Chapter 1.8
Sustainable Infrastructure Project Planning:
Progress in Contemporary Decision Support Tools

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ABSTRACT

Most infrastructure project developments are complex in nature, particularly in the planning phase. During this stage, many vague alternatives are tabled - from the strategic to operational level. Human judgement and decision making are characterised by biases, errors and the use of heuristics. These factors are intangible and hard to measure because they are subjective and qualitative in nature. The problem with human judgement becomes more complex when a group of people are involved. The variety of different stakeholders may cause conflict due to differences in personal judgements. Hence, the available alternatives increase the complexities of the decision making process. Therefore, it is desirable to find ways of enhancing the efficiency of decision making to avoid misunderstandings and conflict within organisations. As a result, numerous attempts have been made to solve problems in this area by leveraging technologies such as decision support systems. However, most construction project management decision support systems only concentrate on model development and neglect fundamentals of computing such as requirement engineering, data communication, data management and human centred computing. Thus, decision support systems are complicated and are less efficient in supporting the decision making of project team members. It is desirable for decision support systems to be simpler, to provide a better collaborative platform, to allow for efficient data manipulation, and to adequately

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reflect user needs. In this chapter, a framework for a more desirable decision support system environment is presented. Some key issues related to decision support system implementation are also described.

INTRODUCTION

Infrastructure projects are sophisticated and dynamic in nature. Successful projects need good teamwork and efficient coordination. Otherwise, projects might experience benefit shortfall. In many countries, most infrastructure projects share the same characteristics in terms of management aspects and shortcomings. Human factors are believed to be a major cause of difficulties due to the presence of unstructured problems which can further contribute to management conflicts. This growing complexity in infrastructure projects has shifted the paradigm of policy makers to adopt Information Communication Technology (ICT) as a driving force in infrastructure project planning (Howes & Robinson, 2005). Therefore, many tools have been developed to assist decision making in construction project management. The variety of uncertainties and alternatives in decision making can be accommodated by using computerized tools such as Decision Support Systems (DSSs).

In construction domain, a growing interest of DSS development has been identified as a promising and interesting research area. Much research have been conducted within project management life cycle phase including the initiation, planning, design and development, detailed design, procurement, manufacture and construction, commissioning and operation and maintenance (Harris & McCaffer, 2001).

However, most of these applications in the construction domain only concentrate on decision model development and neglect fundamentals of computing such as requirement engineering, data communication, data management and human centred computing. Thus, most studies and applications of DSSs are impractical or too complicated to support decision making for project team members. Basically, lay people, such as project managers who do not have fundamentally strong quantitative knowledge, would not utilize these tools.

The aim of this chapter is to investigate the recent development of DSSs in the area of construction project management. In addition, it revisits some basic terminology and components used in a typical system development. It starts from the basic concept of infrastructure project planning with emphasis on decision making. Later, decision tools such as DSSs are discussed, together with the current issues concerning DSS implementation. Finally, a proposed DSS framework for a typical construction application is presented.

INFRASTRUCTURE PROJECT PLANNING

Typically, infrastructure project planning is based on a top-down approach ranging from strategic to operational planning (Niekerk & Voogd, 1999). The term ‘strategic’ incorporates issues relating to long term planning, while ‘operational’ focuses on how to get tasks done. An early framework which modelled infrastructure planning around a few stages and classifications (see Figure 1) was proposed by Grigg (1988).

Based on the above model, ‘policy planning’ refers to the overall policies that will govern the entire program or approach. An example would be the study of the need to subsidize infrastructure to improve the chance of economic development. Secondly, ‘program planning’ refers to activities that have to be undertaken for each service category, such as transportation, roads, water, or waste water management. Program planning may include capital and operating components. Meanwhile, ‘master planning’ specifies where and when facilities should be developed. Next, ‘action planning’ enables the action agency to decide how to

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