U.S. AND INDIAN MANAGERIAL BOUNDARY SPANNING BEHAVIORS IN GLOBALLY DISTRIBUTED SOFTWARE TEAMS

A Dissertation
Submitted to the
Temple University Graduate School

In Partial Fulfillment
of the Requirements for the Degree
EXECUTIVE DOCTORATE OF BUSINESS ADMINISTRATION

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May, 2019
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ABSTRACT

This paper explores the construct of Boundaries and Boundary Spanning in software development teams that consist of members located in both the U.S. and in India. Drawing on literature pertaining to boundaries in business, global boundaries, cultural boundaries, virtual team boundaries, and organizational boundaries, two studies were conducted. The first study measured the boundary spanning behaviors of software team managers of 25 teams. These results were analyzed in conjunction with a standard measure of software team output. No support was found for the hypothesis that frequency of team manager boundary spanning behavior had an impact on overall team output. In the second study, interviews were conducted of 20 software team managers to better understand their perceptions of the boundaries to team success. Managers cited several boundaries to team output, such as those of communication and issues of power-distance. Nearly all managers felt that time zone difference, a temporal boundary, was the most impactful to their own team success. Through flexible pattern matching analysis, categories of team boundaries have been proposed.

Keywords: Software Development, Teams, Culture, India, Management, Boundaries, Boundary Spanning

DEDICATION

Everything I do is for Hank and Joanna. I am hugely proud of both of you. It has been the joy of my life to watch you as you have grown into wonderful and successful people . Thank you for your love, support, and understanding as to why Mom felt the need to doctoral degree at this late stage in the game. I also dedicate this work to my mother, who has provided the role model for my life through her own hard work, dedication to her family, and to the value of education.

ACKNOWLEDGEMENTS

This work would not be complete unless I thanked the many members of the studied software development teams at the target research companies. Everyone graciously gave their time and unvarnished opinions to this work, a work that strives to benefit us all. Thanks also goes to the management of both companies, who saw the value in these research efforts. Special thanks go to Mieke Nee, who out of her own professional interest and desire to improve our teams, helped me organize and conduct my interviews.

I would very much like to thank the Temple EDBA staff for their support and patience in encouraging me through this process, helping me narrow down and focus my interests into a topic that is both meaningful and useful to myself and other managers in my discipline. Particular thanks go to Sunil Wattal, my dissertation advisor, for carefully balancing the right level of support and forced self-examination, and for doing it nearly every week for two years. He magically seemed to know how much (or how little) help to give and when to give it. Additional thanks go to the other members of my committee, Stuart Smith and Noemi Sinkovics, and my external reader, Vivek Tandon. All provided different and invaluable perspectives on the work, its' analysis, and meaning.

Finally, I must thank my fellow EDBA group members, Whitney Collins and Christen Adels. They pulled me through. This program has been worth the work on so many levels, but top among them was meeting and working with you.

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CHAPTER 1

INTRODUCTION

The aim of this research is to better understand the boundaries faced by managers of global software development teams and the behaviors engaged in by managers to overcome those boundaries, with a specific focus on software developments teams consisting of members both in the U.S. and in India. The further aim is to explore the relationship between those boundaries, boundary spanning behaviors, and overall team performance.

Research Motivation

Technological innovation and globalization are currently pushing rapidly increasing business change (Steger, 2009). Adding to the pressure, many businesses not previously considered part of the technology sector now find themselves there and must keep pace with quickly changing technology to survive. The business imperative to produce innovative technology solutions quickly has increased. Yet, at the same time, possibly as many as 70% of all IT projects fail to deliver results (Stanleigh, 2006), with the loss to U.S. companies estimated to be as high as $50 to $150 Billion annually (Hardy-Vallee, 2012). Examples are easily found. In 2004, Ford Motor Company abandoned its new purchasing system after spending approximately $400 million (Charette, 2005). In 2003, programming errors were found in the alarm systems that would have alerted officials in advance of one of the largest electric blackouts in U.S. history, leaving major cities like New York and Boston in darkness for nearly 24 hours, costing an estimated $7 Billion to the national economy (ICF Consulting, 2003; Jesdanun, 2004). In 2012, the U.S. Airforce scrapped a major Enterprise Resource Planning (ERP) system after spending $1.03 Billion without creating any significant military capability (Kanaracus, 2012).

Such losses and complications have put severe pressure on tech teams working on these projects (Glen, 2003; Guzman, Ramos, Seco, & Esteban, 2010). As a result, technology teams are frequently reorganized and restructured to achieve maximum performance at a minimum of cost, with IT "off-shoring" becoming a predominant staffing model in a majority of multinational organizations (Glen, 2003; Lenz & Machado, 2008; Sethi & Gott, 2017). In many multinational companies, decreasing cost has been accomplished by assembling technology teams using workers from both developed and developing countries. In India, a Software Developer earns roughly $14,000 annually (Rawson, 2012), and in the U.S., that same role pays an average of $101,000 a year (Kaner, 2018). Because of technology, collaboration is now possible regardless of distance, so using cheaper resources to get the job done seems to make good economic sense. Western firms continue to outsource more and more jobs, creating ever more dispersed technology teams (Brooks, 2013; Levina & Vaast, 2008). IT teams are also increasingly diverse in other ways, made up of full-time workers, contractors, and workers from consulting firms; with team members often located in various offices and companies around the world (Massey, Hung, Montoya-Weiss, & Ramesh, 2001).

While on the surface it may appear cheaper, creating these global technology teams has some significant challenges (Schotter, Mudambi, Doz, & Gaur, 2017; Wang & Haggerty, 2011). At the same time as the complexity of business needs require increasing intensive collaboration among co-workers, team members find themselves further and further apart, both culturally and geographically. As a result, teams are facing multiple boundaries that must be successfully spanned for the team to achieve its' goals (Gopal & Gosain, 2010; Harvey, Peterson, & Anand, 2014). So, the question becomes, who and how is this boundary spanning to be done? This boundary spanning work falls largely to team managers. Success cannot be left to simply implementing more and more communication technology tools. Just because the tools exist for workers located around the world to collaborate with one another does not mean those tools will necessarily increase worker productivity (Oz, 2005). Since face-to-face meetings among these team members are rare, collaboration can become more difficult at a time when it is increasing crucial. Software development managers who run these teams find themselves operating in an increasingly complicated global corporate landscape that exacerbate issues of control and coordination and make project delivery more and more difficult.

Such demands for innovation and speed under difficult circumstances can often lead to stress and early job burn out (Bass, Beecham, Razzak, & Noll, 2018; Messersmith, 2007; Vimal, 2016). For these reasons, virtual team conflicts can happen frequently and are often more serious than those in traditional teams (Hinds & Bailey, 2003; Thomas, Bostrom, & Gouge, 2007). The stresses that both individual tech workers, their managers, and the tech teams as a whole feel are often manifested in reduced effectiveness and poor-quality work product (Lenz & Machado, 2008). According to Pillis & Furumo (2007), issues of virtual team boundaries can slow technology project completion by nearly 20%. When time to market for technology projects can mean success or failure of any given product, such delays can drastically impact firm revenue and profitability.

Also, under many circumstances, these type of boundaries present companies with further difficulties in building their desired corporate culture, which can often be the "secret sauce" of company success (Meyer, 2015; Schein, 2009). Companies that work across global boundaries can create what is known as a "globalization penalty", scoring lower in areas of organizational health such as establishing corporate vision, project execution, and establishing and maintaining professional internal standards (Dewhurst, Harris, & Heywood, 2011), making the maze of team boundaries ever more complex and costly.

It is in these circumstances that the role of boundary spanners, at all levels of the organization, is becoming increasingly important. Those who can bridge the gap between teams, time zones, geographic distance, cultural norms, and company practices can be the crucial difference between well and mal-functioning teams. This role frequently falls to the managers of these geographically diverse software teams, both in practice and as role models to the rest of the team members. Boundary spanning is one crucial managerial tool, aiding teams to achieve necessary efficiencies. As such, boundary spanning is a key competency of team managers, most often implicitly rather than explicitly (Andersen & Kragh, 2015).

On a more personal note, I have spent the last 20 years as a manager of software development teams with members located in the U.S., UK, Russia, Singapore, Argentina, Columbia, and India. I have both an intense interest and experience in the topic of off-shore software development. Here I have focused specifically on teams based in the U.S. and India since that has become the overwhelmingly predominant makeup of my own teams as well as in many industries (Sethi & Gott, 2017). During my time working with these teams I have found that the boundaries of culture, distance, time, organizational structure, and power distance, to name a few, impact the success of a technology project far more often than the ability of the software developers to successfully write code. I want to unpack these issues and give managers like myself a place to start in the development of an understanding of such issues. We need to work to breakdown the specifics of these boundaries and better understand how they may hinder the success of these teams. Any insight that might help technology professionals make progress towards alleviating the 70% failure rate in IT projects is certainly worth seeking.

Expected Outcomes

The focus here is largely a practical one. The contribution of this research is primarily focused on practical implications for team managers. From that perspective, this work hopes to give guidance on how the frequency and type of their boundary spanning activities may or may not be helping their teams to succeed. Furthermore, it is also important to understand the extent to which different types of managers, such as line managers and senior managers, or managers in the U.S. vs managers in India, face different boundaries and handle them differently, as they are likely to need the unique competencies to do so. These competencies, once made explicit, can be addressed directly with and more fully understood by managers, helping them move closer to team success. Such knowledge may have direct impact on how managers of global software development teams behave, are selected, trained, and interact with each other across boundaries.

Research Structure

The structure of the research output is as follows.

