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CONFERENCE PAPER

Social Network Analysis: Towards a network perspective of expertise coordination and project team performance

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Synopsis:

Project teams often under-deliver or fail to deliver altogether. One of the reasons for such failure may be found in the project team member's inability to coordinate expertise within the project team. Research demonstrates that certain communication patterns foster better expertise and knowledge coordination. The purpose of this article is to find supporting research that certain structures of project expertise networks may affect and predict project performance and expertise coordination within the project team.

Relevance for practice/education:

This article demonstrates that a significant gap exists in research that uses a Social Network Theory methodology to measure project expertise networks and to find implications for project team performance. This paper also demonstrates the benefits of using Social Network Theory in the project management domain.

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Research Design:

This research study involves 15-20 project teams, who will complete a survey measuring their project expertise network, project team performance, and expertise coordination. The article presents the relevant literature on the relationship between network structures and expertise coordination, formulates hypotheses and illustrates a research model.

Main findings:

The findings are demonstrated in the form of a literature review.

Keywords

social network analysis, project team networks, project performance, expertise coordination, and knowledge-sharing networks.

Introduction

In this day and age, project teams are responsible for a significant part of organizational work. Without them, it would be difficult to respond to the growing uncertainty and complexity of the modern-day organizational environment. Team interactions, specifically related to expertise coordination, allow project teams to seek out novel solutions to complex problems and, at the same time, meet externally driven deadlines. Yet, to facilitate effective expertise coordination, project team members need to not only have access to resources, but to also navigate within their project expertise network (Cummings and Cross 2003, Chiocchio 2007, Balkundi and Harrison 2006). Social Network Theory offers both a theoretical framework and a methodological approach that can identify and visualize the structure of relations between team members (i.e. the project network) and, thereby foster a better understanding of team interactions within their project expertise network, which shows the flow of knowledge and expertise within the project team, and their effect on expertise coordination as well as project team performance. This paper intends to review the existing literature and to build an operational model for further research.

A brief background on Social Network Theory

Social networks - the structures that consist of patterned relations (known as ties), and individuals (referred to as actors) are an inevitable part of all organizations. Since Social Network Analysis (SNA) analyzes and maps out network structures, researchers can gain significant insight into communication, information or expertise patterns that are transferred through these networks.

In SNA, actors (e.g., Individuals or groups of individuals) have either direct or indirect relations (also known as ties) with each other. Direct relations produce stronger influence than indirect relations and are often marked by greater intensity and access to information. While direct contacts often circulate similar information in their intimate circles, indirect relations occur through agents (i.e., intermediaries) and bring greater exposure to new information and opportunities (Granovetter 1973; Scott 2012).

Social networks are complex systems, and hence, the relations between entities are dynamic. (Vega-Redondo 2007). Thus, social network structures are not static, but are in a state of

continuous change due to the changing relations between actors (i.e., some ties become non-existent between entities, while other ties form in their place). Such changes within the network arise both intentionally and unintentionally and modify the network structure (Manson 2001).

Social networks reveal different properties of connections that, in turn, influence the beliefs, perceptions, and actions of the actors involved (Scott 2012). SNA is therefore able to infer the effect that certain network structures will have on project team performance and expertise coordination within that team.

Prior research has largely been conducted outside of the business and project management domain. Researchers are starting to value the use of SNA in project management, and the effect that network structures have on individual performance (Cross & Cummings 2014), project team performance (Balkundi and Harrison 2006). It is our intention to show that there is value in expanding SNA further to the project management domain, and to demonstrate that the structures of project expertise networks may affect how expertise is coordinated in project teams, and how, in its turn, it also impacts project team performance.

In what follows, we aim to associate different characteristics from the three levels of a project expertise network (whole network, actor, tie level) with project behaviors and characteristics and rely on existing research literature to determine how the project network might relate to project success.

Project network structures and the project team

Although research in project team networks is limited, studies on team and group, in general, can provide pointers towards a plausible hypothesis for project team performance and project network structures.

