Organizational Behavior and Human Decision Processes 118 (2012) 132–142

Contents lists available at SciVerse ScienceDirect

Organizational Behavior and Human Decision Processes

journal homepage: www.elsevier.com/locate/obhdp

The team scaling fallacy: Underestimating the declining efficiency of larger teams

Bradley R. Staats [a,*], Katherine L. Milkman [b], Craig R. Fox [c]

[a] University of North Carolina at Chapel Hill, McColl Building, CB #3490, Chapel Hill, NC 27599-3490, United States
[b] The Wharton School, The University of Pennsylvania, 3730 Walnut Street, 566 Jon M. Huntsman Hall, Philadelphia, PA 19104, United States
[c] UCLA Anderson School and Department of Psychology, 110 Westwood Plaza #D511, Los Angeles, CA 90095-1481, United States

ARTICLE INFO

Article history:
Received 16 November 2010
Accepted 7 March 2012
Available online 10 April 2012

Keywords:
Coordination neglect
Estimation
Planning fallacy
Team scaling fallacy
Team size

ABSTRACT

The competitive survival of many organizations depends on delivering projects on time and on budget. These firms face decisions concerning how to scale the size of work teams. Larger teams can usually complete tasks more quickly, but the advantages associated with adding workers are often accompanied by various disadvantages (such as the increased burden of coordinating efforts). We note several reasons why managers may focus on process gains when they envision the consequences of making a team larger, and why they may underestimate or underweight process losses. We document a phenomenon that we term the *team scaling fallacy*—as team size increases, people increasingly underestimate the number of labor hours required to complete projects. Using data from two laboratory experiments, and archival data from projects executed at a software company, we find persistent evidence of the team scaling fallacy and explore a reason for its occurrence.

Introduction

Across a wide range of industries and functions, from construction to consulting and from healthcare to new product development, work is delivered to customers in the form of projects completed by teams (Edmondson & Nembhard, 2009; Ilgen, Hollenbeck, Johnson, & Jundt, 2005). Organizations turn to teams for many reasons, one of which is the increased speed with which projects can be completed when work is divided among many people. Organizations also rely increasingly on teams because knowledge is evolving so rapidly that in many settings, no single person has the depth of knowledge required to adequately serve customer needs. Teams also allow for specialization of member roles through the division of labor and can increase the knowledge resources available both within a team and through members' external connections (Haleblian & Finkelstein, 1993; Moreland, Levine, & Wingert, 1996; Reagans & Zuckerman, 2001).

In many project-based organizations that rely on teams, an important key to competitive success is accurately estimating and adhering to project budgets and deadlines. For a business that delivers projects to customers, missing promised budget and deadline estimates can tarnish a previously good reputation with patrons, resulting in lost business. Such errors in forecasting may also turn projects that should have generated profits into money-losing ventures (Heskett, Sasser, & Schlesinger, 1997; Wheelwright & Clark, 1992). Despite the importance of meeting deadlines and correctly estimating costs, industry statistics suggest that many project-based organizations struggle with these activities. For example, studies in the construction, healthcare, aerospace, and information technology industries have found that anywhere from 33% to 88% of projects are delivered late and over budget (Knight, 2011; Standish, 2009; Watson, 2008).

One possible explanation for these budget and deadline overruns is that process challenges arise when people work together, yet estimators do not properly account for them. Research on teams has shown that although increasing a team's size provides the *potential* for many benefits (e.g., through increased specialization and expanded knowledge networks), the team's *actual* productivity may suffer due to process losses (Levine & Moreland, 1998; Steiner, 1972). Increasing a team's size can hamper its coordination, diminish its members' motivation, and increase conflict among team members (Hare, 1952; Ingham, Levinger, Graves, & Peckham, 1974; Moreland et al., 1996). An interesting question is whether estimators are sufficiently sensitive to these problems. In this paper, we investigate whether estimators exhibit a bias that we term the *team scaling fallacy*—a tendency to increasingly underestimate task completion time as team size grows. We confirm the hypothesis that the team scaling fallacy plagues estimators in both the laboratory and the field. We also identify and test an important driver of this phenomenon: the tendency to focus too much on the process gains associated with increasing team size, relative to the process losses.

* Corresponding author. Fax: +1 919 962 6949.
E-mail address: bstaats@unc.edu (B.R. Staats).

0749-5978/$ - see front matter © 2012 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.obhdp.2012.03.002

Background and hypotheses

Impact of team size on team performance

Before investigating the impact of team scaling on forecasting errors, it is important to consider how team size affects team performance (see Levine and Moreland (1998) and Moreland et al. (1996) for reviews of this topic). Increasing size offers a team multiple benefits. Labor can be subdivided across more team members, for example. This division of labor makes it possible to match workers with the tasks that are most interesting to them and for which they are best suited. It can also foster task specialization, which improves performance (Moreland & Myaskovsky, 2000; Newell & Rosenbloom, 1981; Wegner, 1987). Moreover, larger teams are likely to have a broader base of knowledge and experience (Haleblian & Finkelstein, 1993; Reagans & Zuckerman, 2001), which can prove beneficial. Larger teams also possess more slack resources, which can be deployed if circumstances change (Moreland et al., 1996).