Chapter	Title	Purpose
1	Introduction & Research Motivation	• State the purpose of the work. • Demonstrate the importance of this area of study. • Outline expected outcomes.
2	Literature Review	• Survey relevant literature in multiple related subjects. • Identify gaps in knowledge base. • Derive a framework for continued research.
3	Study One: Survey of Manager Boundary Spanning Behavior	• Detail the first study conducted: designed to quantify the boundary spanning behaviors of managers of software development teams with members in the US and India.
4	Study Two: Manager Interviews, Gaining Deeper Insight into Boundaries and Boundary Spanning	• Detail second study conduct: consisting of interviews with team managers in both the U.S. and India regarding their own perception of boundaries and their boundary spanning behaviors.
5	Discussion, Limitations, and Further Research	• Ties together the overall themes of both studies. • Develops contributions to practice. • Explores areas of limitation and further research.

CHAPTER 2

LITERATURE REVIEW & BACKGROUND

Introduction

The focus of the research concerns multiple constructs, the intersection of which, I believe represents a gap in the current literature. In my approach to the literature, I will examine three main areas. First, I explore research on Boundaries and Boundary Spanning in business. Then I will turn my attention more specifically to the Boundaries and Boundary Spanning that occurs in global software development teams, with a focus on teams split between the U.S. and India, emphasizing cultural boundaries. Finally, the literature review focus shifts to the relationship between Boundaries, Boundary Spanning, and overall team performance.

Boundary Spanning in Business

With the increasing complexity in global organizations, the term "Boundary Spanning" has taken on a host of meanings and become a broad categorization for many individual and group activities (Schotter et al., 2017). In search of a definition of boundary spanning, the act of distributing knowledge or information across those boundaries is a recurring theme (Andersen & Kragh, 2015; Caldwell & O'Reilly, 1982; Glaser, Fourne, & Elfring, 2015; Lee, Shin, & Lee, 2011a; Ratcheva, 2009). Boundary Spanners are often those who act as gatekeepers. In fact, the concept of boundary-spanning has been linked with research on gatekeepers (Haas, 2015), but boundary spanners are also those who build relationships and use information to bridge organizational gaps (Lee et al., 2011a), characteristics not usually associated with the role of gatekeepers. Table 1, below details some of the most foundational definitions of Boundary Spanning that can currently be found in scholarly literature.

Table 1. Boundary Spanning Definitions Across Disciplines

Definition	Measure	Primary Discipline	Reference
Direct involvement in managing the relationship with the partner, entailing intense and extensive ongoing interaction with staff and managers of the other party.	The number of managers directly engaged in the export manager role, requiring explicit boundary spanning activities.	Management	Araújo-Pinzón, Álvarez-Dardet, Ramón-Jerónimo, & Flórez-López, 2017
A set of communication and coordination activities performed by individuals within an organization and between organizations to integrate activities across multiple cultural, institutional and organizational contexts	Psychic Distance	International Business	Schotter et al., 2017
The bundle of skills, abilities and personal characteristics that contribute to effective inter-organizational behavior.	Tracking of specific boundary spanning behaviors and traits during fieldwork (communicating, resolving conflict, building trust, etc.)	Management	Williams, 2002
Gatekeeper, scout, ambassador, and guard of associated knowledge.	Team knowledge transfer competencies	International Business	Lee, Shin, & Lee, 2011
Those who serve to filter and transfer information across organizational boundaries	Attention to Social Cues	Psychology	Caldwell & O'Reilly, 1982
Information processing units.	Occurrence of three meta-practices used to deal with managerial dilemmas.	Management	Andersen & Kragh, 2015
Those who engage in the processes of distributing knowledge.	Instances of crossing project boundaries of action, knowledge, and social relations.	Management	Ratcheva, 2009
Activities through which new knowledge and expertise are sought from other units.	A survey of business units counting instances of giving or receiving new knowledge or expertise to and from other units.	Management	Glaser, Fourne, & Elfring, 2015

Table 1, continued

Social relationships that cross organizational constructs.	Ease of generating creative ideas when interacting with a specific partner.	Sociology	Dokko, Kane, & Tortoriello, 2014
Systems thinking leading to the understanding of specific needs and interests of the organization, allowing them to move through the formal and informal		Management	Langan-Fox & Cooper, 2014
recoding of information between two diverse units		Information Systems	
Persons who operate at the periphery or boundary of an organization, performing organizational relevant tasks, relating the organization with elements outside it		Management	Leifer & Huber, 2017
A specialized function that seeks opportunities to mediate the flow of information between relevant actors in a focal organizational unit and its task environment.		Management	Birkinshaw, Ambos, & Bouquet, 2017
A series of activities external to a group including mapping, gathering information and resources, scanning, feedback seeking, opening communication channels, informing, coordinating, negotiation, mold, allowing entry, translating, filtering, classifying, delivering, and protecting.	Observation of specific activities that fall into the defined categories.	Management	(Ancona & Caldwell, 1992)

Although elements of the construct of boundary spanning appear in earlier research, the phrase “boundary spanning” appears earliest in the literature in articles by Tushman (1977) and Aldrich & Herker (1977). Boundary spanning behavior itself was also described by March & Simon (1958) in their book Organizations, and by Katz and Kahn (1966) and Brown (1966) (Haas, 2015). Their focus was on specific boundary spanning behavior which included information exchange, access to resources, access to markets, group representation, trigger of organizational change, and coordinator and facilitator roles(Haas, 2015). Ancona and Caldwell (1992; 1988) looked at boundary spanning from the aspect of group dynamics, focusing their research on the activities of the group towards outside entities, and the boundary spanning behaviors in which the team members engaged. In their research, they found fifteen different categories of boundary spanning activities: modeling, gathering information, gathering resources, detecting, feedback seeking, opening communication channels, informing, coordinating, negotiating, molding, allowing entry, translating, filtering, classifying, delivering, and protecting (Ancona & Caldwell, 1988). They classified these activities into four categories of boundary spanning behaviors. See Table 2 below.

Table 2. Classification of Manager Boundary Spanning Activities
(Ancona & Caldwell, 1988)

Category of Boundary Spanning Behavior	Specific Manager Behavior
Scout	Modeling
	Gathering Information & Resources
	Scanning
	Feedback Seeking
Ambassador	Opening Communication Channels
	Informing
	Coordinating & Negotiating
	Molding
Sentry	Allowing Entry
	Translating
	Filtering
Guard	Classifying
	Delivering
	Protecting

In a later work, Ancona and Caldwell (1992) slightly reorganized their boundary spanning behavior categories into the follow: “Ambassador” activities that include both protective and persuasive goals, “Task Coordinator” activities that are related to coordination and negotiation with outsiders and stakeholders, “Scout” activities related to scanning, mapping and information gathering, and “Guard” activities that are undertaken to avoid releasing information. This framework for identifying boundary spanning activities in managers forms the basis for the first study in this dissertation.

Focusing on areas of innovation and R&D, key boundary spanning research findings have largely centered on a small number of managers with unique skills sets emerge as those who navigate successfully across these boundaries (Cummings & Haas, 2012; Schotter et al., 2017). The focus on this navigation has been largely concerned with information processing (Andersen & Kragh, 2015; M. L. Tushman & Scanlan, 1981) and management practice (Levina & Vaast, 2005). The relational view of boundary spanners has also become well developed, with the boundary spanner as person who builds bridges, creates opportunities for increased communication, and engages in relational leadership (Gittell & Douglass, 2012). Dokko, Kane, & Tortoriello (2014) and Abbott (1995), examining boundary spanning from a sociological perspective, explored issues of group identification and its relationship to boundary spanning activities. To date, existing research on boundary spanners in the business context has been predominantly limited to a case studies, with no significant body of research yet emerging (Langan-Fox & Cooper, 2014; Schotter et al., 2017).

Boundaries in Global Software Teams

In this research, I examine global software development teams consisting of members in both the U.S. and India. These teams have increasingly become part of complicated global value chains (Holtbrügge, Schillo, Rogers, & Friedmann, 2011; Levina & Vaast, 2008), and face many boundaries to their success. These boundaries are defined as borders, both external and internal to organizations, that clearly define entities (Aldrich & Herker, 1977; Schotter et al., 2017). Whatever is inside these entity lines have something in common, which those outside the entity do not (Abbott, 1995). In today's multi-national companies, those lines include differences of corporate and local culture, time zone, working practices, processes, as well as hierarchal and functional expertise (Langan-Fox & Cooper, 2014), to name a few. However, most of the existing research has focused on boundaries of geography, hierarchy, and function (Schotter et al., 2017). Here we seek to move to the next step beyond those boundaries largely explored at the generic team or firm level and view them more specifically from the perspective of these global software development teams. Based on a review of the literature, a categorization of the different types of boundaries that are faced by these globally distributed software development teams has started to emerge. These are summarized in the following sections.

Cultural Boundaries Each nation and organization has a distinctive, influential, and describable culture which shapes everything in the human realm (Pieterse, 2009). Culture is defined as a pattern of shared tacit assumptions, learned by a group as it solved its problems of external adaptation and internal integration (Schein, 2009) and is conceptualized as implicit, systematically causal, and carves a unique territory (McSweney, 2002). To effectively structure and motivate cross-cultural virtual teams, managers need to understand the different cultural motivations and issues that both people and the organizations face within their respective societies. Cultural values can often be a stronger predictor of organizational and employee outcomes than can individual differences such as personality traits or professional experience and skill (Schein, 2009; Taras, Kirkman, & Steel, 2010).

