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Investigating key challenges in major public engineering projects by a network-theory based analysis of stakeholder concerns: A case study

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Abstract

The diversities of stakeholder concerns and intricate interdependencies between stakeholder concerns are important factors adding complexities to major public engineering projects (MEPs). Using case study and network-theory based analysis in a large reclamation project, this paper investigated the key stakeholder concerns and concern interdependencies of MEPs, and how they bring major challenges confronted by stakeholders. The network analysis identifies five major challenges of the case: "applying highly advanced and complex construction technology", "mitigating project disruptions to the environment and marine ecology", "conducting public and community consultation during construction phase", "site constraints due to nearby air and marine traffic", and "meeting government standard on the quality of new materials and equipment". Recommendations are provided to alleviate these problems for future MEPs. This paper contributes to a new angle, the network perspective, of analyzing stakeholder concern interdependencies and their practical implications on MEPs. The findings provide useful insights on common pitfalls of MEPs.

Keywords: Stakeholder concern; Stakeholder analysis; Network analysis; Major engineering project

1. Introduction

Major public engineering projects (MEPs) are substantial investment, which are initiated and funded by the government, to provide communal facilities essential for boosting economic growth as well as enhancing the environment and societal quality of life (Zeng et al., 2015). MEPs are characterized by being dimensionally huge and human-oriented (Yeo, 1995); having extreme complexity, high risks and long lead time (Fiori and Kovaka, 2005); involving multiple stakeholders at different levels; and producing considerable impacts to the society, economy and natural environment (Zhai et al., 2009). The cost of MEP is huge where the governments and researchers worldwide have accepted the range of US$500 million–1 billion as the cost threshold per project (FHA, 2005; Hu et al., 2015). Failures of MEPs have been discussed in many studies, where the complexities of stakeholders, stakeholder issues and their interrelationships are highlighted as major factors adding difficulties to MEP management (Olander and Landin, 2005).

MEPs involve a wide range of stakeholders who come from diverse backgrounds and raise various issues that are at stake in the project. These concerns might be favorably or unfavorably affected owing to the achievement of project objectives (PMI, 1996). Although they are often conflicting and relate to diverse topics, stakeholder concerns springing from a MEP are bonded with strong and dynamic interdependencies. The presence of a concern can evoke or govern the existence as well as incidence of other directly or indirectly related concerns in the same project environment (Fang et al., 2012). The interactions and

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chain effects between stakeholder concerns increase uncertainties in stakeholder behaviors and project decision making, therefore posing great challenges to both stakeholder management and the delivery of MEPs. In fact, a MEP can be considered as a network of interrelated stakeholder concerns. A network perspective to analyze stakeholder concerns, their interrelationships and proliferating impacts on the project is essential; without which the stakeholder analysis process might compromise in completeness and accuracy, leading to poor stakeholder satisfaction, uninformed project decision making and unsatisfactory MEP performance.

In recent decades, researchers have developed various stakeholder analysis processes and tools in an attempt to cope with stakeholder complexities in MEPs. Mitchell et al. (1997) established *stakeholder salience model* to determine the classes of stakeholders based on their possession of three attributes: power, urgency, and legitimacy. The *power/interest matrix* is another broadly used method to classify stakeholders based on their power and interest levels (Olander and Landin, 2008). Rowley (1997) proposed a relational approach to evaluate stakeholder influences, and predict their behaviors and levels of demands towards focal company by investigating stakeholder relationships. These traditional methods are useful in classifying stakeholders and evaluating their impacts according to stakeholder attributes, attitudes and interdependencies; nonetheless, they are insufficient to address complexities brought by stakeholder concerns, concern relationships and their chain effects on the project. The existing methods view stakeholder concerns as being independent and stationary in vacuum. Consequently, they may not be able to help in answering the following questions: (1) What stakeholder concerns are at stake in a project and how are these concerns interconnected? (2) What are the practical implications of these concern interdependencies on stakeholder management and project implementation? To bridge these research gaps, a network perspective to investigate concern interdependencies in MEPs is of theoretical and practical importance.

Network-theory based analysis is a potential method to investigate stakeholder concern interdependencies in MEPs by visualizing the relationship fabrics and examining quantitatively their structural properties (Wasserman and Faust, 1994). Stakeholder concerns exist in a form of network in each MEP; however, the existing stakeholder analysis methods have overlooked concern interdependencies and their proliferating impacts. Using a network approach can help project team to capture the cause-and-effect relationships among stakeholder concerns, identify key concerns and interactions, as well as understand the key challenges encountered by project stakeholders based on the network analysis results. Researchers of the construction management field have applied network analysis to examine various interdependencies, such as human relationships of project participants (Dogan et al., 2015; Solis et al., 2013), project risk interactions (Fang et al., 2012; Yang and Zou, 2014), and interconnections between elements of an infrastructure system (Eusgeld et al., 2009; Zhang et al., 2015). Despite the need of using a network approach for concern interdependency analysis in MEPs, such empirical studies appear to be lacking. Therefore, this paper demonstrates the use of network-theory based analysis for identifying key stakeholder concerns and concern relationships in MEPs through a case study, as well as identifies major challenges in the case project based on the network analysis results.

This paper starts with a review of the major stakeholders and concerns in MEPs, followed by an overview of the network theory and usage of network analysis in construction management field. The research methodology section explains the case study method, as well as the network development and analytical process. A MEP of large-scale reclamation is presented as case study to illustrate the identification of key stakeholder concerns and interdependencies using a network approach, and show how the network analysis results help to identify major challenges confronted by project stakeholders. After determining the key challenges, the discussion section provides an in-depth investigation on their root causes and includes recommendations to tackle these problems in future MEPs.

2. Literature review

2.1. The concepts of stakeholder and stakeholder concerns in MEPs

The stakeholder theory was originated from strategic management in 1963 when the Stanford Research Institute primarily defined stakeholders as individuals whose existences are vital to organizational survival (Freeman, 1984). The stakeholder concept was given wider recognition since Freeman (1984) elaborated on stakeholder definition as any entities "who can affect or is affected by the achievement of the firm's objectives" in his classic: *Strategic Management: a Stakeholder Approach*. Thereafter, scholars enriched the stakeholder theory to enhance its position. For example, Donaldson and Preston (1995) proposed three approaches to look into stakeholder theory: (1) *descriptive*, which explores stakeholder management process and develops methods; (2) *instrumental*, which investigates how stakeholder management influences the accomplishment of organizational goals; and (3) *normative*, which considers moral guidelines to manage stakeholders. McElroy and Mills (2000) categorized stakeholders into five types based on their individual attitudes regarding a project, including "active opposition", "passive opposition", "not committed", "passive support" and "active support". Bourne (2005) developed *Stakeholder Circle* tool to visualize stakeholder influences and prioritize their importance by considering stakeholder "power" and "urgency" (from Mitchell et al.'s model) and another attribute: "proximity". Following the advancement of stakeholder theory, scholars have realized its potential to be implemented in other domains including construction management. In project management context, the Project Management Institute (PMI) (1996) describes project stakeholders as any "individuals and organizations who are actively involved in the project, or whose interests may be positively or negatively affected as a result of project execution or successful project completion". In this study, PMI's definition is used to conceptualize stakeholders in MEPs.

MEPs comprise a wide range of stakeholders, while various methods are available to identify who they are. Classifying stakeholders into groups is a popular approach to stakeholder identification; while stakeholders' contractual relationships with