

Structuring for Innovation: How Virtual Teams Can Adopt Open Source Practices

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ABSTRACT

With steep global competition, solving complex business and societal problems require innovative virtual teams, such as self-leading virtual teams (SLVTs). Yet, organizations fail at forming successful SLVTs, as these teams face higher challenges than typical innovation teams. Unlike traditional organizations, Open Source Software teams (OSS) overcome challenges faced by SLVTs. Yet, recent research shows that for organizations to successfully apply OSS practices, they should first understand and adapt OSS structures (facilities, processes and norms). This study aims at unearthing how OSS structures differ from organizational SLVTs. Multiple comparative longitudinal case studies of cutting-edge OSS teams versus organizational SLVTs will be conducted to (1) enable emulation of innovative OSS leadership structures, and (2) theorize about SLVT enablement. This research aims at enabling innovative practice transfer using a practice-based approach. This approach identifies how structures and leadership recursively evolve in practice, providing a realistic view of how they can be emulated.

Keywords

Leadership, self-leading virtual teams, qualitative research, open source software teams.

INTRODUCTION

Today's competitive global business environment requires innovative solutions to complex problems (Baumol 2002; Hoyt and Blascovich 2003). This often requires the use of self-leading virtual teams (SLVTs), i.e. globally distributed teams, whose members have decision-making autonomy and behavioral control, and who collaborate through information and communication technologies (adapted from Manz and Sims Jr 1980). SLVTs are progressively becoming vital in software development, research collaborations, and citizen science projects (Hawthorne and Perry 2005; Kirkman and Shapiro 1997; Newman et al. 2012). SLVTs' value stems from a worldwide trend towards global collaboration addressing such issues as economic development, antipoverty, health, environment, and education (Huxam and Vangen 2000). SLVT use is becoming a norm in software development for higher performance, innovation and worker satisfaction (Moe et al. 2009; Rising et al. 2000; Schatz and Abdelshafi 2005).

While many established organizations are motivated to use SLVTs, they often fail at creating or maintaining successful SLVTs (Kerber and Buono 2004; Moe et al. 2009; Wheatley and Wilemon 1999; Zakaria et al. 2004). The extensive reliance of virtual teams on technologies for their communication, coordination and work changes the nature of member interaction and leadership (Kiesler and Sproull 1992). Specifically, the lack of shared context, discontinuities in communication, and ambiguity in leadership hamper decision-making and bring about conflicts in such teams (Armstrong and Cole 2002; Watson-Manheim et al. 2002). Thus, SMGTs face more challenges than typical innovation teams. Based on their review of the literature, Avolio et al. (2009) conclude that due to these challenges new leadership theories are needed to succeed with these novel organizational forms. I aim at developing a practice-based leadership theory of SLVT enablement by answering the following general research question:

How can organizations successfully facilitate and maintain innovative self-leading virtual teams?

LITERATURE

(Self-) Leadership is linked to the setting in which it is embedded (Shamir and Howell 1999). Organizations play an important role in determining and moderating leadership processes (Pawar and Eastman 1997). Therefore, leadership theory should take into consideration how organizational structures influence the leadership emergence within the teams (Shamir

and Howell 1999). In this study, I focus on how specifically the organizational structures embedded in teams facilitate self-leadership of teams.

Organizations have many different aspects such as the environment that they reside in, the nature of their industry, the nature of their work that is involved, the culture they reside in, among others. The organizational environment may be dynamic versus static, which may influence the level of dynamism that is needed within the organization. For example in dynamic environments, more flexible organizational processes may be needed, and organizations may be required to facilitate these processes with flexible technology infrastructure. Such organizations may be more successful when they have norms that facilitate creativity, flexibility and goal accomplishment rather than fulfilling long-standing requirements, and being rewarded for obedience and for maintaining the status quo.

These different factors trickle down to the team settings, and affect the workings and the nature of the team in terms of the facilities that are available to the team, the processes the team members use to communicate, make decisions and to work, and the norms of the team related to these processes. I discuss these factors next.