There is a significant body of work in the literature on the importance of culture in business, but there is a logical starting place. Cultural boundaries in business can be explored through the lens of Hofstede's (1993; 1983) groundbreaking work, categorizing business culture into four dimensions, Power Distance, Uncertainty Avoidance, Individualism, and Masculinity. Although Hofstede's work has been criticized for eurocentrism (Ponterotto, 2010) and ignoring gender differences (Shinnar, Giacomin, & Janssen, 2012), it has been widely used to describe the cultural conditions in organizations of different countries and provides a useful lens for the examination of cultural boundaries. Cooke & Nmeterson (2012, page 20) provide a succinct summary of Hofstede's cultural organizational framework.

> ***Power distance*** *refers to the extent to which a society accepts the unequal distribution of power, wealth and prestige. In countries with high power distance scores, we will expect to see behavioral passivity and subservience towards superiors. Authoritarian management styles are likely to prevail. Organizations in countries with low power distance scores are likely to be egalitarian and participative.*
>
> ***Uncertainty avoidance*** *indicates the extent to which people of different cultures tolerate uncertainty or ambiguity. People are more likely to accept change, innovative ideas and risk in organizations in low uncertainty avoidance cultures, and to resist them in organizations in high uncertainty avoidance cultures, thereby requiring more guidance and instruction to prepare them for change.*
>
> ***Masculinity-femininity*** *refers to separation of gender roles in society. In high masculinity cultures, men are expected to be strong, tough and assertive; and women meek, gentle and nurturing. Organizations in 'masculine' societies tend to be structured around the expectation that people live to work. As a result, masculine-type organizations tend to be competitive arenas where strength and assertiveness are rewarded. Feminine societies are characterized by some degree of gender overlap, with expectations that men and women tolerate and demonstrate a degree of modesty and concern for the quality of life. Organizations in feminine societies tend to rely more on intuition and negotiation and less on logic, assertion and competition.*

> ***Individualism-collectivism*** *concerns the degree to which cultures emphasize personal initiative and achievement or collective, group-centered concerns. In individualistic societies, there is an expectation that individuals should be responsible for their own well-being. By contrast, collectivist societies exhibit high degrees of social solidarity. Cohesive groups inside and outside the organization give individuals a sense of identity and belonging, demanding considerable loyalty in return for that sense of security.*(Cooke & Nmeterson, 2012)

In a later work Hofstede (1994) expanded his framework to include a fifth dimension of *Time Orientation*, dimensions along a short-term or long-term view. In 2010 a sixth dimension was added to the model, *Indulgence vs. Restraint*. This was based on sociologist Michael Minkov's work, and is defined as Indulgence: the tendency to allow relatively free gratification related to enjoying life vs. Restraint: a conviction that such gratification needs to be curbed and regulated by social norms (Hofstede, Hofstede, & Minkov, 2010). Personally, I have seen all of these dimensions at play in the management of global software development teams.

In 1991, furthering the work on cultural boundaries in the workplace, Robert J. House of the Wharton School of Business started the "Global Leadership and Organizational Behavior Effectiveness" (GLOBE) Research Program. The program set out to explore the research question, "How is culture related to societal, organizational, and leader effectiveness?" (Hoppe & Eckert, 2012). Directly expanding on and echoing many of Hofstede's findings (Hofstede, 1994), the project identified nine cultural dimensions: Assertiveness, Future Orientation, Gender Egalitarianism, Humane Orientation, Institutional Collectivism, In-Group Collectivism, Performance Orientation, Power Distance, and Uncertainly Avoidance (Chhokar, Brodbeck, & House, 2008). These boundary definitions add even more detail and nuance to the boundaries that must be spanned by those managing cross-cultural teams. In addition to the nine cultural dimensions, The GLOBE study, focusing largely on leadership, outlined six leadership factors, Team-Oriented Leadership, Charismatic/Value-Based Leadership, Autonomous Leadership, Humane Leadership, Participative Leadership, and Self-Protective Leadership.

Boundaries Presented by Indian and U.S. Cultural Differences

Since my specific interests lie in software development teams with members both in the U.S. and in India, and with managers both in the U.S. and India, it is important to dig deeper into the literature as it specifically pertains to the cultural differences and similarities of U.S. and Indian managers. The more cultural diversity between business team members, the more difficulty a team will have in establishing relationships (Di-Marco, Taylor, & Alin, 2011) creating additional team boundaries. In this area, most of the literature focuses on management and team cultural differences in general, not on the specific differences found between U.S and Indian managers of software development.

First, it is very important to note that both India and the U.S. are very diverse countries, with vast regional differences that affect the way people work. What is acceptable and effective in the work place in New York City would not necessarily be so in Houston, TX. India is also greatly diverse, even perhaps more so than the U.S. India as we now know it was not a fully formed country until fairly recently, 1950 (Chhokar et al., 2008). There are 22 officially recognized languages in India. While Hindu is the predominant religion, there are also large populations of Muslims, Buddhists, Sikhs, and Christians (Alim, 2014). To generalize culture in either the U.S. or India is difficult and problematic. However, both countries rely on economic and social organizations that binds them together (Chhokar et al., 2008). Complicating the matter further, corporate cultures vary widely from one business organization to the next, even within a nation (Schein, 2009).

Several key differences emerge in the literature in both team management and the teams themselves when looking at U.S. and Indian teams. Several authors note the reluctance of both Indian team members and team managers to question or challenge the tasks they are given by their American counterparts, even if they know those tasks may be difficult or there is a better way to achieve the same results (Krishna, Sahay, & Walsham, 2004; Pherwat & Rider, 2018). Putting this into the framework of Hofstede's work, a possible explanation is the differences in Power Distance Indices between the U.S. and Indian teams, see Chart 1 below. In Hofstede's 1983 study, India had a rank of 47 out of 50 countries when it came to power distance. In general, the Indian teams are more deferential to authority, relying on a top down organizational structure for direction and even security. The U.S. had a rank of 16 and comes from a more egalitarian point of view (Hofstede, 2016).

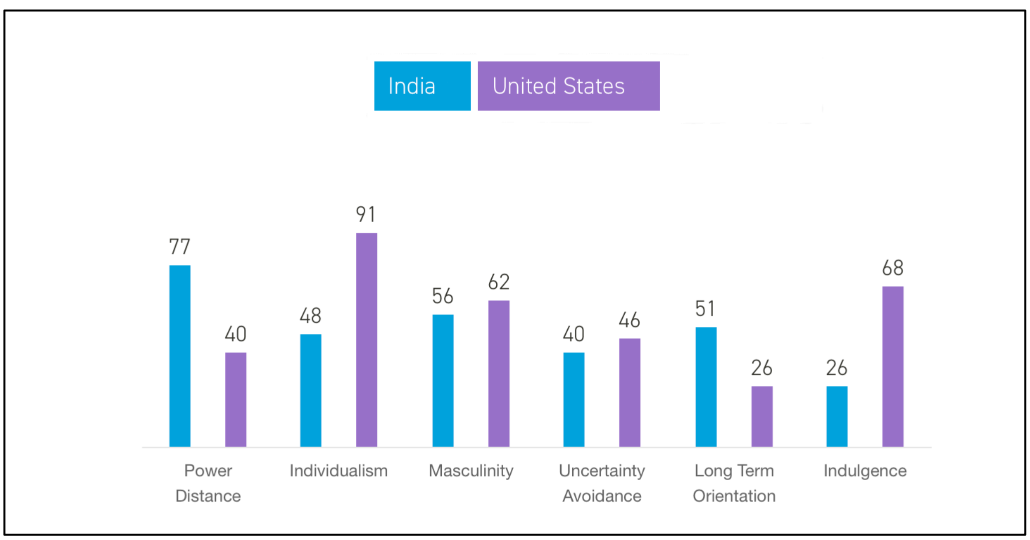


Figure 1. India and the U.S. Scores as Defined by Hofstede's Dimensions of Business Culture (2016, Hofstede Insights)

Using the Hofstede framework, a 2003 study of American, Indian, and Korean managers found support for the notion that culture has a strong influence on the ethical attitude of business managers (Christie, Kwon, Stoeberl, & Baumhart, 2003). Both Americans (99%) and Indians (96%) felt that they needed to be ethical in business to achieve long-term success, however Indians felt more difficultly in making ethical decision. Indians considered issues like nepotism, software piracy, firing of older employees, and sharing of insider information as less unethical than did their American counter parts. Indians considered harm to the environment as more unethical than did Americans. The study supported a strong relationship between ethical attitudes of managers and the cultural dimensions of individualism and power distance. Such a relationship was not supported for the dimensions of masculinity, uncertainly avoidance, and long-term orientation (Christie et al., 2003). Similarly, Neelankavil, Mathur, & Zhang, (2000) found that cultural values such as individualism impact managerial perceptions and behaviors.

Focus groups conducted in India as part of the GLOBE project compared participants' perceptions of American and Indian mangers (Chhokar et al., 2008) , see Table 3 below. The study points to some additional cultural differences that may create boundaries between U.S. and Indian managers and their teams. Since Indians are usually more formal, they place more emphasis on rituals and ceremonies. I have seen this in practice. When I or my team members visit our software partner's offices in India, we are greeted with a "Welcoming Ceremony", involving flowers, scarves, and sweet beverages. When our Indian partners visit our offices, we buy them a cup of coffee, find them a desk, and get to work. Also, Indian managers often have a different concept of time, with less import placed on punctuality. Schedules are frequently more shifting and flexible than in the U.S. This is another area I have seen in practice many times. Combining the two issues, we have had to institute some minor ceremonies to signal the time for our daily meetings to begin each day.

