Cairo University

Investigating the Performance of Relational Contracts Using Social Network Analysis

By

Mahmoud Mohamed Abd El-Moneim El-Sayed

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfilment of the
Requirements for the Degree of
MASTER OF SCIENCE
In
STRUCTURAL ENGINEERING

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Title of Thesis:

Investigating the Performance of Relational Contracts Using Social Network Analysis

Key Words:

Relational Contracts, Social Network Analysis, Integrated Project Delivery, Partnering.

Summary:
Construction projects are generally characterized by their evolving complexity where any given project would include - among other reasons - multiparty relationships and numerous transactions. Managing these relationships is often complicated further by the traditional contractual approaches, which diverge the focus of involved parties away from the project main goals and promote individualism among the associated parties. Hence, relational contracts were introduced in an attempt to align the goal of the different parties to enhance the multi-party interactions, communication, and collaboration. This study presents a simulated model-based comparative analysis between two of the main relational contracts standard forms in the US and the UK; namely, (1) the Association of Consultant Architects (ACA) Project Partnering Contract PPC2000, and (2) the American Institute of Architects (AIA) Document C191™ – 2009, Standard Form Multi-Party Agreement for Integrated Project Delivery. The performance of the selected processes defined in these two forms was graphically and computationally analyzed using Social Network Analysis (SNA). Employing SNA is an innovative approach to model and analyze the expected interactions among the involved parties under each contractual setting. In this study, UCINET 6 for Windows was used to analyze the networks data for the change orders, disputes resolution, Estimating the contract's price, and design processes according to the provisions of each contract form. Metrics such as Adjacency, Degree Centrality, and Closeness Centrality were insightful in providing a deeper understanding of the expected level of collaboration and involvement among the involved parties at each step of the four processes. Meanwhile the processes in both forms promote direct communication among most of the key parties, the results of graphical and computational analysis favored PPC2000 form over C191 form in terms of the clarity of procedures and in terms of the general results of connectivity.

Acknowledgements

I would like to express my extreme gratitude to my supervisors **Dr. Omar H. Al-Anwar & Dr. Islam H. El-Adaway** for their continuous support of my M.Sc. study and research, their patience, motivation, immense knowledge and valuable ideas. I am also very grateful to **Dr Mohamed Bakry,** and **Prof. Mohamed Mahdy Marzouk** for their time and help.

Last but not least, I am eternally grateful to **my parents** and **my friends** for their support and encouragement every step of the way.

Mahmoud Mohamed Abd El-Moneim El-Sayed

April 27th , 2017

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Abstract

Construction projects are generally characterized by their evolving complexity where any given project would include - among other reasons - multiparty relationships and numerous transactions. Managing these relationships is often complicated further by the traditional contractual approaches, which diverge the focus of involved parties away from the project main goals and promote individualism among the associated parties. Hence, relational contracts were introduced in an attempt to align the goals of the different parties to enhance the multi-party interactions, communication, and collaboration. This study presents a simulated model-based comparative analysis between two of the main relational contracts standard forms in the US and the UK; namely, (1) the Association of Consultant Architects (ACA) Project Partnering Contract PPC2000, and (2) the American Institute of Architects (AIA) Document C191™ – 2009, Standard Form Multi-Party Agreement for Integrated Project Delivery. The performance of the selected processes defined in these two forms was graphically and computationally analyzed using Social Network Analysis (SNA). Employing SNA is an innovative approach to model and analyze the expected interactions among the involved parties under each contractual setting. In this study, UCINET 6 for Windows was used to analyze the networks data for the change orders, disputes resolution, estimating the contract price, and design processes according to the provisions of each contract form. Metrics such as Adjacency, Degree Centrality, and Closeness Centrality were insightful in providing a deeper understanding of the expected level of collaboration and involvement among the involved parties at each step of the four processes. While the processes in both forms promote direct communication among most of the key parties, the results of graphical and computational analysis favored PPC2000 form over C191 form in terms of the clarity of procedures and in terms of the general results of connectivity and centrality. The analysis and SNA results emphasized that ACA's PPC2000 provides the users with a clear roles of actors in each process and show obvious and clear communication channels among involved parties. On the other hand, AIA C191 in all processes lacks this clarity.

Chapter 1: Introduction

1.1. Research Topic

Construction projects are usually characterized by their complexity, which is attributed to the interdependency between their tasks and relationships [1]. Conventional contracts are criticized by their inability to account for such complexity because of their promotion of hierarchical contracting and fragmentation, which often leads to adversarial relationships among contractual parties [2]. Conflicts, claims, and disputes among the associated stakeholders are the expected outcome from such adversarial relationships [1].