Facilities- While technological factors are important for all teams, they are indispensable for SLVTs. SLVTs are dependent on the technology infrastructure and the hardware and software to communicate with each other, to coordinate member tasks and even to conduct their work. Perrow (1970) suggests that technologies influence task complexity in that they enable the users to analyze and divide the tasks so that that work can be reduced to mechanical steps and participants can follow an objective procedure to solve problems. This eases problem resolution. On the other hand, in cases where the technology does not ease problem analysis, the resolution of problems requires team members to rely on knowledge, experience and intuition. This, in return makes leader emergence more likely as individuals have a higher tendency to look to others for problem resolution (Shamir and Howell 1999).

In addition, the existence of other, non-technological facilities that allow for the team members to meet face to face (as needed) may be crucial for some teams. The ability to see each other may influence the emergence of leaders. For example, the .com boom enabled the younger entrepreneurs with high technical skills, who otherwise lack managerial skills, to emerge as leaders in a virtual environment where face-to-face interaction is relatively low.

The technology infrastructure and the specific technology in use influence both the leader and member behaviors about both the tasks and about how the group dynamics and group atmosphere is managed.

Processes- Each team has many processes ranging from how the team is managed to how the work is managed. Examples for team management include the identification or emergence of leaders, how conflicts are resolved and how team members receive feedback and rewards. Task related processes include decisions on work performance, work coordination, and the decisions on the selection, use and abandonment of technology. As leadership behaviors focus on two areas: group's task and group members' relationships with each other, the emergence and manifestation of leadership are highly influenced by the processes related to teams' task and team members' relationships (Eseryel 2009).

Norms- Norms are defined as social entities that hold implicit and explicit rules that guide an individual member's interpretation, contribution and behavior (Annabi 2005). Team norms are influenced by national, organizational and occupational cultures. Creating norms is one of the most important steps in group formation. Norms allow team members to form reliable expectations of others' actions (Rossi 2004). One can expect that teams have norms accompanying almost each facility and each process including management and leadership. Therefore norms are just as connected to leadership emergence and manifestation as the processes are. The importance of such norms have been documented in software development and also in OSS development teams (Raymond 1998; Stewart and Gosain 2005).

My research question addresses an important gap about the contribution of team structures to leadership emergence, manifestation and change largely ignored by extant research on self-leading virtual teams, which can be examined in two distinct streams. Next, I describe these two research streams and discuss the important gaps within these streams.

The first stream of self-leading team literature focused on formal external leader behaviors in enabling teams' self-leadership (e.g., Druskat and Wheeler 2003; Kirkman and Benson 1999; Manz and Sims Jr 1987; O'Connell et al. 2002; Stewart and Manz 1995; Stoker 2008; Wageman 2001). Researchers find that external leaders design these teams and create leadership structures (Houghton et al. 2003; Wageman 2001). Despite its valuable contributions, this research stream ignored which leadership structures (information and communication technologies, processes and norms) enable self-leadership, therefore rendering it impossible for the practitioners to create and maintain SLVTs.

The second research stream focused on emergent leader behaviors. Researchers found that emergent leaders initiate, schedule, integrate work (Yoo and Alavi 2004), initiate change, seek external feedback, direct, coordinate, monitor, facilitate

and mentors others (Carte et al. 2006), manage group emotion (Pescosolido 2002), and initiate structure (Stoker 2008). However, how the emergence of such leadership is fostered by the organization through organizational structures is not covered within this research.