Table 3. Comparison of Indian and American Managers in Focus Groups Conducted in India (Chhokar et al., 2008)

Characteristics of Indian Managers	**Characteristics of American Managers**
Somewhat lackadaisical and indifferent	Task oriented
More relationship oriented	Impersonal
Somewhat Knowledgeable in several areas	Specialized
Long-term time horizon	Short-term time horizon
Believe verbal statements	Require documentary proof
More trusting	Less trusting
Emotion oriented	Fact oriented
Efforts oriented	Result oriented
Less demanding	More demanding
Conservative, cautious	Generally, less conservative
Low risk taking	Higher risk taking
Hurting others is not good	It doesn't matter if others are hurt
Greater human touch	Materialistic, cold
Formal	Informal
	Better Equipped – Technology & Facilities
	Better Time Managers

Di-Marco, Taylor, & Alin, (2011) found in a study of U.S. and Indian engineering teams, that conflicts were largely a result of national cultural boundaries. These boundaries included the unfamiliarity with slang and local work practices as the major causes of boundary creation. Their work found that an Indian expatriate embedded in the U.S. onshore team to play a boundary spanning role increased collaboration effectiveness. Neelankavil, Mathur, and Zhang (2000) found that despite such differences, middle managers in the U.S. and India were all primarily concerned with motivating, training, evaluating, communication, and controlling as contributors to their performance.

Virtual Team Boundaries Virtual teams have given rise to a new set of leadership challenges especially as it relates to team outcomes and performance (Hambley, O'Neill, & Kline, 2007; Holtbrügge et al., 2011). As the technology to create such teams has quickly given rise to the predominance of virtual teams, Virtual Team Work theory, literature, and research has grown correspondingly. This research has focused on both global and local virtual teams. Virtual Team Work theory has focused on areas of Inputs (Design, Culture, Technical, Training), Socio-Emotional Processes (Relationship Building, Trust), Task Processes (Communication, Coordination), and Outputs (Performance, Satisfaction) (Powell, Piccoli, & Ives, 2004).

With these additional factors, the traits needed to form the basis for a successful team is widened when managing a virtual team. Connecting team members that may never meet face to face to each other and to the team's mission, surmounting language, distance, and technology barriers, identifying and using the right communication channels are some of the additional difficulties that need to be addressed for a virtual team to be successful. Virtual teams provide the manager with these additional boundaries of time, distance, and technology (Zhang et al., 2008).

Organizational Boundaries Organizational boundaries include those of structure (Zhang, Tremaine, Milewski, Fjermestad, & O'Sullivan, 2012) – divisions, departments, and sub-units; networks and the relationships that may form as a result of structure (Rozovsky, 2015; Williams, 2002). These include the vertical boundaries of hierarchy and status (Langan-Fox & Cooper, 2014). Because software development and technology teams in multinational organizations are increasingly comprised of outsourced and off-shore relationships (Lenz & Machado, 2008), the added boundaries of client and consultant is of particular relevance to this discussion. Additional examples of the organizational category of boundaries include boundaries of reward systems (Levi & Slem, 1995), say, who is eligible for bonuses and who is not; and finally, boundaries of the tasks themselves, as similar words may be used to describe different tasks within the various boundaries of the organization (Levi & Slem, 1995; Massey et al., 2001). These boundaries of task, known as horizontal boundaries, also concern function and expertise (Langan-Fox & Cooper, 2014).

Global Business Boundaries The global business climate provides companies and managers with an additional set of boundaries. Globalization crosses boundaries of government, politics, media, economics, ideology, law and social movements (Lia, 2008; Pieterse, 2009). These boundaries can have some tangible and immediate effects on multinational corporations. For example, the expanding influence of the emerging markets of India and China are rapidly growing as competition, as a potential workforce, and as a potential market for goods (Steger, 2009), greatly effecting business strategy. Governmental manipulation of currency can render a country more or less attractive to sell goods and buy labor (Pieterse, 2009). In another example, the global political climate will dictate how easily workers can be moved from one country to another (Mosco, 2006; Schotter et al., 2017).

What I have touched on here are the multiple constructs impacting global software development teams with members in the U.S. and India, forming a sea of boundaries that team managers must span to achieve success. Table 4 below is a distillation and categorization of these boundaries, creating a framework concerning boundaries of globalization, culture, virtual team, and organization.

Table 4. Boundaries Faced by Managers in Globally Distributed Software Teams with Members in the U.S. and India

Global Business Boundaries	**Cultural Boundaries**	**Virtual Team Boundaries**	**Organizational Boundaries**
Technological Innovation Environment Emerging Markets Media Geo-Politics Ideology Economics Law Local Work Practices	Power Distance Time Orientation Masculinity Individualism Uncertainly Avoidance Time-Orientation Indulgence vs Restraint	Time Distance Technology Communication Skills	Structure Relationships Rewards Networks Tasks

Boundary Spanning and Team Performance

Several authors have supported the case that boundary spanning behaviors by team members contribute to better overall performance (Choi, 2002; Harvey et al., 2014; Sawyer, Guinan, & Cooprider, 2010). In their 1992 work on a Team Effectiveness Framework, Tannenbaum, Beard & Salas (2017) featured boundary spanning as a key process in the determination of team effectiveness. Others highlight the importance of boundary spanning behaviors of team leaders (Ancona & Caldwell, 1992; Burke et al., 2006; Druskat & Wheeler, 2004; Joshi, Pandey, & Han, 2009; Marrone, 2010). Druskat & Wheeler (2004) examined the workings of 300 teams. They found that the best leaders, the ones who contributed the most to team success, were those who focused on managing the boundaries between the team and the larger organization. Taking a resourced based view, Ancona, (1990) and Burke et al., (2006) suggest that boundary spanning by managers works to bring more highly valued resources into the team, contributing to team success.

Leader-Member Exchange Theory (LMX), centering on the dyadic interactions between leaders and followers, puts forth the idea that followers and leaders form strong ties of trust, respect, and emotion based on the frequency and quality of their interactions (Northouse, 2015). These ties effect the quality of work for both leaders and followers (Khatri, 2011). It follows that increasing boundaries to exchange would reduce leaders and followers opportunities to form these ties.

Looking more specifically at the issue of boundary spanning in global software teams, several articles and studies have focused on reducing the need for collaboration through methods of task separation rather than exploring how to better facilitate interaction (Carmel & Agarwal, 2001; Krishna et al., 2004; Pandey & Pattnaik, 2016). However, Gopal & Gosain (2010) do propose that boundary spanning is an important element in the organizational controls necessary to ensure project performance in software development outsourcings. This is echoed by Søderberg, Krishna, & Bjørn (2013), who highlight the importance of boundary spanning roles in large software projects conducted by outsourced vendors based in India. They examined the issue from the perspective of the Indian partners themselves, which is unusual in that most research on multi-national outsourcing has been conducted from the perspective of the hiring, usually western, firm. Choi (2002) points out that boundary spanning by team managers is perhaps most important for team performance when the environment is complex, which is particularly relevant in complicated and long-running technical projects faced by many global software teams.

Conclusion

My topic of interest cuts across many topics and constructs: software development in teams, team performance, virtual teams, cultural issues in business, management and team differences in the U.S. and India, globalization, organizational structure, boundaries and boundary spanning. While many of these areas have large bodies of literature, such as cultural issues in business and team performance, and others have fewer works, such as boundary spanning, there exists a significant gap in the literature. There is very limited work combining these areas, specifically on the issue of boundaries and boundary spanning in the management of U.S. and Indian software development teams. I will focus on the intersection of all of these constructs.

CHAPTER 3

STUDY ONE: SURVEY OF MANAGER BOUNDARY SPANNING BEHAVIOR

Introduction

In my first study, known going forward as Study One, I sought to quantify the frequency of boundary spanning behaviors of software development team managers with team members in both the U.S. and India, with a hope of finding some relationship between the frequency of those behaviors and team success. This led me to the following research question.

What is the relationship between the frequency of boundary spanning activities of team managers of software development teams with members in both the U.S. and India to overall team performance?

To explore this question, I asked both software development team managers and team members to report the number of times they had observed or engaged in certain boundary spanning activities. Those results were analyzed against a standard measure of team performance. In Study Two, discussed later in this work, I will focus on the specific boundaries faced by these team managers.

Conceptual Background, Study Context, & Framing

All of the boundaries discussed in the Literature Review section undoubtedly present business managers in many disciplines with challenges, requiring increasingly sharp managerial skills. This study is specifically concerned with globally distributed software development teams, the predominant model for technology teams in large multinational corporations (Gopal & Gosain, 2010; Lenz & Machado, 2008; Pherwat &

Rider, 2018). The predominant staffing model for software development is supplementing existing teams with off-shore consultants from other organizations (Oshri, Kotlarsky, Rottman, & Willcocks, 2009), presenting additional boundaries. Figure 2 is an illustration of common software development team structure in business organizations today.

