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Geo-referenced sustainability assessment: a strategic framework for urban planning decisions
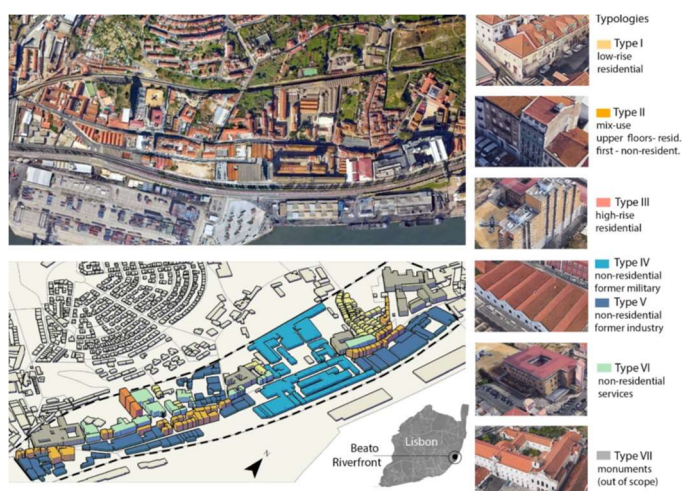
Summary

Cities are the major hubs of attraction of today's socio-economic development, as well as the principal contributors for the largest share of greenhouse gas emissions released and resource consumption. Consequently, planning and managing cities' growth and changes are among the main challenges of the 21st century. From the urban planning point of view, addressing these challenges requires the development of decision support tools capable of helping urban planners and related professionals to make sustainable land-use choices. During the past decade, numerous urban sustainability assessment tools, such as BREEAMCommunities or LEED-Neighborhoods, have been developed and used worldwide to support such planning decisions. These existing tools provide a set of criteria, design to help decisionmakers defining objectives and measures that can improve the sustainable performance of a given urban area. Nevertheless, these assessment tools present limitations on the selection of the most suited locations or estimating investment costs.

This thesis proposes two methodological improvements to the existing tools. First, it combines urban sustainability assessment with geographical information systems (GIS) to support the identification of the most suited locations for the implementation of improvement measures. Second, it incorporates life cycle costs (LCC) analysis into the sustainability assessment to estimate and compare the investment costs of alternative options. These proposed improvements are tested for the city of Lisbon and can be extended to other urban areas where similar input data is available.

This work results in the development of a new workflow of analysis for geo-referenced urban sustainability assessment. The workflow starts with the quantitative assessment and diagnosis of a city sustainability performance, identifying the highest and lowest performance urban clusters for each sustainability issue analyzed, based on GIS modeling; followed by the economic feasibility study of the possible alternative measures to improve the sustainability levels of the lowest performance areas, using LCC. This workflow can be applied in a loop to continuously estimate the improvements of the city's sustainable performance according to the measures implemented. The main findings of this thesis can be used to optimize the existing assessment tools or developing new ones. The outcomes can also help local governments or municipalities defining land-use policies adapted to the local characteristics of each site, or even urban planners and architects defining the priority issues to consider in the development of an urban project.

Keywords

Sustainability assessment, urban planning, Geographic Information Systems (GIS), Life Cycle Costs (LCC).

PhD student
Joana Maria Jorge Simões Pedro

PhD program
Sustainable Energy Systems (IST, University of Lisbon)

Supervisor
Carlos Santos Silva (IST, University of Lisbon)

Co-supervisor
Manuel Pinheiro (CERIS, IST, University of Lisbon)

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