Along with these benefits, increasing team size presents challenges involving coordination, motivation, and conflict (Hackman, 2002; Levine & Moreland, 1998; Steiner, 1972). With respect to coordination, the potential for coordination losses increases as a team grows because the number of communication linkages among members increases at a nonlinear rate.[1] More time is thus required to keep all members informed (Brooks, 1975; Stasser & Taylor, 1991). The threat of miscommunication also increases when information is passed among a greater number of members, each of whom may interpret the information differently, based on his or her personal background (Allen, 1977; Bechky, 2003). Further, although a larger team creates opportunities for division of labor, completed work must be integrated at some point, requiring additional time and effort (Heath & Staudenmayer, 2000; Lawrence & Lorsch, 1967).

A second challenge associated with increasing team size involves member motivation. Members of growing teams may experience decreased motivation. For example, members of larger teams may exert less effort, due to such factors as social loafing and free riding (Albanese & Fleet, 1985; Karau & Williams, 1993; Latané, Williams, & Harkins, 1979). Also, members of larger teams may find their membership to be less satisfying (Hackman & Vidmar, 1970; Mullen, Symons, Hu, & Salas, 1989), which can weaken their commitment.

A third challenge associated with increasing team size is the increasing potential for conflict among members, which can again harm team performance (Brewer & Kramer, 1986; O'Dell, 1968). For example, members may be less willing to help one another in a larger team, or they may suppress the ideas of others in order to promote their own ideas (Diehl & Stroebe, 1987; Latané & Nida, 1981; Paulus & Yang, 2000).

Biases in estimating the impact of increasing team size

Our focus in this paper is not on whether team performance improves or deteriorates as a team grows. Rather, we are concerned with whether people *are sufficiently sensitive* to the impact of increasing team size on the total number of hours of labor required to complete a project.

A principal reason why people may underestimate diminishing returns to increasing team size is that they may underestimate the additional time needed to coordinate team members' efforts. This error, known as *coordination neglect* (Heath & Staudenmayer, 2000), has been hypothesized to occur when estimators attend more to the gains in efficiency that can be achieved by dividing responsibility for project components among team members than they do to the time required to integrate that work. As a team grows, its opportunities for dividing labor increase, but so does the complexity of integrating completed work. Thus, if people focus primarily on the gains from dividing labor, then their estimates of the effort required to complete a project will be increasingly overoptimistic as a team grows in size. Although coordination neglect has been discussed in the academic literature, we are aware of no published empirical tests of coordination neglect and its implications.

Past research on decision making has focused on documenting biases that lead people to make inaccurate judgments across a range of domains (see e.g., Bazerman & Moore, 2009; Gilovich, Griffin, & Kahneman, 2002). Early research on judgment and decision-making demonstrated that people are poor intuitive statisticians (Tversky & Kahneman, 1974), making many errors when they estimate probabilities. More recent research has demonstrated that people also exhibit a wide range of self-serving biases, such as over-optimism about their own abilities (see Moore & Healy, 2008). For example, studies of brainstorming have shown that many people believe that groups will be more productive than individuals, even though a comparable number of individuals will consistently outperform a group when it comes to brainstorming (Diehl & Stroebe, 1987). Group brainstorming may persist because people feel more satisfied working in a group and have an inflated view of their own contribution to the brainstorming process (Nijstad, Stroebe, & Lodewijkx, 2006; Paulus & Yang, 2000).

Predictors who have a stake in a project's success may also exhibit self-serving biases when estimating project completion times. Past research has shown that many people exhibit a "planning fallacy," underestimating how much of their *own* effort will be required to complete a project alone (Buehler, Griffin, & Ross, 2002; Kahneman & Tversky, 1979) or with teammates (Buehler, Messervey, & Griffin, 2005; Sanna, Parks, Chang, & Carter, 2005). This bias is said to arise from a tendency to imagine scenarios involving success, using details of the case at hand, without adequate attention to relevant base rates of performance on similar projects in the past (Buehler, Griffin, & Ross, 1994; Kahneman & Lovallo, 1993).

Although the planning fallacy might contribute to budget and deadline overruns in many organizations, we believe that it would not generally contribute to a team scaling fallacy. First, the planning fallacy does not seem to afflict outsiders—it biases only an individual's predictions about his or her *own* performance (Buehler et al., 1994). However, in many organizations, those who are responsible for estimating the total labor hours required for a team to complete a project are not members of the team that will carry out the assignment. Second, even when predictors do have a stake in project outcomes, it is not clear why the severity of the planning fallacy should vary for teams of different sizes when task characteristics are otherwise held constant. Indeed, to the extent that partitioning a task among the members of larger teams causes estimators to more thoroughly "unpack" the components of a project, that process should reduce the planning fallacy (Kruger & Evans, 2004).

We study whether people who must estimate the total amount of labor required to complete a team project are appropriately responsive to differences in team size. The specific metric we examined is the error in the estimated total number of hours (or minutes) of labor required to complete the project ("effort"). This metric is more relevant than a "missed deadline" because if a project is running behind schedule, then employees can be induced to work overtime, thus meeting their calendar deadline, yet exceeding their effort budget and thereby inflating project costs.

[1] There are $\frac{N\times(N-1)}{2}$ possible linkages within a team, where N is the number of team members.