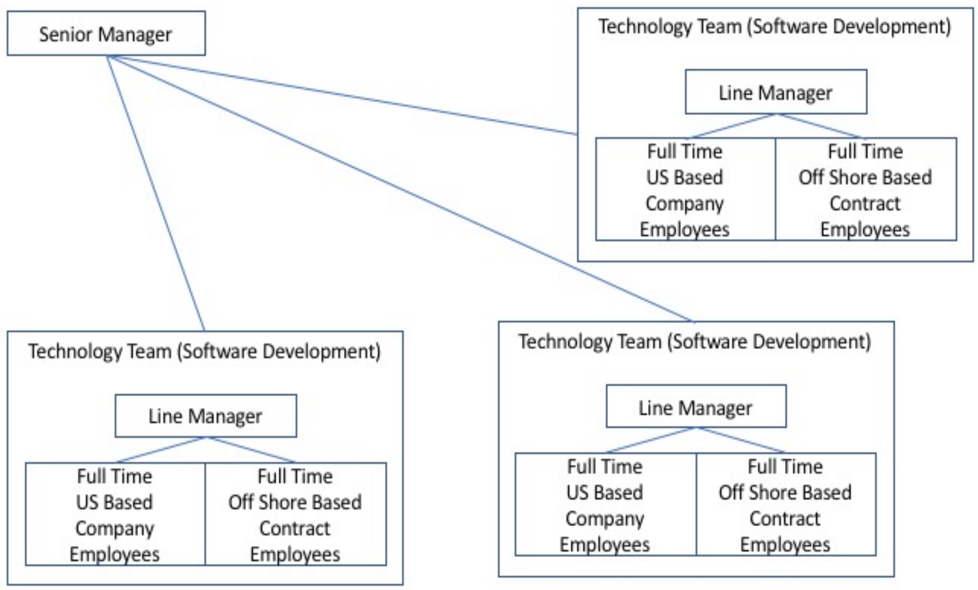


Figure 2. Common Software Development Team Organizational Structure

Even more specifically, I focused my attention to the global software teams that are formed between western companies and off-shore software development partners in India. India and other low-cost countries have received the bulk of the offshoring and outsourcing jobs over the last several decades (Bjørn, Søderberg, & Krishna, 2017; Sethi & Gott, 2017). According to the A. T. Kearney Global Services Location Index, a measure of globalization and global industry trends in operations and outsourcing, India has held the top position in global outsourcing for the last 13 years, with over 200 multinational corporation operating in India (Sethi & Gott, 2017). The number of software firms in India has grown in the last decade from approximately 100 in 2003 to nearly 2400 in 2013, with the revenue expected to reach $10 Billion USD by 2020 (Chatterjee, 2013). Software development team managers in the U.S. and other western countries frequently find themselves engaging in the boundary spanning behaviors necessary to manage teams composed of both local technology professionals and those located thousands of miles away in India (Gopal & Gosain, 2010).

An advantage of studying software development teams is that their output can often be easily measured with the outputs of a standard software development methodology known as Agile. Agile software development methodology has largely emerged as a global common software development process. There are several varieties of Agile Software Development—Kanban, Scrum, Scaled Agile Framework (SAFe), and eXtreme Programming (XP)—to name a few. Here the focus is on Scrum practice since it is a commonly used framework and is the most relevant to my experience. The Scrum Alliance, a professional organization promoting the use of Scrum Agile Software Development Methodology, conducted research in 2015 in which they found that 42% of software development shops in 108 countries currently use Scrum. Using Scrum methodology, teams break down software development requirements into small pieces of work that can be coded and tested in a short period of time, usually two weeks. Those pieces of work are known as “User Stories”. Although there are often many detailed specifications and tasks, User Stories generally take on a standard structure of “As a < type of user >, I want < some goal > so that < some reason >” (Cohn, 2004). Each User Story is estimated by the team as to how many points, a measure of team capacity, will be required to complete the User Story. For example, a User Story for a marketing system could be, “As an Editor, I want to review content before it is published so that I can assure it is optimized with correct grammar and tone.”

The short periods of time in which the coding work is to be completed are known as “Sprints”. Work is evaluated at the end of each sprint for completion and correctness. Working with descriptions of functionality that have meaning to the users and doing so in small periods of time prevents software projects from moving to far afield from stakeholder requirements. The completion level after each sprint also gives us a standard measure of team output and effectiveness, output (%) = user story points completed/user story points assigned.

At this point it is important to highlight the difficulty many researchers have encountered in observing and measuring boundary spanning activities themselves. The boundaries that teams face, such as culture and language for example, are not necessarily independent, making measurement of each boundary, and the behavior that spans it, difficult to measure in isolation from each other (Espinosa, Cummings, Wilson, & Pearce, 2003; Schotter & Beamish, 2011). Often teams are nested within other teams, or there are boundaries both external and internal to the team, as is the case with this study here (Espinosa et al., 2003), see Figure 2. The definition of the team, and what is internal or external to it, may shift the perception of boundaries for each team member. Here I will consider all boundary spanning activities, those conducted both inside the team and with outside entities.

Hypothesis

As previously discussed, software development teams are under increased pressure to perform while at the same time facing more and more complex environments, riddled with the complicated boundaries of globalization, culture, virtual team, and organization. It follows that those teams whose managers are skilled at spanning these boundaries will avoid some of the pitfalls of miscommunication and misunderstanding that often come with working in such teams and will ultimately perform better. Here I seek to better understand the impact of the frequency of boundary spanning behavior of managers on team performance.

Team performance is not based solely on the actions of the direct team manager (Detert & Trevino, 2010; Hambrick & Mason, 1984), and not all members of any given team perform the same functions (Appelo, 2011; Espinosa, Slaughter, Kraut, & Herbsleb, 2007). This is true for managers as well. Senior managers (managers of managers) and line managers do not perform the same tasks or think about their work in the same ways (Glen, 2003; Gregoire, 2015). Line managers are focused on controlling and directing the day to day work of the team members. Senior leaders are responsible for thinking more strategically, creating longer range plans and processes to fulfill business targets (Miles, 2012). Exploring these concepts as it relates to the boundary spanning behaviors of senior and line managers of global software development teams, my hypotheses are then:

H1 – Team performance is positively affected by the boundary spanning activities engaged in by line managers.

H2 - Team performance is positively affected by the boundary spanning activities engaged in by senior managers (managers of managers).

H1 and H2 are illustrated below in Figure 3.

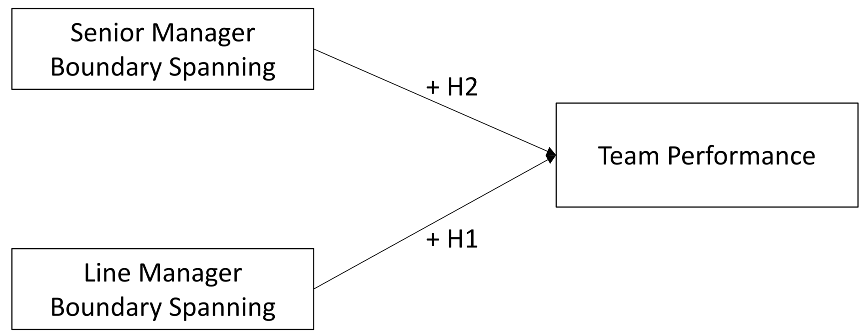


Figure 3. H1 and H2: The Positive Effects of Boundary Spanning by Managers on Team Performance of Global Software Development Teams

Methodology

Measuring Boundary Spanning Behaviors

As previously discussed, measuring boundary spanning behaviors is problematic. Here I rely on the previously discussed work of Ancona and Caldwell (1988, 1992) as a framework for measurement. This work has become the basis and reference for several other studies concerning boundary spanning (Choi, 2002; Faraj & Yan, 2009; Lee, Shin, & Lee, 2011b; Marrone, Tesluk, & Carson, 2007). I used the relevant concepts they created to clarify the notion of boundary-spanning activities. After performing a factor analysis on 24 boundary-activity items, Ancona and Caldwell (1992) identified four types of activities: “Ambassador” activities that include both protective and persuasive goals, “Task Coordinator” activities that are related to coordination and negotiation with outsiders and stakeholders, “Scout” activities related to scanning, mapping and information gathering, and “Guard” activities that are undertaken to avoid releasing information (Ancona & Caldwell, 1992). The four listed categories contained items such as modeling, gathering information, gathering resources, detecting, feedback seeking, opening communication channels, informing, coordinating, negotiating, molding, allowing entry, translating, filtering, classifying, delivering, and protecting. I used these boundary activity items as the basis for survey questions to quantify the boundary spanning behaviors of team leaders.

Data was gathered from a survey of 25 globally distributed software development teams in a U.S. based company that has outsourced a significant part of its daily work to an off-shore consulting company in India. Respondents were taken from a pool of approximately 120 software developers, test engineers, and their line and senior team managers. Respondents were asked for their observations on boundary spanning behaviors of their managers, or to self-report such behavior. Surveys were administered online, allowing the study to reach all members of these teams at the same time with the same questions. A pilot study with seven respondents was conducted to ensure the questions were equally understood by participants in the U.S. and in India. After the pilot study, I spoke directly with the respondents for feedback on the meaning and understanding of the questions, not on the survey results themselves. Those results were not included in the final data set. After the pilot survey, I removed five questions from Ancona and Caldwell's scale as not relevant to the organization – those activities do not take place in these teams. As such, this eliminated the "Guard" category. The questions pertaining to that category are simply made non-relevant by the transparency of the Scrum agile software development methodology in use by all teams in this study. This left eight questions in the "Ambassador" category, eight in the "Task Coordinator" category, and seven in the "Scout" category, with several of the questions being coded to more than one category.

After answering qualifying questions to determine if the respondent is a senior manager, line manager, or team member on a global software development team, they were then asked to rate the frequency of certain boundary spanning behaviors appropriate to their level. Team members were asked, on a scale of 0 to 100, how many times they had observed their direct manager and senior manager (manager's manager) engage in such behaviors in the last three months. On the same scale, managers were asked how many times they had engaged in such behaviors or had observed their managers similarly. Table 5 below is a sample of statements presented to each group of respondents, representing the various boundaries faced by managers.