The contribution of this research to innovation will be to address this timely research gap: this research will enable the transfer of information and communication technologies, processes and norms that support self-leadership from cutting-edge innovative teams, namely, the Open Source Software (OSS) teams, to other settings. OSS teams are global and self-leading teams whose members are distributed around the world and develop software mainly through information and communication technologies. The Dutch Scientific Council for Government Policy (WRR) and researchers identify OSS as a unique and successful alternative to conventional innovation models (Crowston et al. 2012; Kogut and Metiu 2001; Lee and Cole 2003; Nooteboom and Went 2008; Von Hippel and von Krogh 2003). Due to immense success of OSS SLVTs, the European Commission and the U.S. National Science Foundation advise the transfer of innovative OSS collaboration practices to traditional organizations (Ghosh 2006). While companies try to do this through collaborations with OSS teams as part of their information systems strategy (Wasserman 2009), many including IBM, Sun, Microsoft and Nokia report challenges in leading these teams (e.g., Jaaksi 2007). Encouraged by these recommendations, previous research identified unique leadership behaviors contributing to OSS success (Eseryel 2010; Eseryel and Eseryel forthcoming). Yet, Crowston et al. (2012) recently observed that a major challenge for traditional organizations in emulating OSS practices (such as leadership) stem from their lack of understanding of unique OSS structures. Therefore it is imperative to fully understand how OSS structures differ from organizational SLVTs and how similar structures can be adopted to emulate and maintain over time innovative self-leadership practices of OSS teams. Thus, my specific research questions include:

RQ1: How do the team structures (information and communication technologies, processes and norms) of successful OSS teams differ from structures of similar organizational teams?

RQ2: How can the innovative OSS structures be transferred to and successfully used by organizational teams?

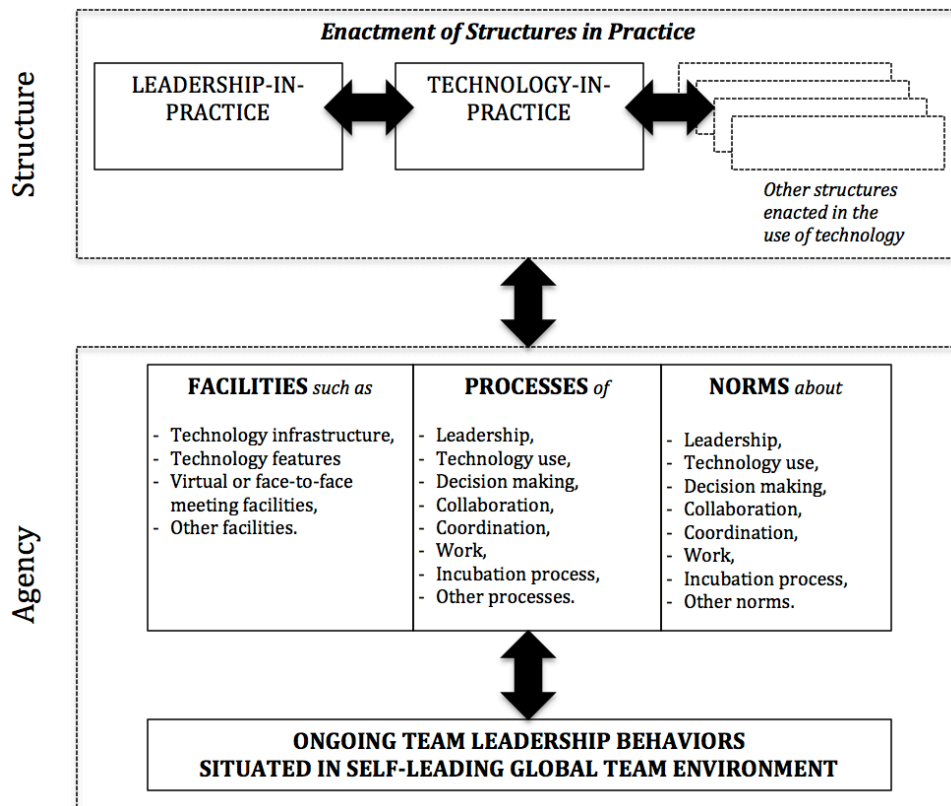
While the existing structures are important in setting the ground for team leadership, neither the team leadership nor the team structures stay stable over time. On the contrary, both evolve to respond to emerging needs that may be imposed on the team internally or externally by the general organization or due to the environment of the organization or both. Examples may be a change in the processes of the organization, which may be due to external regulatory bodies, which require compliance by all organizations within a regulated industry. Similarly new coming members may contribute to the change in structures. During the evolution of the structures, these influences may affect rules for leadership or the specific internal leaders. For example, if a hospital is required to implement medical patient records system due to a new regulatory requirement that forces all hospitals to manage their patient data using information systems, this not only changes the technology facilities but most likely also the accompanying processes of the hospital. This change may also cause the emergence of individuals who have previous experience with implementation and use of medical records as leaders, therefore changing the leadership in the organization. Similarly a change in leaders and the nature of leadership may in turn bring about changes in organizational structures. For example, following the emergence of technology-savvy individuals as leaders, these leaders may identify existing weaknesses in the organization's technology infrastructure. Leaders may therefore take on a number of new initiatives that cause a further change in the technologies (facilities), which then brings about a change in the processes that are connected to those technologies. These examples are in line with the argument that participants enact and contribute to socially constructing the organizational environments and thus team structures (Kanter 1987; Weick 1979). Therefore my last research question is as follows:

RQ3: How do these team structures and leadership co-evolve and relate to each other over time?

In answering the first two research questions, the selected theoretical approach should enable the identification of structures such as processes and norms. Structural theories may be a good fit for this task. However, structural theories are less able to account effectively for ongoing changes in both information and communication technologies and their use as individuals provide leadership (Orlikowski 2000). In social life, team members do not enact leadership in a vacuum. They draw on the information and communication technologies and other facilities available to them, and use organizational

processes guided by accompanying norms to inform their leadership and followership behaviors (Figure 1). Thus, through agency, new or altered structures may be enacted in practice. This way, individuals recursively instantiate and reconstitute their technology and leadership (Orlikowski 2000). Therefore capturing such a recursive change is important to answer the third research question. Therefore, the practice-based approach (Levina and Vaast 2008; Orlikowski 2000) will be used in this research. Practice-based approach extends structural models of technology (DeSanctis and Poole 1994; Orlikowski 1992; Orlikowski and Robey 1991) that identify the processes and norms built into technology by developers and later appropriated by the users. Practice approach has been used earlier in Information Systems research (Levina and Vaast 2005; Luna-Reyes et al. 2005; Orlikowski 2000; Orlikowski 2002).

Figure 1. Theoretical Research Framework
(Adapted from Orlikowski, 2000)



To answer the questions, first the team structures will be determined. Then appropriation of technology will be analyzed by determining the elements of agency using the practice-based approach. The practice-based approach will allow the analysis of how technology "shapes (leadership) action by facilitating certain outcomes and constraining others" over time, thus answering the second and third research questions (Orlikowski and Robey 1991).

RESEARCH METHOD

In developing a practice-based theory on SLGT leadership, a multiple comparative case study design, an accepted research method in information systems field (Benbasat et al. 1987; Dubé and Paré 2003; Pare and Elam 1997), will be employed. Case study design allows the investigation of the contemporary phenomenon of how organizations facilitate and maintain self-leading global teams, over which the researcher has no control (Yin 2003). This research design advances previous research in two fundamental ways:

First, whereas the leadership research in IS typically focuses on identifying behaviors of either formal (e.g., Peppard and Ward 1999) or informal leaders (e.g., Carte et al. 2006; Yoo and Alavi 2004) at a single point in time, this study focuses on leadership-enabling structures and uses a longitudinal design, therefore capturing a more realistic picture of leadership enablement and evolution over time.

Second, previous literature typically depends on others' perceptions of leadership solely based on interviews. Yet, this approach does not allow the researcher to objectively analyze the relationship between leadership and its enablers. Thus, to analyze the interaction between leadership and organizational structures, this study combines the following data: (1) interviews to identify leadership perceptions; and (2) archival data analysis of team's communication, collaboration, and work to determine how leadership manifests in the technology artifact and how leadership interacts with processes and norms.

