



Review of the application of social network analysis (SNA) in construction project management research

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Abstract

Over the past two decades, social network analysis (SNA) has elicited increasing attention in construction project management (CPM) research as a response to the emerging perspective of viewing projects as network-based organizational organizations. However, a thorough review of SNA application in CPM research is unavailable. This study aims to address this gap by reviewing 63 SNA papers published in eight peer-reviewed journals from 1997 to 2015 to ascertain the status of this research area and identify future research directions. The papers are analyzed in terms of institutional and individual contribution, citations, topic coverage and research design and methodologies. Three research directions, namely, internal stakeholder networks for outcome-related values, external stakeholder networks for process-related values, and external stakeholder networks for outcome-related values, are identified. The findings of this study are believed to provide useful references for the future application of SNA in CPM research.

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1. Introduction

The last two decades witnessed the rapid growth of research studies with social network analysis (SNA) applied in construction project management (CPM) research; these studies aimed to understand the network characteristics of construction projects as a response to the emerging perspective of viewing projects as temporary network-based organizations (Turner and Müller, 2003; Taylor and Levitt, 2007). Compared with that of permanent organizations such as firms and public organizations, the organization of a construction project is temporary in nature and has a limited life cycle; this temporary organization is intentionally designed to achieve the objectives or goals of a permanent organization or certain shareholders through complex

problem-solving processes (Turner and Müller, 2003). From the sociological perspective of an organization (Katz and Kahn, 1978), project organization can be viewed as a combination of social groupings with relatively stable patterns of interaction over time. As a result, formal and informal relationships are established. Therefore, SNA is suitable for analyzing organizational behaviors in construction projects (Hansen et al., 2005; Tortoriello et al., 2012) and can provide a more relational, contextual, and holistic picture of project organizations in construction (Borgatti and Foster, 2003).

As an advanced and robust technique, SNA has been widely utilized in various fields, such as sociology (Simmel and Wolff, 1950), anthropology (Tichy et al., 1979), and political science (Klijn and Koppenjan, 2000), to address different issues under a specific network circumstance. In the past three decades, SNA has been increasingly advocated as a key approach to addressing network organization issues in management, particularly network characteristics and the effects of business organizations (Tichy et al., 1979). With the rapid development of SNA tools, such as

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UCINET and PAJEK, SNA has been gradually applied as a key method of hybrid research design to address several important topics in management research, such as knowledge transfer, resource mobilization and consensus building (Bodin and Crona, 2009; Carlsson and Sandström, 2008; Newig et al., 2010).

In response to this trend, SNA was introduced in CPM research in the 1990s and has gained increasing popularity in the field over the past two decades (Chinowsky and Taylor, 2012) because of its capability to investigate various relationships within or among project participants (Dogan et al., 2013). This method can also address the social connections among all participants involved in a project by using a set of socially linking nodes and the relationships of these nodes with the operating environment, which can also be conceptualized as a network across organizational boundaries (e.g., Solis et al., 2013). Lin (2014) reported that the use of SNA can help explain actual management structures in construction projects, identify the key characteristics of a construction project organization and explore the potential threats that cause engineering mistakes.

To highlight the significance of SNA in construction research and other engineering projects, Chinowsky and Taylor (2012) conducted a general review of 30 SNA-based journal papers from 1997 to 2011. The rapid development of SNA application in CPM research, as shown in Fig. 1 (25 journal papers published between 2012 and 2014), requires a thorough and quantitative literature review. Given the social aspects of construction projects, particularly those of construction megaprojects (Hu et al., 2015), these references can help address the fundamental changes and the shift of research paradigms in project management research (Li et al., 2011). The extensive application of SNA in this field provides useful methodological insights into future project organization research that aims to explore the existence and strength of connections among various actors within construction project networks (Li et al., 2011). Therefore, the aim of this study is to conduct a thorough review of SNA-based papers published in selected journals between 1997 and 2015. An in-depth examination of these papers through a structured and quantitative method can help researchers understand the current body of knowledge and stimulate their inspirations for future SNA-based applications in CPM research. The specific objectives of this study are as follows: (1) identify the coverage of

SNA-based research published in CPM journals from 1997 to 2015, (2) recognize the contributions made by various institutions and writers to SNA-based research during the said period, and (3) examine the evolution of interests, methodologies, and research trend of SNA-based research papers during the said period.

2. Theoretical base

2.1. Review of SNA developments in sociology and management

SNA stems from investigations by Moreno (1934) and Lewin (1936) on the social relations and network characteristics of individuals. Traditionally, the application of SNA was based on a triangulated theoretical ground in sociological and anthropological perspectives (Tichy et al., 1979), such as balance theory (Cartwright and Harary, 1956) and social comparison in social psychology (Festinger, 1954). Studies that adopted these perspectives mainly focused on the informal relational links of the social group identity of individuals. The subsequent use of SNA has created two indigenous theoretical perspectives, namely, heterophily theory and structural role theory (Kilduff and Tsai, 2003). The heterophily perspective stems from Simmel and Wolff's (1950) investigation on group membership and social interactions among individuals. This perspective hypothesizes that new information and unusual resources can be obtained from relatively strange group members who may be members of other social groups or brokers who have joined groups. Most SNA-based studies from this perspective extended this hypothesis and examined the strength of weak ties (Granovetter, 1973; Granovetter, 1985) and structural holes (Burt, 2000). SNA studies that adopted a structural role perspective incorporated a psychological perspective to clarify the various role settings of individuals in a social network structure (Kilduff and Tsai, 2003), such as structural equivalence (Lorrain and White, 1971), structural cohesion and role equivalence (Krackhardt and Porter, 1986).

The 'organizational network' has become a fashionable description for certain organizational forms in management research beginning in the late 1970s (Tichy et al., 1979; Kilduff and Tsai, 2003). This type of organization is characterized by repetitive exchanges among semi-autonomous organizations based on trust and embedded social relationships to secure transactions and reduce costs (Bradach and Eccles, 1989; Powell, 1990). In particular, SNA enables this research perspective to provide a different insight into isolated individual actors within the organizational context, with a focus on the relations or structured patterns of individual actors (Brass et al., 2004; Kilduff and Tsai, 2003). In the late 1970s, empirical management research began to introduce SNA-related research perspectives to examine relational links, particularly formal links, in network structures within business organizations (Tichy et al., 1979). Given the rapid development of powerful SNA software, such as UCINET and PAJEK, this perspective has expanded significantly in the past three decades and has been adopted to examine network characteristics and effects within a business organization, such as knowledge transfer, resource mobilization and consensus building (Bodin and Crona, 2009; Carlsson and

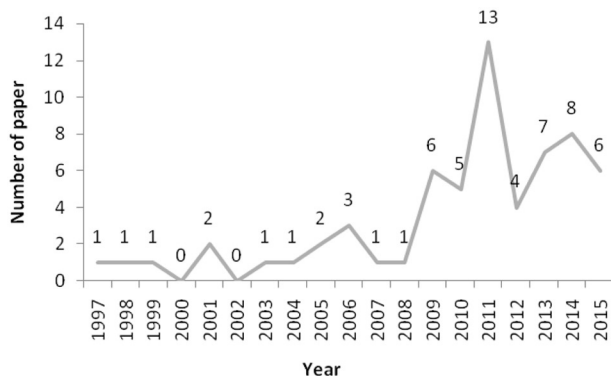


Fig. 1. The number of SNA-based papers published in journals from 1997 to 2015.

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