Teams with many direct and indirect ties create a dense network, which allows team members to respond well to crises, to continuously interact with team members, and to foster a free flow of information (Ahuja and Carley 1998, Krackhardt and Stern 1988; Krackhardt 1999; Cross & Prusak 2002). Disconnected project team networks (with a low density of ties) may hinder their own performance by not sharing critical information. In such networks, the few individuals that are better connected to the rest of the team than the others may involuntarily hoard or distort the information that they share with the rest of their team members and, thereby, negatively affect team performance (Burt 1992). Because the exchange of significant task-relevant information is particularly important to project teams, as project work requires timely coordination of knowledge and expertise for successful project completion (Chiocchio 2012), the structure and connectedness of the project expertise network (as a whole) plays an important role. Therefore the following propositions, based on the network level, are as follows:

H1a: Density of ties in the project expertise network will be positively related to project team performance.

H1b: Degree centralization in the project expertise network will be negatively related to coordination of expertise.

The Project Leader and the Social Network

Research demonstrates that team leaders central to their network are more competent and carry a wealth of knowledge as well as expertise gained through experience, interactions and their own skills (Balkundi and Harrison 2006).

While centralization relates to the whole network (i.e., the degree to which a network), centrality refers to a single actor's position in the network. Despite the project leader's competence and skills in project management, s/he also needs to be able to effectively navigate among the project team, stakeholders, clients and the steering committee and to coordinate, monitor and direct the delivery of the project. In a sense, a part of project manager's job is related to coordinating the expertise among his team members. This requires a conscious ability to navigate within the social network of the organization. It follows that to aid the team in problem solving and to provide relevant information for specific tasks, the project leader needs to be central in the expertise network. Otherwise, the project manager, without knowing who possesses the relevant information and how to align that information with the project tasks, may find himself in an unfortunate position of following only the formal (hierarchical) channels for the delivery of the project, which may hinder project performance and project team performance (Cross and Prusak 2002). To further this point, Cross and Cummings (2003) suggested that an integrative and interconnected network structure is essential for positive performance, as such structure decreases the reliance on a single person within the network and allows for an effective flow of information between the project group. Therefore, the following actor-level propositions align with the research:

> *H2a: Project leader's degree centrality in the project advice network will be positively related to coordination of expertise in project teams.*

> *H2b: Project leader's degree centrality in the project advice network will be positively related to project team performance.*

Although it is assumed that the project leader acts in the best interest of his team, the project leader could contribute to the structural holes in project teams to exercise more power of the information that each group member receives (Cummings and Cross 2003; Burt 1992) and to "enjoy the concurrent informational power benefits from non-redundant ties" (Sparrow et al. 2002 p.318).

Thus, while project leader does not have full control of his team's interactions, s/he can still affect them by avoiding intentional structural holes within the team network and by fostering dynamic interactions between team members.

Project Team Performance and Project Performance

A variety of measures exist to assess project team performance. These comprise outcome-based project measures that include but are not limited to cost, budget, profit, sales, schedule and cost variance (Fleming & Koppelman 2000), self-assessments, feedback mechanism, measures that account for team health, team orientation, team longevity and team viability (Ammeter and Dukerich 2002). All of these measures have their benefits and limitations. While self-report measures of performance are often distorted, and objective measures are not always available or carry the same level of significance among different projects, assessments by expert judgment could result in reliable performance data.

For the purpose of this study, project team performance will be split into project performance and team orientation.

Despite the disagreement between scholars about what constitutes project success, there is a general consensus in literature focusing on project success with Baker, Murphy and Fisher (1998) stating that projects are judged to be successful based on subjective perceptions and a project will often be deemed to be an overall success if the project has met its primary mission, and the key individuals on the project team along with the key stakeholders (clients and users) are satisfied with the project outcome. Although the technical factors of projects delivery – scope, time and cost are important within the overall context of the project, they are not the primary determinants of project success. For the purpose of this study, Pinto and Slevin's (1988) survey will be used to measure project outcomes.

The concept of team orientation perceives a healthy team as a potentially high performing team, where team members support, respect and trust each other; where team goals are placed above personal interests, communication is frequent, information flows freely, and teambuilding occurs in harmony with the team environment (Katzenbach and Smith 1993; Balkundi and Harrison 2006).

Such team players that will not only perform well in their existing team but will also often be a part of productive teams in further projects. To measure the internal state of the project team, a survey from Watson, Johnson & Merritt (1998) was adapted; it provides comprehensive and validated questions that measure team orientation.

Project network and expertise coordination

Because project teams are seen as an important organizing factor for a large amount of work in organizations, team interactions, specifically related to task and coordination, play a significant role in both project team performance and effective project management (Chiocchio 2007).

