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Handling project dependencies in portfolio management

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Abstract

Although construction is a project-based industry, management focus has recently shifted from projects to project portfolios to meet strategic objectives of companies that require holistic analysis of the projects undertaken. Dependencies between projects within a portfolio need to be taken into consideration since they may significantly affect the portfolio success with their combined effects. There are limited studies in the area of construction project portfolio management that investigate how the dependencies between projects can be handled. In this paper, a method is presented to calculate and visualize project dependencies to support decision making process within a portfolio management tool for construction projects. Within this context, a dependency map is proposed not only to identify different dependencies and their effects within the portfolio, but also to take into consideration the combined effect of dependencies. An illustrative case study is depicted in the paper to demonstrate how the proposed method works and how its results can be used to support decision-making during portfolio selection.

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Keywords: decision support system; network analysis; portfolio management; project dependencies; visualization.

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1. Introduction

Construction is a project-based industry. The unit of analysis and focus of decision-making (bidding, risk assessment, etc.) are the "projects". During decision-making, construction projects are generally handled as they are independent from each other and the decision support tools are usually designed to be used at the "project level". However, most of the companies are executing projects simultaneously and there exist dependencies between these projects due to shared resources, similar technical requirements, physical locations, contractual agreements and similar external environment. When a project success is dependent on other projects, it can be stated that relationship exists between these projects[1]. Projects may share many resources and may have common objectives to be achieved. Therefore, there can be a resource, outcome, market/benefit, financial, or learning dependency between projects[2]. Thus, projects need to be handled from a "portfolio" perspective and managed at the "portfolio level" as it has been widely discussed in the literature[3,4,5]. Although, research on portfolio management has been widely carried out in the industries such as finance and regarding projects such as technology, innovation, and research and development projects; construction industry specific studies have been very limited in this area[6,7,8]. Portfolio success is considerably dependent on identification of relations between projects and generation of strategies accordingly[2,4,9]. In his study, Rungi (2010a)[5] states the importance of evaluation of dependencies between projects to achieve portfolio success and argues that interdependency management is a critical success factor. Portfolio management is a complicated process since it requires comprehensive analysis of strategic objectives, financial profit, project performance, demand conditions, resources, capabilities, risks and other similar parameters[10,11]. Thus, methods and tools are required for facilitating portfolio management process as it is widely emphasized in the literature[11,12,13]. This paper is a part of a research project conducted to develop a portfolio management tool for construction companies. A visual, intelligent (capable of generating and using knowledge), and dynamic (capable of updating) tool has been designed, which also enables identification and visualization of project dependencies. It has been generated at the end of an iterative process through feedbacks obtained by interaction with academicians and construction company professionals, and has been coded by a professional software company. The tool has a potential to provide decision support in the management of risks and resource allocation, also facilitates learning from projects based on the identified project dependencies. In this paper, we will present the quantification method used for project dependency assessment in this tool.

2. Research background

In order to improve portfolio performance, dependencies between the projects must be absolutely taken into consideration in the identification and evaluation processes[2,5]. Importance of dependency evaluation between projects is considerably mentioned in literature; however, a comprehensive study focused on evaluation of dependencies has not been published yet[14].

Various types of dependencies can be present between the projects. *Resource dependency* can be explained as a limitation where resources are used jointly in another project or constraint to starting/ending of projects. *Market/interest dependency* represents the complementary/competitive effects of projects for each other. *Product dependency* implies a technical requirement or any other product/return is expected from another project. *Learning/experience dependency* is about the knowledge to be obtained in one project is to be used in another project. Lastly, *financial dependency* exists when there are financial relationships between projects. Rungi (2010b)[15] underlines that analysis of dependencies within portfolios has contributions in effective portfolio selection and portfolio success. However, in the same study he has shown that although companies are generally aware of the existence of inter-project interactions, they do not include them in their evaluations since they believe that the analysis and evaluation of relations are difficult and time consuming. The existing studies on dependency analysis usually consist of subjective evaluations as self-reporting methods, optimization methods, and visual representation methods[5]. The visual methods contribute to a more realistic view for evaluation of portfolios; however, they still have some limitations. Dependencies of projects are generally depicted through 2x2 matrix representations; however, these representations are not capable of reflecting multi-level dependencies between projects. They are capable of pairwise dependency analysis between projects and not capable of representing accumulated effects between projects. For example; in case of a dependency of project A to B, and Project B to C; this method is not able to evaluate the effect