Table 5. Survey Statements Categorized by Organizational Level of Respondent (Based on Ancona & Caldwell, 1992)

Category	Manager	Team Member	Category of Boundary Spanning
Series 1	I absorb outside pressures for the remote team, so it can work free of interference.	I observe my direct manager absorb outside pressures for the remote team, so it can work free of interference.	Ambassador
	My manager absorbs outside pressures for the remote team, so it can work free of interference.	I observe my senior manager absorb outside pressures for the team, so it can work free of interference.	
Series 2	I persuade other individuals that the team's activities are important.	My manager persuades other individuals that the team's activities are important.	Ambassador
	My manager persuades other individuals that the team's activities are important.	My senior manager persuades other individuals that the team's activities are important.	
Series 3	I scan the environment inside my organization for threats to the team.	My manager scans the environment inside my organization for threats to the team.	Ambassador Scout
	My manager scans the environment inside my organization for threats to the team.	My senior manager scans the environment inside my organization for threats to the team.	
Series 4	I persuade others to support the team's decisions.	My manager persuades others to support the team's decisions.	Ambassador Task Coordinator
	My manager persuades others to support the team's decisions.	My senior manager persuades others to support the team's decisions.	
Series 5	I acquire resources (e.g., money, new members, equipment) for the team.	My manager acquires resources (e.g., money, new members, equipment) for the team.	Ambassador Task Coordinator
	My manager acquires resources (e, g., money, new members, equipment) for the remote team.	My senior manager acquires resources (e, g., money, new members, equipment) for the remote team.	
Series 6	I report the progress of the team to a higher organizational level.	My manager reports the progress of the team to a higher organizational level.	Ambassador Task Coordinator
	My manager reports the progress of the team to a higher organizational level.	My senior manager reports the progress of the team to a higher organizational level.	
Series 7	I find out whether others in the company support or oppose your team's activities.	My manager finds out whether others in the company support or oppose your team's activities.	Ambassador Scout
	My manager finds out whether others in the company support or oppose your team's activities.	My senior manager finds out whether others in the company support or oppose your team's activities.	

Table 5, continued

Series 8	I find out information on my company's strategy or political situation that may affect the team.	My manager finds out information on your company's strategy or political situation that may affect the team.	Ambassador Scout
	My manager finds out information on your company's strategy or political situation that may affect the team.	My senior manager finds out information on your company's strategy or political situation that may affect the team.	
Series 9	I resolve logistical, engineering, or design problems with external groups.	My manager resolves logistical, engineering, or design problems with external groups.	Task Coordinator Scout
	My manager resolves logistical, engineering, or design problems with external groups.	My senior manager resolves logistical, engineering, or design problems with external groups.	
Series 10	I procure things the team needs from other groups or individuals in the company.	My manager procures things the team needs from other groups or individuals in the company.	Task Coordinator
	My manager procures things the team needs from other groups or individuals in the company.	My senior manager procures things the team needs from other groups or individuals in the company.	
Series 11	I negotiate with others for delivery deadlines.	My manager negotiates with others for delivery deadlines.	Task Coordinator
	My manager negotiates with others for delivery deadlines.	My senior manager negotiates with others for delivery deadlines.	
Series 12	I find out what competing firms or groups are doing on similar projects.	My manager finds out what competing firms or groups are doing on similar projects.	Scout
	My manager finds out what competing firms or groups are doing on similar projects.	My senior manager finds out what competing firms or groups are doing on similar projects.	
Series 13	I scan the environment inside or outside the organization for product ideas and expertise.	My scans the environment inside or outside the organization for product ideas and expertise.	Task Coordinator Scout
	My manager scans the environment inside or outside the organization for product ideas and expertise.	My senior manager scans the environment inside or outside the organization for product ideas and expertise.	
Series 14	I collect technical information and ideas from individuals from outside the team.	My manager collects technical information and ideas from individuals from outside the team.	Task Coordinator Scout
	My manager collects technical information and ideas from individuals from outside the team.	My senior manager collects technical information and ideas from individuals from outside the team.	

Measuring Team Performance

In order to uncover any relationship between boundary spanning behaviors of managers and team performance, team effectiveness must also be measured. All Scrum teams measure output (task completion) in much the same way, number of tasks (known as “stories”) completed per development “sprint”. As previously discussed, a “sprint” is a predetermined period of time in which work is completed, usually two weeks. This output can easily be expressed as a percentage, work actually completed over work scheduled to be completed. A regular output score of 85% or higher is considered acceptable output for a software development teams. I regular output score above 95% may indicate that the team is not committing to enough work during the planning phases. They may not be stretching their goals, so a consistently very high completion percentage is not usually optimal. For this study, I measured software development team output of the same 25 teams for the same period of time, three months, as respondents were asked to report on manager boundary spanning behavior. Scrum teams usually give themselves names that are meaningful to them in some way (like Arsenal, Voltron, Automation, etc.). I have changed all team names for the purposes of this study.

Results

Team Performance: Scrum Metrics

Software development team output was pulled from our regular work tracking system, VersionOne, a commonly used software development tracking tool used in the industry, for the period April, May, and June, 2018. This is expressed as the percentage of work that was assigned to and subsequently completed by each team. This data appears below in Table 6 below.

Table 6.Team Performance Percentage, April-June 2018

Team Alias	Team Output (%)
Currant	58
Apple	65
Orange	66
Grape	67
Papaya	67
Pineapple	68
Peach	72
Apricot	75
Avocado	76
Blackberry	77
Cherry	78
Tangerine	78
Plum	80
Fig	81
Pomegranate	81
Strawberry	81
Grapefruit	82
Lemon	85
Melon	85
Lime	86
Banana	87
Kiwi	88
Pear	89
Mango	89
Coconut	91

Managers' Boundary Spanning Behavior Frequency: Team Survey Results

96 responses were received to an online survey of manager boundary spanning behavior frequency, an approximate 80% response rate from the total population of 120 team members and managers located in both the U.S. and India. That population consisted of a total 25 different software development teams. Of the 96 responses, four

were rejected because no team name was identified. Nine responses were rejected because no questions were answered after the qualifying questions. Once this data was removed, there were no remaining responses for the Plum and Strawberry teams, so those teams were removed from the study entirely. This left 83 completed responses.

Each respondent answered 28 questions regarding their observed frequency of boundary spanning behaviors of team managers (see Table 2). Since the unit of analysis here is at the team level, those scores were averaged across each team to form three boundary spanning scores for each team. Those scores were 1) Line Manager Boundary Spanning; 2) Senior Manager Boundary Spanning; and 3) Overall Team Managers Boundary Spanning. See Table 7 below for this data.

Table 7.Team Managers' Boundary Spanning Scores, Frequency, April-June 2018

Team Alias	Overall Boundary Score (Frequency)	Line Manager Boundary Score (Frequency)	Senior Manager Boundary Score (Frequency)
Currant	29	30	27
Apple	17	17	17
Orange	86	86	85
Grape	30	31	26
Papaya	43	49	38
Pineapple	55	59	52
Peach	55	59	52
Apricot	23	29	17
Avocado	2	3	1
Blackberry	37	39	35
Cherry	8	9	7
Tangerine	12	17	10
Fig	12	17	7
Pomegranate	2	2	1
Grapefruit	8	10	5
Lemon	23	24	20
Melon	17	17	27
Lime	12	14	9
Banana	47	47	46
Kiwi	12	17	7
Pear	16	25	7
Mango	28	29	27
Coconut	17	16	14

In all teams except one, the Melon Team, the team members and managers reported perceiving more boundary spanning behaviors in line managers than in senior managers. This is illustrated in Figure 4, below.

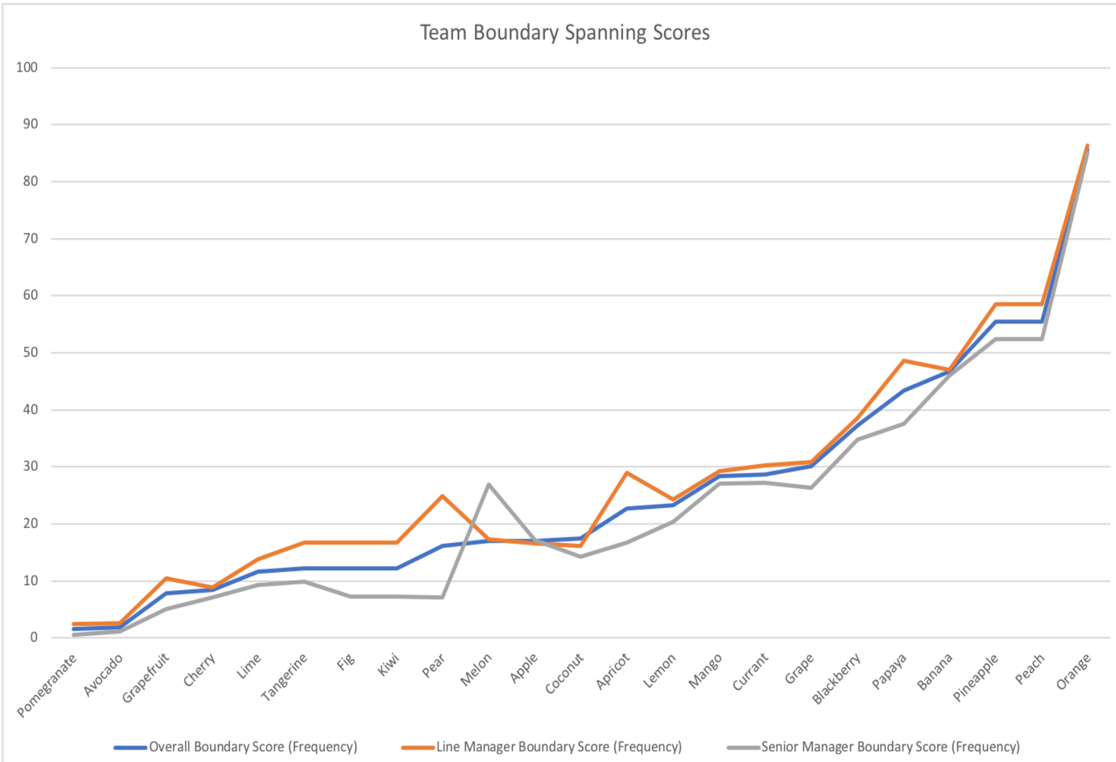


Figure 4. Managers Boundary Spanning Scores by Team, Frequency, April-June 2018

Boundary Spanning Behaviors and Team Performance

Looking at the results together, neither H1 nor H2 were supported. First, let's look at H1 – *Team performance is positively affected by the boundary spanning activities engaged in by line managers*. The regression data in Figure 5 below indicates that team performance is not positively affected by the boundary spanning activities engaged in by line managers. The regression line, in fact, leads us in the opposite direction, that the boundary spanning activities of line managers may negatively affect team performance.