Coordination in project teams refers to the use of strategies and behavioral patterns aimed at integrating and aligning the actions, knowledge and objectives of interdependent members with the view to attain common goals (Arrow, McGrath & Berdahl 2000; Brannick, Prince et al. 1995). It is through coordination that teams are able to function as a whole. Thus, when coordination is poor, process losses occur that negatively affect project team performance (Rico et al. 2008). Past research has demonstrated that teams rely on explicit team coordination (Espinosa, Lerch & Kraut 2004). Despite the benefits of planning mechanisms (also known as impersonal, or administrative coordination) and communication mechanisms – achieved through feedback processes, personal coordination of formal and informal interaction – recent literature emphasizes the importance of *implicit coordination*, which takes place when team members *anticipate* the needs and action of each other, and are able to *adjust* their own behaviors accordingly. This is especially relevant to project teams that often deal with ambiguity and are required to adapt to stress and uncertainty, which affect the team's cognitive thought processes and flexibility.

Expertise coordination

Faraj and Sproul (2001) created an expertise coordination measure that can be largely attributed to implicit coordination rather than explicit coordination. By using this measure, it is possible to assess implicit coordination.

Literature provides two distinct interpretations of expertise. The first view considers knowledge to be an abstract representation, *while expertise is the possession of such knowledge*

(Faraj & Sproull 2000). Thus, teams are seen as instrumental in collecting expertise from different areas and accumulating individual skills and knowledge. The other perspective assumes that expertise emerges from the structural interactions between individuals and is context dependent.

Faraj and Sproul (2000) suggest that expertise coordination consists of the following elements: knowledge of expertise location, recognizing the need for expertise, bringing expertise to bear. Teams that are conscious of how knowledge is transferred to other members have shown an increase in team performance (Liang et al. 1995, Stasser 1992). Similarly, Cross and Cummings (2004) demonstrated that because one's awareness of other's expertise is associated with collecting information from that person, individuals that are aware of expertise networks are able to use them resourcefully and to respond timely to difficult situations, thereby positively affecting project team performance (Cross et al. 2003). Thus the following hypothesis is proposed:

> *H3: Expertise coordination within the project team will be positively related to project team performance*

A part of effective expertise coordination lies in the team's ability to integrate and communicate the knowledge acquired with the rest of the team. This is where the team network is instrumental in communicating the relevant knowledge, as formal processes of expertise access are not sufficient for complex problems and tasks (Kmetz 1984).

Strength of ties

In 1973, Granovetter suggested that in certain circumstances, weak relations (i.e., ties) carry more value than strong ties. Because strong ties form clusters of similar people, the information in these clusters is often redundant. Weak ties, on the other hand, can create a "local bridge" to different networks of individuals with access to new information.

Later, Burt (1992) drew a distinction between the two concepts of tie strength and the density of ties. He suggested that redundancy of information is characteristic of a dense network rather than merely strong ties. Because strong ties require a lot of time to maintain, shedding some of those ties could allow one to focus on ties that bridge structural holes and retain new information.

Although organizations would benefit from weak ties and access to structural holes, when it comes to expertise and knowledge within an organization, research tends to favor strong ties. Specifically, Hansen (1999) differentiated between giving out and receiving information. He suggested that there is a difference between identifying, locating and transferring knowledge. He concluded that project networks composed predominantly out of weak ties yield explicit knowledge. Although some projects require outside information, the ones that are characterized by complexity and require tacit knowledge, which takes time to explain and learn, would benefit from fostering strong ties (Ghoshal et al. 1994; Hansen 1999; Szulanski 1996; Uzzi 1996, 1997; Levin and Cross 2004). Thus, consistent with these findings the following hypothesis is proposed on the network tie level:

> *Hypothesis 4a: Tie Strength will be positively associated with expertise coordination.*

> *Hypothesis 4b: Tie Strength will be positively associated with project team performance.*

Tie strength has been measured in different ways. In practice, scholars have measured ties as reciprocated nomination (for strong ties) and unreciprocated nominations for weak ties (Friedkin 1980). Granovetter (1973) used frequency of contact as a determinant of tie strength. This research study incorporates Granovetter's measures of tie strength because they provide an objective measure that deals with the purpose of the research questions.

