CERIS | Civil Engineering Research and Innovation for Sustainability

A decision support tool for the flexible development of constrained airports

Summary

The air transport market is a highly competitive business and airports are called to quickly respond to new requirements, such as demand fluctuations, technology developments, new regulations and financial restrictions in order to survive as a profitable business. However, airports are infrastructures with a long-term return investment. Any change on this infrastructure should be efficiently conducted to manage the airport resources (e.g. installed capacity) and its cost. The motivation for this thesis relied on the airport's difficulty to cope with these unpredictable events. Approaches to airport development based on principles of flexibility have been advocated. Yet, research into flexible airport development is still very much in its early stages and the benefits offlexibility have been discussed at a theoretical level. This research intends to contribute to achieve superior knowledge and a better understanding of how to deploy flexible airport development plans and ultimately, to advance towards a more mature body of research work. Additionally, it also presents a decision support tool whose purpose is to support the choice between different flexible options for passenger terminals in the extension case.

The development of the decision support tool was guided by two research hypotheses. The first is that in cases of airport extension, the opportunities provided by flexibility can be assessed and, hence, exploited through the analysis of the relevant processes occurring in the element undergoing the development. The second is that flexibility is characterised by five fundamental variables: implementation time, removability, performance, costs and, value for money. A two-tier approach was used to evidence the decision support tool. Firstly, a series of interviews were conducted with worldwide airport practitioners to empirically evidence the tool. Secondly, the decision support tool was applied to a case study – Terminal 2 at Lisbon Airport. This application was based on simulation modelling built using the AnyLogic software. The simulation model is based on discrete-events to explore changes in the passenger processes at an airport terminal with an agent-based component that is provided by the pedestrian library of AnyLogic. The agent-based component provides passengers with the ability to interact with the physical environment. The main conclusions to de drawn are, firstly, that the evaluation of flexibility can be tied to the performance of the processes, using the five fundamental variables described above. Secondly, the results of the simulation modelling evidence that flexible options can lead to small capacity increases of the aeronautical activities and consequently, to improve the level of service at airport terminals.

Keywords

Flexibility, airport development, airport terminals, passenger processes, modelling, simulation.

PhD student
Liliana Magalhães

PhD program
Transportation Systems (IST, University of Lisbon)

Supervisor
Vasco Reis (CERIS, IST, University of Lisbon)

Co-supervisor
Rosário Macário (CERIS, IST, University of Lisbon)

Period
2011-2018