Collaboration and cooperation among all contractual entities are essential but often challenging ingredients to the success of construction projects; thus motivating the development of relational contracts, such as Integrated Project Delivery in the United States of America and Partnering in the United Kingdom. A relational contract is an agreement whereby all contractual parties collaboratively and cooperatively work together under the same conditions. Relational contracts decentralize decisions, create a trust-based environment, promote open communications, enhance cooperation, and maximize the efficiency of the construction process by aligning interests and integrating the talent of all involved parties in a collaborative environment [3]. Relational contracts have gained popularity in the US construction industry [2]. However, there are serious challenges and obstacles with the up-take of, understanding of, approach to, and implementation of partnering within and across different national and institutional settings [4]. To this end, multiple entities are developing standard forms of relational contracts and agreements. Two of these forms were selected to be within the scope of this study; namely, (1) the Association of Consultant Architects (ACA) Project Partnering Contract PPC2000, and (2) the American Institute of Architects (AIA) Document C191™ – 2009, Standard Form Multi-Party Agreement for Integrated Project Delivery.

While guided by the same principles of relational contracts, the two selected standard forms propose different procedures and processes; and hence are expected to achieve the goals of relational contracts to various degrees. This study aims to investigate the Change Orders, Disputes Resolution, Design, and Estimating the Contract Price processes as proposed by each standard form and compare how the information flow and communication channels are shaped. To this end, this study presents an innovative methodology to model and analyze the contractual clauses using Social Network Analysis (SNA) in order to have an insight into the relationships among the contractual parties.

Social networks have increasingly and widely affected our lives, largely, because of the opportunities provided by the Internet [5]. SNA is a well-established methodology to investigate social networks through the usage of mathematical formulations abstracted from graph theory [4]. SNA has been successfully used in social sciences to evaluate how individuals and institutions, which constitute social networks, are influenced and

affected by the societal or professional networks [6]. The concept of networks and some basic SNA terminology have entered people's everyday lives and increasingly inform our understanding of the society in which we live [1]. However, our thinking and understanding are not familiar with modeling institutions and organization, specially, in the construction industry as social networks [5].

All organizations and institutions consisting of people are considered to be social networks, since social relationships exist among these people. The relationships among these people could be measured to investigate the quality of these relationships. If the relationships among any organization's employees are poor, this organization will not be able to achieve its goals or at least it will achieve its goals with great difficulty. Therefore, it was a must to find a method to measure and investigate the relationships among any group of people or entities. SNA allows us to model, measure, analyze, and investigate the relationships among a group of people. Further, SNA measures the position of each actor and evaluates the prominence of this actor in the network. SNA uses both graphical and mathematical approaches to investigate and analyze the quality of relationships, the strengths of relationships, and the flow of information among actors. Hereinafter, this study in the literature review chapter presents and demonstrates the theory of SNA and the approach it follows to achieve its aforementioned functions. The usage of SNA is growing rapidly in the engineering and construction industry, where concepts such as trust and communication among project participants are receiving significant attention [7]. A social network is a social structure that always consists of actors (nodes) that are connected by one or more specific type of relations which are usually represented as arrows among these nodes, such as friendship, firm alliance, or international trade [8]. As contracts organize and arrange the relationships among involved parties, therefore, it is expected that multiple communication channels emerge. Thus, SNA's degree and closeness centralities were best suited for the analysis associated with this study.

SNA has been applied to several civil and construction engineering applications where the networks' main actors were people or organizations controlled by people [9]. El-Adaway et al. (2016) presented an SNA model to analyze transportation networks, and consequently corroborate the effectiveness of SNA as a complementary tool for improved transportation planning [10]. Wambeke et al. (2012) presented an SNA model using centrality analysis to identify a social network of construction trades [11]. Wambeke's research was useful to project managers and is significant as it outlines and illustrates a method of identifying the underlying network and associated key trades of a construction project based on spatial proximity [11]. Priven et al. (2015) presented an SNA model to investigate and identify the effects of the last planner system on social networks among construction trade crews [12]. Chinowsky et al. (2008) studied the engineering-based approach to project success to reconfigure this approach and to reemphasize the need to develop high performing teams by recognizing the importance of the project network [13]. This recognition was formalized in the social network model of construction that integrated classic project management concepts with social science variables to enhance the focus on knowledge sharing as the foundation for achieving high performance teams and project results. Park et al. (2011) presented an SNA model