The Operational Model

The operational model in Fig. 1 depicts the measures used to assess the research variables and incorporates the hypotheses construed from past research. It is worth noting that the project expertise network is considered as an independent variable, while the project team performance and expertise coordination are dependent variables. The network measures incorporate different levels of analysis. On the network level, density is one of the most used measures in SNA and refers to the interconnectedness of actors, or the amount of ties between team members in relation to the greatest number of ties possible; degree centralisation refers to the social network structure as a whole and evaluates how centralised the network is (i.e., if relations are not spread out, but tend to point towards a handful of individuals). On the actor or individual level, degree centrality measures the actor's position in relation to others within the network, while on the tie level tie-strength measures the strength of the relations between individuals by determining how often these individuals interact with each other and the nature of their relationship.

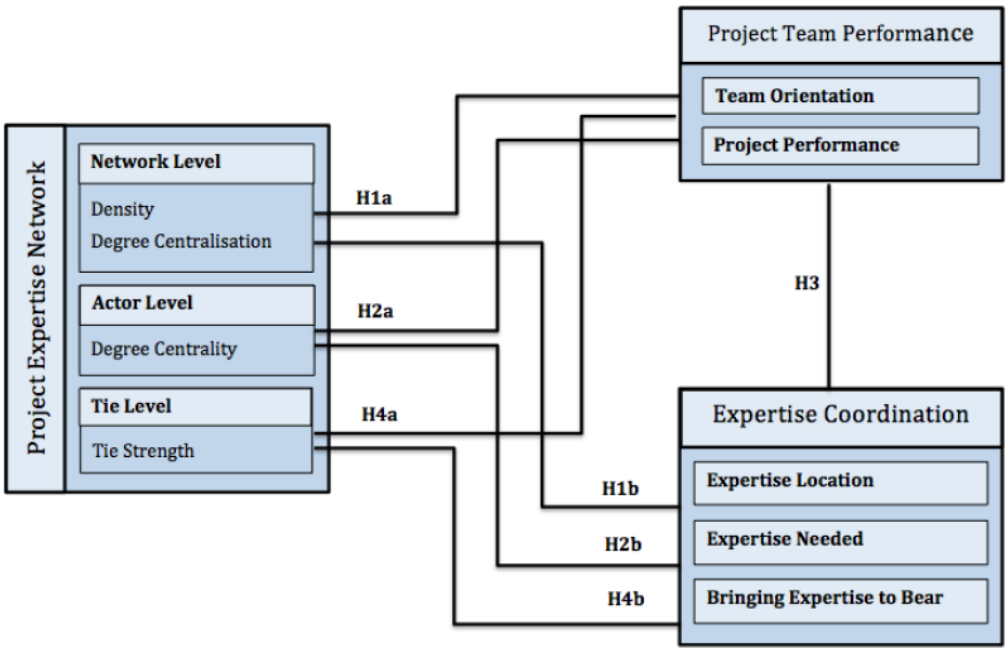

Figure 1 Operational Model

Project team performance is separated into two parts to measure project performance (a survey of Pinto and Slevin 1988) and team orientation (a survey of Watson, Johnson and Merritt 1998).

Expertise coordination measures will be based on Faraj and Sproull's (2000), and include three main categories: locating expertise, knowing where expertise is needed and bringing expertise to bear.

Because the operational model supports the existing research, it offers a comprehensive approach for collecting the required data.

Conclusion and Limitations

With the growing complexity of the current organizational environment, teams will remain as an important organizing factor of organizational work (Chiocchio 2007). Project teams, in particular, will need to be productive and efficient. Through SNA it is possible to improve our understanding of team interactions, and thereby point out the project expertise network structures that may aid these teams in coordinating expertise and improving their performance.

This paper outlined the relevant research and attempted to clarify the relationship between the project expertise network, expertise coordination and project team performance; it also presented an operational model, formed from the hypotheses that were supported by a review of the literature.

The limitations of this study include the highly debated definition of project success, the clarification of what project work entails due to the large diversity that project teams encounter within the organizational domain. It is also problematic that social network analysis uses a snapshot of a current network state and does not measure the actual project dynamics that may change within an organization due to a host of reason (i.e., change management, strategic alliances, people leaving their jobs, shifting to other departments). The amount of members in a project team may also pose a problem for this research as well as the amount of time the individual has been employed for.

All these elements are acknowledged and represent an imminent hurdle for the research study. Yet, despite these limitations, this research has the potential to clarify the effect that project expertise networks have on project team performance and coordination of expertise - a relationship that has not been studied specifically in project teams. Thus, this study stresses the value of extending Social Network Theory to the project management domain to gain a better understanding of project phenomena.

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