



Understanding the assembly of interdisciplinary teams and its impact on performance



Alina Lungeanu*, Yun Huang, Noshir S. Contractor

Northwestern University, Evanston, IL, USA

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ABSTRACT

Interdisciplinary teams are assembled in scientific research and are aimed at solving complex problems. Given their increasing importance, it is not surprising that considerable attention has been focused on processes of collaboration in interdisciplinary teams. Despite such efforts, we know less about the factors affecting the assembly of such teams in the first place. In this paper, we investigate the structure and the success of interdisciplinary scientific research teams. We examine the assembly factors using a sample of 1103 grant proposals submitted to two National Science Foundation interdisciplinary initiatives during a 3-year period, including both awarded and non-awarded proposals. The results indicate that individuals' likelihood of collaboration on a proposal is higher among those with longer tenure, lower institutional tier, lower H-index, and with higher levels of prior co-authorship and citation relationships. However, successful proposals have a little bit different relational patterns: individuals' likelihood of collaboration is higher among those with lower institutional tier, lower H-index, (female) gender, higher levels of prior co-authorship, but with lower levels of prior citation relationships.

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1. Introduction

“Discovery increasingly requires the expertise of individuals with different perspectives—from different disciplines and often from different nations—working together to accommodate the extraordinary complexity of today’s science and engineering challenges.” (National Science Foundation, 2006)

There is a growing recognition of the importance of interdisciplinary teams in addressing contemporary societal and scientific challenges. Such teams bring together scientists from diverse fields (McCormick, 1982) to create a common understanding of issues (Hall, Feng, Moser, Stokols, & Taylor, 2008; Huuoniemi, Klein, Bruun, & Hukkinen, 2010; Wagner et al., 2011) “whose solutions are beyond the scope of a single discipline or area of research practice” (National Academies, 2004, p. 26). While interdisciplinary scientific teams share some similarities to traditional teams, they operate in a more complex environment (Klein, 2005). Specifically, these teams are established to solve complex problems that homogenous or cohesive teams, which are traditional for individual disciplines, cannot (Younglove-Webb, Gray, Abdalla, & Thurow, 1999).

The increasing importance of interdisciplinary teams in science has prompted scholars to investigate the key factors behind effective collaboration among such team members (Fiore, 2008; Olson, Zimmerman, & Bos, 2008; Stokols, Hall, Taylor, & Moser, 2008). This research showed how interdisciplinary scientific teams benefit from understanding the importance of collaboration networks and proposed ways to efficiently collaborate within and across university boundaries (Cummings & Kiesler, 2008). Research has also demonstrated that team collaborations yielded publications with a higher intellectual

* Corresponding author. Tel.: +1 847 644 3887.

E-mail address: alina.lungeanu@u.northwestern.edu (A. Lungeanu).

impact than single researchers did (Wuchty, Jones, & Uzzi, 2007). And yet, consistently assembling teams that produce significant knowledge is a daunting task, for intellectual as well as logistic and technical reasons. As a result, while people form teams all the time, they often do so in a suboptimal manner, negatively impacting the scientific enterprise. Therefore, there is clearly a need for an understanding of how interdisciplinary scientific teams form and how they can be “optimized for the knowledge and skills required for the science to be conducted” (Börner et al., 2010).

Understanding the assembly of interdisciplinary scientific teams and the drivers affecting their success is important for at least two reasons. First, many teams in the workplace today are ad-hoc, agile, distributed, and transient entities, as they emerge from a larger primordial network of relationships within virtual communities. These teams are formed of researchers that made individual decisions on whether to collaborate or not. The scientific enterprise is one of the areas where this trend is particularly noteworthy (Bercovitz & Feldman, 2011). Therefore, interdisciplinary collaboration provides an appropriate context to study team formation and to understand individuals’ motivations to choose team members and engage in team work.

Second, interdisciplinary scientific teams also incorporate specialized expertise, concepts, and diverse methodological and theoretical approaches (National Academies, 2004). This requirement produces extreme heterogeneity across many attributes of an interdisciplinary team. And yet, these interdisciplinary teams must utilize the heterogeneous attributes of their members to successfully accomplish their goals (Börner et al., 2010). Therefore, such teams serve as an excellent context to study the mechanisms that drive the formation of successful teams where members need to possess specialized and diverse expertise.

As we mentioned, prior research mostly examined the factors affecting team effectiveness without considering how these teams were formed in the first place (Acedo, Barroso, Casanueva, & Galán, 2006; Guimera, Uzzi, Spiro, & Amaral, 2005). Our study seeks to advance our understanding of team assembly processes. We believe this area of scholarly inquiry is especially important given the freedom individuals have in choosing team members and given the diverse and specialized expertise needed to successfully accomplish their goals. We draw upon theories on the formation of social networks (Contractor, Wasserman, & Faust, 2006), their extensions to the assembly of teams (Contractor, 2013) as well as the more extensive research on groups and teams (Levine & Moreland, 1998) to examine the factors leading to assembly of interdisciplinary scientific teams in general and successful collaborations in particular. Our hypotheses build on these theories to predict how individual level factors (i.e., gender, tenure, and university affiliation) and relational factors (i.e. prior collaboration and citation relationships) influence the formation of interdisciplinary scientific teams and to identify the factors influencing team success. We conclude with implications of our findings to research and policy on interdisciplinary scientific collaboration.

2. Theoretical background and hypotheses

National Academies (2004, p. 26) defines interdisciplinary research as “a mode of research by teams or individuals that integrates information, data, techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline or area of research practice.” While this definition refers to both teams and individuals, Fiore (2008, p. 272) stressed the importance of the concept of the “team” in interdisciplinary research by emphasizing that interdisciplinary research is in fact team research because “it is infeasible to conduct interdisciplinary research independently.” Scientific interdisciplinary teams are made-up of scientists from diverse disciplines that are brought together to create a common understanding of complex issues or problems (Hall et al., 2008; Wagner et al., 2011).

The interdisciplinary scientific teams have only recently emerged as a distinct area of research. The few studies of interdisciplinary collaboration conducted thus far emphasize the importance of leadership, trust, and communication (Fiore, 2008), the need for time to develop common ground (O’Donnell & Derry, 2005), and the greater significance of individual characteristics over organizational factors in determining the shape of interdisciplinary networks (Rhoten, 2004; Rhoten & Parker, 2004).

More recently, scholars have examined the issue of distributed versus collocated collaboration in scientific research. Jones and colleagues showed that, while multi-university collaborations represent the fastest growing mode of co-authorship (Jones, Wuchty, & Uzzi, 2008; Wuchty et al., 2007), the geographical dispersion of both researchers and universities continues to be challenging and not uniformly successful. The process of developing and maintaining the awareness of what is going on in their work environment (Kraut, Fussell, Brennan, & Siegel, 2002) is more difficult in dispersed teams than in collocated ones (Cramton, 2002). Research has begun to explore ways to resolve this issue. Prior experience in working together has been shown to diminish the negative impact of geographic and disciplinary relations (Cummings & Kiesler, 2008) and to increase the quality of team outcomes (Guimera et al., 2005).

While advancing our knowledge of interdisciplinary scientific collaboration, prior research has done little to understand the factors affecting the assembly and success of interdisciplinary teams. We draw upon the literatures in social networks and groups and teams to fill in this research gap.

2.1. Assembly of interdisciplinary teams

Generalizing from the literature on groups and teams to interdisciplinary scientific teams presents two challenges. First, most prior research examined teams that were already formed and in which the team members had no discretion

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