Interview research (Crowston et al. 2007a; Scozzi et al. 2008) and archival data analysis (Crowston et al. 2007b; Eseryel and Eseryel forthcoming; Li et al. 2008) have been successfully used separately in OSS research. Yet, combining these allow a more thorough understanding of how OSS leadership unfolds (Eseryel and Eseryel forthcoming).

Case Selection

The industry of the organization, and the organizational environment influence the degree of leadership emergence and the nature of leadership. Dynamic environments, such as software development environments, allow for leadership emergence more than static environments (Shamir and Howell 1999). Some researchers argue that organizational environments influence not only leadership emergence, but also the type of leadership that emerges. For example Shamir and Howell (1999) suggest that organizational environments with a high degree of change or great opportunities for change allow the emergence of charismatic leaders more than stable environment. Similarly, Bass and Avolio (1993) found that transformational leaders tend to be accepted more in organizations facing rapidly changing technologies and markets. Therefore, to eliminate the variance in leadership due to the influence of the industry and its environments, I will select companies in a single, highly dynamic industry, namely the software development industry. Software industry is also a good fit for this study because (1) virtual teams are becoming the norm in software development (Carmel and Sawyer 1998) as prescribed by many software development methods (Moe et al. 2009; Rising et al. 2000; Schatz and Abdelshafi 2005) and (2) focusing on one area minimizes the risk of extraneous variation as recommended by Eisenhardt (1989). I will select 4 successful cases; two highly innovative OSS teams from, and two innovative organizational SLGTs from a software company. The OSS teams that will be investigated, similar to other organizational self-leading teams, have an umbrella organization that provide organizational structures, IS infrastructure, norms and reporting requirements to the teams (Ljungberg 2000). During case selection, I will create theoretical variance (Eisenhardt 1989) using a single dimension; open source versus organizational SLGTs, while trying to keep other dimensions such as team success, task complexity, team maturity similar for reasons of comparability (Eisenhardt 1989). This comparison allows the identification of structural differences of two types of SLGTs, and how to transfer the best practices from the OSS setting to organizational settings.

I will collect data from key informants about the general structures within the Apache and company in general. Moreover, I will retrospectively collect data from the team members about the initiation of the project (Time 0), as well as about the current time period (Time 1) and repeat this one year later (Time 2). Two coders (including myself) will analyze archival data inductively. Once we independently code archival data, we will discuss and repeat the coding and memoing process until a coding schema is developed and reliability of the schema is established at 80% or higher. Then all archival data will be coded by myself using the reliable coding schema (Neuendorf 2002).

I will make explicit distinction between different stages of my theory building process (Pettigrew 1990). Following Eisenhardt (1989), I first conduct within-case studies and write individual case reports with rich descriptions. After completing within-case analysis, relationships will be analyzed across cases to develop tentative propositions by grouping similar cross-case findings. New iterations of within- and cross-case analysis will be conducted until findings saturate (Miles and Huberman 1994).

CONCLUSION

The innovative nature of this research is situated at the theoretical, practical and methodological levels. On the theoretical level, I will develop a practice-based theory about SLGT enablement through knowledge-transfer from uniquely innovative OSS teams, rather than solely reporting SLGT leader characteristics. On the practical level, the study design differs from previous OSS research, which unearths certain aspects of OSS with the faulty assumption that these can be directly copied in practice by organizations. Rather, this research will investigate how innovative OSS leadership practices can be transferred to

organizational settings by emulating similar structures. Therefore, findings will be directly useable by practitioners in organizations. On the methodological level, my research design fundamentally deviates from the previous IS leadership research by conducting longitudinal research of real-life teams. The innovative aspect of the methodology is the triangulation of data on team perceptions (through interviews) with actual communication, coordination, and work behaviors (through archival data analysis). This helps identify the nature of perceived leadership based on interviews, and the observation of how leadership and structures co-evolve using the archival data. In the past, such archival data was not available due to limited time and access that companies are willing to dedicate to support research. However, such data is now available for virtual teams, especially for OSS teams.

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