Methodology for Environmental Sustainability Evaluation of Airport Development Alternatives

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ABSTRACT

This study develops a new approach for the evaluation of greener airport systems. The proposed concepts demonstrate how to implement greener practices from the early stages of an airport infrastructure project in an economically rational and stakeholder-focused manner. Objectives of the proposed methodology are two-fold: (1) to promote greener design practices among airport planners, designers, and managers, and (2) to institute active communication among all airport stakeholders. The study 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.

Keywords: Airports, Cost Function, Environmental Evaluation, Life-Cycle Analysis, Multi-Criteria Analysis, Performance Indicators, Utility Function

INTRODUCTION

As the demand for air transportation continues to grow worldwide, so does the need for increased aviation capacity and airport infrastructure. However, construction and expansion of airports, and increased air traffic demand all have negative impacts on the environment. Construction and expansion of airports commonly rely on traditional environmental assessment tools when addressing local and global environmental impacts. To date, we found a lack of comprehensive, systemic and contemporary environmental evaluation assessment tools
capable of handling complex infrastructure systems such as airports, especially in the sustainable environment. To address these needs, this study introduces comprehensive 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 an airport infrastructure project in an economically rational and stakeholder-focused manner. The concepts presented here are also valid and applicable to other types of infrastructure systems.

The expansion of airports has continuously been causing growing concerns to direct stakeholders and the general public as a result of significant adverse impacts of such expansion on local communities and the environment. There is a widespread recognition of the environmental consequences of airport construction and operation at both the local and global levels (Janic, 1999). Such concerns consistently constrain airport development, despite the crucial role of airports 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 a comprehensive evaluation methodology has two main objectives: first, to promote greener design practices among airport planners, designers, and managers, and second, to institute an active communication among all airport stakeholders, while overcoming the shortcomings of traditional environmental impact assessments and thus ensuring capacity enhancement. This study 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.

Background

Based on a review of industry practice and scholarly literature, we find that there is currently no generic assessment procedure designed to accommodate the complexity and specificity of airport systems, nor to provide a dynamic platform for discussion among interested parties. Effective consideration of stakeholder concerns is central to the progress of the project and to avoiding possible litigation costs. An effective methodology should also be applicable to a broad range of project scales, from the minor remodeling of existing facilities to the complete development of new systems, covering most airport functional categories including, but not limited to, airside infrastructure, terminal buildings, cargo facilities, ground transportation and airport support equipment.

Common practices to demonstrate the environmental sustainability of master plan proposals typically include the preparation of intensely comprehensive regulatory environmental impact assessments (FAA, 2006), the certification of new buildings using generic green building standards (USGBC, 2008), and qualitative evaluations on a case-by-case basis. In rare instances, local airport authorities have developed their own sustainability design and construction guidelines to offset the absence of a more adequate method (City of Chicago OMP, 2003; LAWA, 2009). Doubts as to the actual effectiveness of traditional measures,
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