cost and utility functions, and (5) a flexible implementation strategy to enable end-users to adjust the complexity of the evaluation. This study is intended to open a discussion for the development of a methodological tool that fulfills aims of promoting greener airport design, while at the same time satisfactorily addressing stakeholder concerns.

In this chapter, we start by reviewing existing practices and argue the need for an evaluation methodology specifically tailored for airport systems. From there, we identify the main challenges for an effective and transparent evaluation process in line with our two fundamental objectives. We analyze the respective pros and cons of features from existing methods to determine the most relevant concepts and techniques. We subsequently present our step-by-step methodology for evaluating the environmental sustainability of airport systems and demonstrate how it addresses the shortcomings of existing methods. A numerical example and a selection of performance criteria illustrate real-world applicability. Finally, arguments on the inclusion of a life-cycle perspective and discussion on the development of a dynamic stakeholder platform call for further research on the topic.