Abstract

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Current Applications of Game Theory in Construction Engineering and Management: a Social Network Approach

Game theory provides a rigorous mathematical approach to evaluate and predict stakeholders' interactions. Even though the construction industry is rich with encounters among its stakeholders, construction engineering and management (CEM) research lacks a thorough investigation of game-theoretic applications. This paper presents an overview of the current game-theoretic models in CEM research, aiming to enhance the understanding of the applications of game theory in analyzing CEM strategic interactions within multiple application domains and project delivery systems (PDS). The authors analyzed 87 CEM peer-reviewed publications employing game-theoretic models between 1998 and 2019. The analysis accounted for CEM application domain, involvement of stakeholders, PDS addressed, and type of game theoretic solution used in each publication. The authors performed a Social Network Analysis (SNA) of the current game-theoretic interactions, identifying literature trends and gaps to be addressed in future research. Unlike traditional literature review methods, SNA provides a mathematical approach in analyzing the existing body of knowledge. Research findings demonstrate the contributions of game theory in seven CEM applications (conflict resolution bargaining and negotiations allocation of cooperative benefits governance and supervision evolution of cooperation and trust construction bidding and risk allocation). Through SNA, the highest degree centrality levels were found in Owner-Contractor games in the context of CEM bidding, conflict resolution as well as bargaining and negotiations. SNA also revealed the need for further investigation of interactions among CEM stakeholders within PDS other than the traditional Design-Bid-Build and Public-Private-Partnerships. Moreover, games featuring strategic alliances and supply chains of multi-agents can provide more adequate reflections of actual interactions.