However, with a relatively low RSquare score of .194, the boundary spanning activities of line managers as measured here are not a strong indicator of team performance positively or negatively.

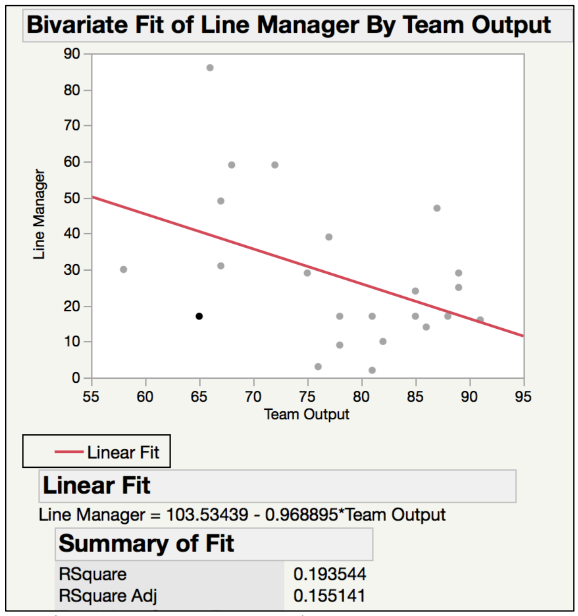


Figure 5. Regression: Line Manager Boundary Score to Team Performance: Frequency, April-June 2018

With the second hypothesis, H2 - *Team performance is positively affected by the boundary spanning activities engaged in by senior managers (managers of managers),* the results are similar. The regression data in Figure 6 indicates that team performance is not positively affected by the boundary spanning activities engaged in by senior managers. Again, with a relatively low RSquare score of .194, the boundary spanning activities of line managers as measured here are not a strong indicator of team performance. However, with a p-value of .035, there is some evidence against the null hypothesis: *H0, Boundary spanning activities engaged in by senior managers has no effect on team performance*. I will attempt to unpack these counter intuitive results.

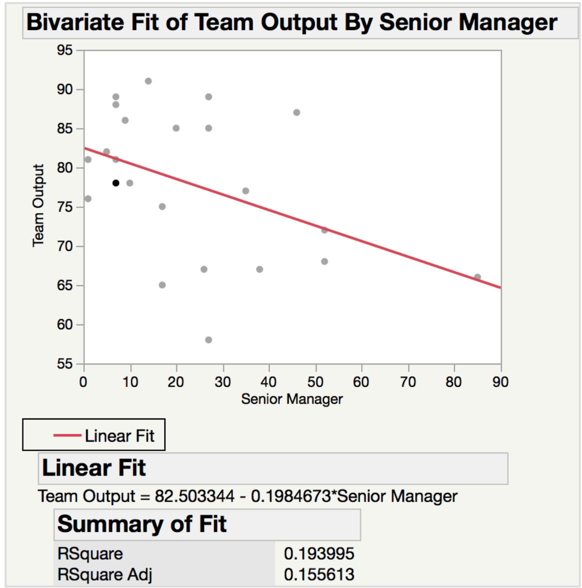


Figure 6. Regression: Senior Manager Boundary Score to Team Performance: Frequency, April-June 2018

When these two scores, Line Manager Boundary Spanning Score and Senior Manager Boundary Spanning Score are combined, the results are the same. Overall, the reported boundary spanning behaviors were not a positive indicator of team output, illustrated in Figure 7.

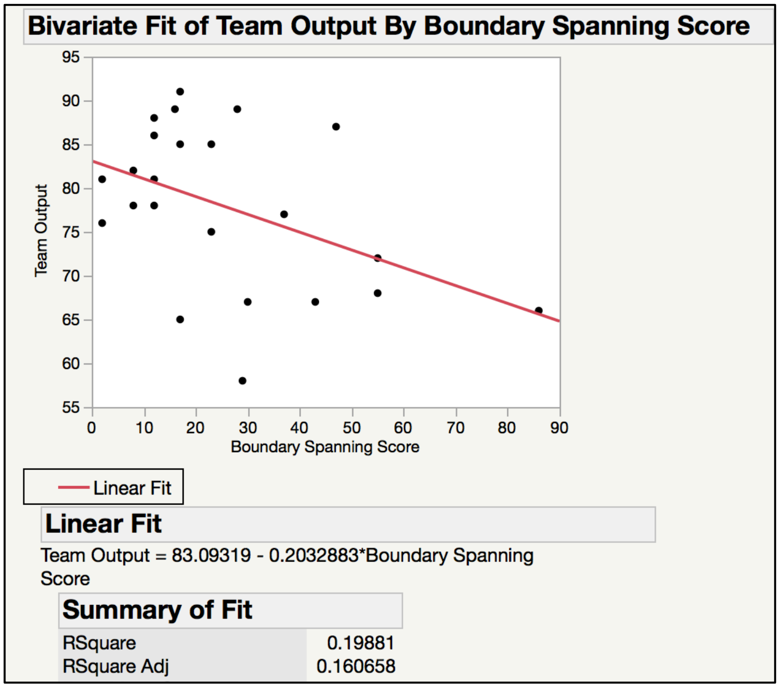


Figure 7. Overall Team Managers' Boundary Spanning Score to Team Performance: Frequency, April-June 2018

Analysis

With neither H1 nor H2 supported, is there some other factor affecting team performance that would account for these results? It seems contrary to conventional wisdom or common sense that the opposite of both H1 and H2, that team performance is negatively impacted by the boundary spanning behaviors of line and senior managers, would be the case. I looked at several other factors of these teams in hopes of understanding their relationship with team performance. Those factors were technology development stack, team size, percentage of team located in the Indian consulting company, and the overall age of the team.

Running a multivariate fit model on the variables age of the team, line manager boundary spanning score, senior manager boundary spanning score, overall team boundary spanning score, team size, and percentage of team off-shore, still only predicts team output about 27% of the time. This is illustrated in Table 8 below. The overall team boundary spanning score is not a strong predictor of team output with a probability score of .8027. Age of the team is the strongest, and the only significant, predictor of team output.

Response Team Output

Effect Summary

Source	LogWorth	PValue
Age of Team	0.541	0.28782
Line Manager	0.135	0.73315
Boundary Spanning Score	0.095	0.80269
Team Size	0.026	0.94259
Senior Manager	0.010	0.97755
Percentage Offshore	0.007	0.98440

Summary of Fit

RSquare	0.273214
RSquare Adj	0.000669
Root Mean Square Error	9.272007
Mean of Response	77.86957
Observations (or Sum Wgts)	23

Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob>|t|
Intercept	71.948399	14.20959	5.06	0.0001*
Boundary Spanning Score	-0.493655	1.943083	-0.25	0.8027
Line Manager	0.4092208	1.179459	0.35	0.7331
Senior Manager	-0.025335	0.886404	-0.03	0.9776
Team Size	0.1347437	1.84179	0.07	0.9426
Age of Team	0.1831815	0.166603	1.10	0.2878
Percentage Offshore	0.0019309	0.097241	0.02	0.9844

Table 8. Regression Effects of Standard Software Development Team Variable on Team Output.

Team Age

Looking further at the impact of team age on the relationship to boundary spanning score and team output, the data revealed some difference between younger teams and older teams. The median age team is 34 months, with n=12 of 34 months or younger and n=11 of older than 34 months. These overall counter-intuitive results, that increased boundary spanning scores are associated with decreased team performance, still holds for teams 34 months or younger. See Figure 8 below.

