Chapter 75
Inter and Intra Cities Smartness:
A Survey on Location Problems and GIS Tools

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ABSTRACT

The rapid advances in Information and Communication Technologies (ICT) contribute to the creation of 'Smart Cities'/'Knowledge Precincts' that use data, information and technologies to enable innovative business models. This contributes to the nations' development. For smart cities/knowledge precincts to realize the planned social and economic impact; they have to be well-located and planned. Creating connections among cities also contributes to their smartness. This, calls for concepts of inter and intra smartness contributed in this chapter. The question is: a) how to locate the components of the smart city internally and b) how to locate the smart cities relative to each other and to their communities. Location problems are tackled with optimization and Geographic Information Systems (GIS) tools. This chapter starts by giving definitions on the topic and then presents a survey on the 'Smart Cities'/'Knowledge Precincts' location problems that use optimization and GIS tools and concludes with avenues for future research.

INTRODUCTION

The rapid innovations and advances in information and communication technologies (ICT) contribute to the creation of 'Smart Cities' (SC) and 'Knowledge Precincts' (KP). Smart cities are knowledge based. They use data, information and communication technologies strategically to provide more efficient, new or enhanced services to citizens, manage, optimize the existing infrastructure and plan for making it more effective, reduce organizational silos and employ new levels of cross-sector collaboration; and enable innovative business models for public and private sector service provision.

For cities to be smart and for knowledge precincts to realize the planned social and economic impact, they have to be properly located and they have to be planned in a way that integrates services of different kinds and from different sectors. Creating the connections among cities also contributes to the cities' smartness. This calls for concepts of inter-smartness and intra-smartness that are contributed in this chapter. The question is then: a) how to locate services and different components of the smart city internally and b) how to locate the smart cities relative to each other and to the community within which they are located. The literature is rich with analytical tools, algorithms and decision support frameworks that address the location problem. Location decisions have traditionally been determined by factors such as cost, access to markets and raw materials. Smart cities' location needs to consider other factors such as quality of life. However, many of the literature contributions can still give insights to the SC and KP location problem.

Since the birth of Geographic Information Systems (GIS) in the late 1960s, the analysis of mapped data has become an important part of understanding and managing the geographic space. This new approach helps us to spatially and digitally characterize and communicate complex spatial relationships. Hence, the location problem is tackled with both optimization and GIS tools. Actually, GIS form, more and more, a backbone for the location analysis problem.

This chapter is organized as follows. It starts with a background section that gives definitions to the knowledge precincts/smart cities and other important terms relevant to the covered topic. It then presents a survey on the location analysis problems solved for different applications. Even when solved in other contexts, tools and methods used are potentially transferable to the smart cities and knowledge precincts location analysis problem. This problem, however, has the objectives of fostering the knowledge based economy and contributing to wealth creation of nations. The review details both the optimization and GIS tools used for solving location problems. The chapter ends with a conclusion and important avenues for future research.

BACKGROUND

In this section, definitions of the terms as will be used in this chapter will be provided. The authors will adopt some definitions of the literature or provide their definitions for the different terms used. The section also presents the topic discussed.

ICT (information and communications technology – or technologies) is considered as an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (Rouse, 2005). ICT can also be defined as the digital processing and utilization of information by the use of electronic computers; it comprises the storage, retrieval, conversion and transmission of information (Okauru, 2010). ICT refers to two components: information technology (IT) and communication technology (CT). IT refers to computer software and hardware, including tablets and personal digital assistance (PDA) devices. CT refers to internet facilities, including smart phones (Mamun, Danaher & Rahman, 2015). Most of the definitions in the literature share a similar notion which is that information has to be generated and shared. They also assert that, such information must be digital or electronic.

ICT infrastructure enables the development of the next generation smart cities and will become its backbone. As smart cities grow in number and a larger percentage of the population moves to inhabit

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