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Location Analysis for Public Sector Decision-Making in Uncertain Times: An introduction to the Special Issue

A location problem aims at finding the best position for a set of facilities within a given region in order to optimize a specific objective function. While the origins of this class of problems can be traced back to applications related to private sector industries, in the last decades there have been many theoretical developments and applications concerning the location of public-sector facilities (i.e. schools, post offices, emergency services, environmental protection services, fire stations, hospitals, ambulances, waste management centres). These models represent a viable decision support tool for institutions that are planning to expand their capacity in a given region and/or market. However, this very well established research strand has recently started to be influenced by contemporary events related to the changing, uncertain and turbulent nature of our times.

In recent years, due to the global recession, subsequent austerity measures and the general interest to reduce costs and improve efficiency, public sector bodies have been very interested in the rationalization of their facility networks providing essential services to the population; in many cases, these rationalization efforts have involved thorough reorganizations of the service supply systems (including, for instance, relocation, downsizing, closure and expansion of existing facilities). In this context, decisions may depend on various factors such as the nature of the service, accessibility parameters and characteristics of the demand. Also, the need to take into account multiple stakeholders' views might further increase the complexity of these decisions, leading to inherently multi-objective problems to be solved in a highly political environment. However, local authorities and public bodies may often lack adequate predictive instruments (and, in some cases, access to data) for appropriately estimating the impact of such decisions, which, usually, are mainly performed on a qualitative basis. In this sense, the development of suitable tools to evaluate financial benefits and social impacts of possible decisions may represent a useful support.

In an attempt to address these research questions, this special issue presents a selection of cutting-edge papers dealing with contemporary challenges arising in the design, management and operation of public sector facility networks.

The special issue has received very strong interest from researchers and practitioners working in the field, also thanks to related sessions that were arranged at the joint EWGLA/ISOLDE meeting that was held in Naples and Capri in June 2014. After several rounds of peer review by two or three reviewers, 6 papers were selected for publication, providing a wide range of application contexts and methodologies. A brief overview of each paper is then reported (contributions are listed following the alphabetical order of the first author).

The paper from Bruno et al. (2016)[1] deals with the problem of institutional mergers in education systems, a timely issue being experienced by some European countries due to severe reductions in public expenditure in the education sector. The study is concerned with case studies from Italy, where central and local governments have been promoting actions aimed at modifying the current configuration of the existing facilities offering educational services, in order to increase the affordability of the system while still providing a required minimum service level. Authors provide two novel mathematical models for addressing rationalisation decisions in the Italian education system, testing them by means of real-world case studies.

An interesting application of facility location and network expansion to a public sector supply chain that operates for humanitarian purposes is provided by the study of Celik et al. (2016). This paper develops a comprehensive model (incorporating also routing planning) to optimize the delivery system of donated breastmilk to neonates in need, along with a real-world case study from South Africa. Inherent uncertainty of supply and demand and various equity measures as objective functions are incorporated in the proposed mathematical programming model through the generation of multiple scenarios. Computational experiments are performed in order to analyse trade-offs between required service levels and the effects of public health policies, budget availability, and assumptions about supply and demand.

The study from Chaudhary et al. (2016) investigates the provision of another fundamental service in urban contexts, developing an evaluation framework for siting decisions for fire stations in the very densely populated metropolitan area of Kathmandu (Nepal).The paper deploys an interesting integration of multi-criteria-decision analysis (by employing Analytic Hierarchy Process) with a GIS interface, considering four different selection criteria such as land cover, distance from roads, distance from rivers and population density, providing interesting insight about public sector decision making in a developing country.

Murray and Feng (2016) address location issues related tonight-time lighting in urban contexts. Street lighting is a fundamental service to be provided by local authorities; however, it is very costly and energy intensive, with negative impacts on the environment. Therefore, while city councils need to ensure a minimum service level, the position of street lights needs to be optimized also bearing in mind these negative consequences. Starting from the consideration that decision making in this area has evolved over time using simple rule-of-thumb planning standards, authors develop an example of a systematic assessment and re-evaluation procedures for the enhancement of the spatial efficiency of a public lighting infrastructure based on a combination of Geographic Information Systems (GISs) and spatial optimization, applying this methodology to a real case study from the San Diego (USA) urban area.

A further application to humanitarian logistics context is provided by the study of Sahin et al. (2016), dealing with debris removal issues in disaster-affected regions. This topic is of great importance as debris can block roads and prohibit emergency aid teams from accessing areas in need. The focus of the study is on providing emergency relief supplies to affected regions as soon as possible by unblocking roads through removing the accumulated debris. Mathematical models that select paths for transporting emergency aid materials in the presence of debris to

[1] This contribution was included in the Special Issue as an invited paper; as such, its review process was not handled by the Guest Editors, but directly by the Editor-in-Chief.

disaster-affected regions are developed and tested on a data set from Istanbul (Turkey); authors also deploy a fast heuristic methodology to solve the problem.

In the context of intelligent transport systems, Sterle et al. (2016) develop a model (based on integer linear programming flow-intercepting facility location problems) for the location of variable message signs (VMSs). These mobile facilities play a major role in providing drivers with useful information (for instance, about traffic and congestion conditions) during their trips. The paper considers the problem of finding the optimal location of a set of portable VMSs within an urban network where flow patterns change during a time horizon. Different models are developed and applied to test problems, in order to compare the provided solutions.

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