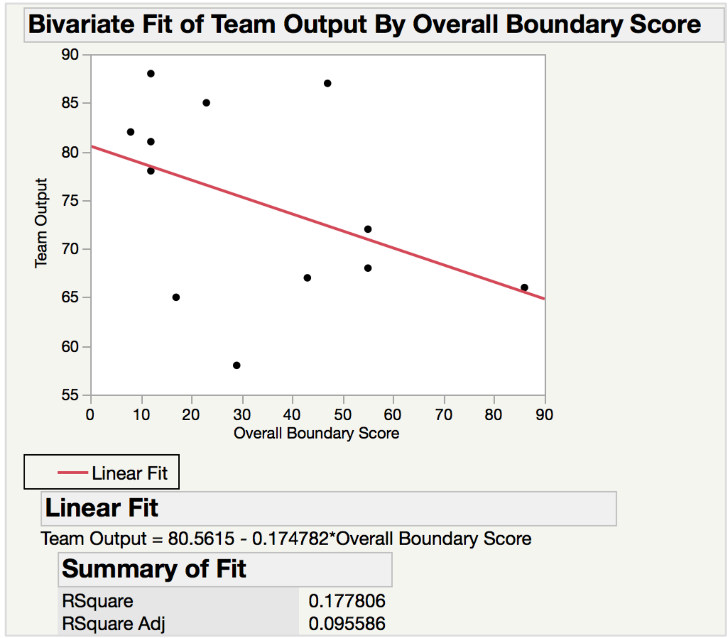


Figure 8. Regression: Younger Teams (Less than 34 Months) Boundary Spanning Scores to Team Performance: Frequency, April-June 2018

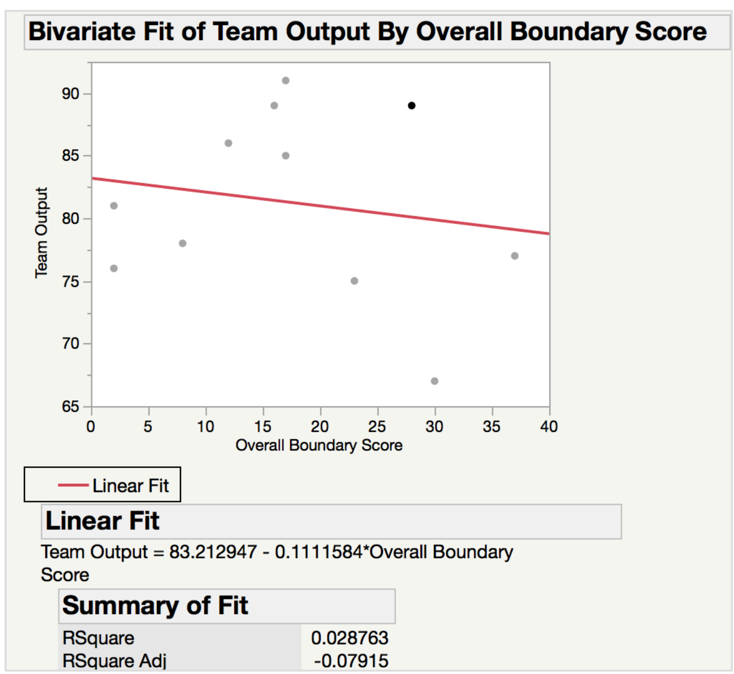


Figure 9. Regression: Older Teams (More than 34 Months) Boundary Spanning Scores to Team Performance: Frequency April-June 2018

However, when I looked at older teams, those that have been working together for more than 34 months, that association still holds but become less apparent, as illustrated in Figure 9.

What could explain this difference in scores for team age? Putting aside that the results for young teams and older teams are still both counter to my hypothesis, the more pronounced results for younger teams could be explained in this way. The problems that new teams face are even more difficult to overcome regardless of the amount of boundary spanning behavior exhibited by managers. It could also be that younger teams have newer managers, who, although they are engaging in boundary spanning behaviors are not practiced enough to reap any positive results. Figure 10 below does show that, in this sample, the time the manager has spent on the team has an association with greater team output, but with decreased overall boundary spanning scores.

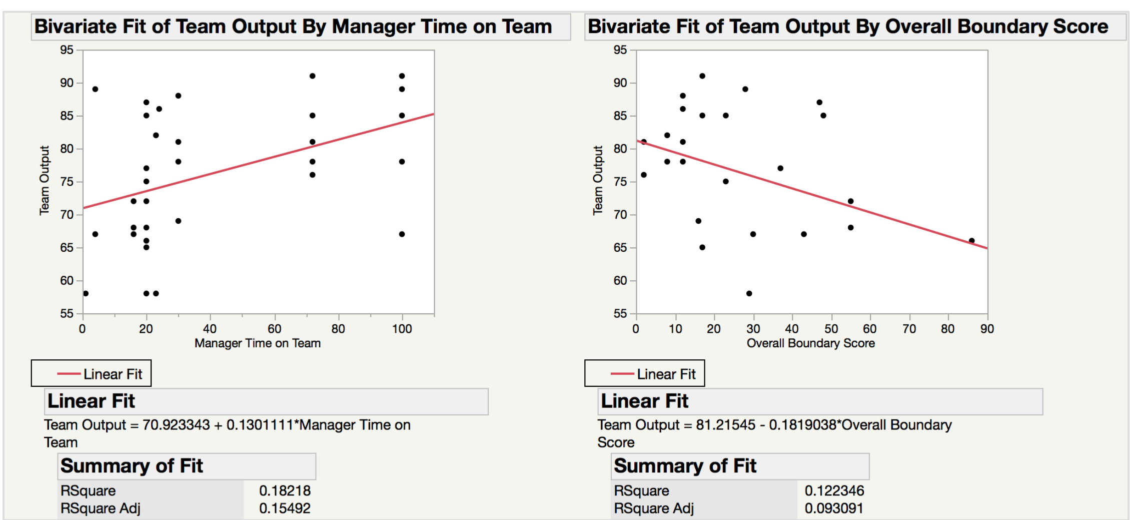


Figure 10. Regression: Team Output by Time Manager has Served on Team

Type of Software Development Technologies

Not all development technologies are the same, and some may be considered more difficult or complicated than others. Perhaps that is a factor in overall team performance. The teams fell into four application development technology stacks, .net, Java, Cold Fusion, and Business Process Mapping Software such as Pega and Salesforce. The average Overall Team Boundary Spanning Score based on development stack does not skew in one way or another, with their average scores all being fairly similar, as illustrated in Table 9 below. These results indicate that development stack has not had a significant impact on team performance, illustrated in Figure 11 .

Table 9.Team Boundary Spanning Scores by Application Development Stack

Development Stack	Overall Team Boundary Spanning Score Average
Java	78
BPM	75
.net	77
Cold Fusion	85

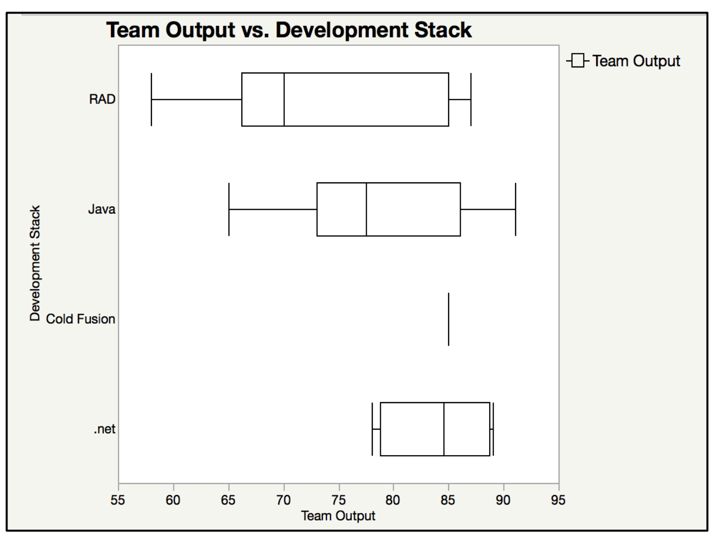


Figure 11.Overall Team Output vs. Development Stack

Team Members & Team Managers

Team members and managers perceive the activities of managers differently. Did this lead to team members and team managers reporting boundary spanning activities of managers significantly differently? There are bound to be many such activities that managers perform, but team members never see. Looking at the team boundary scanning scores in relationship to team output, isolated by team manager and team members, there does not appear to be much difference and neither set of results support H1 or H2. See Figure 12 for an illustration.

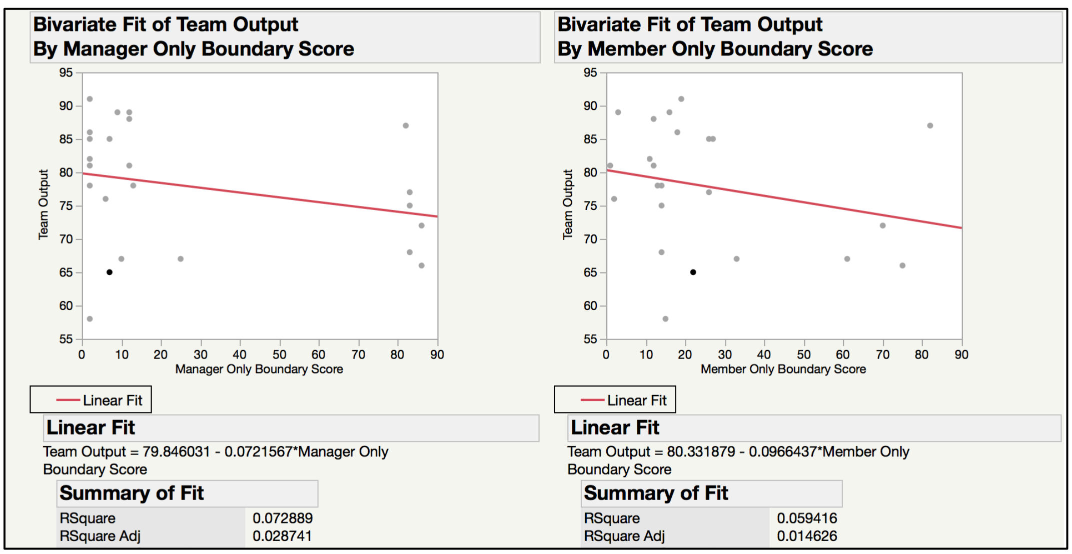
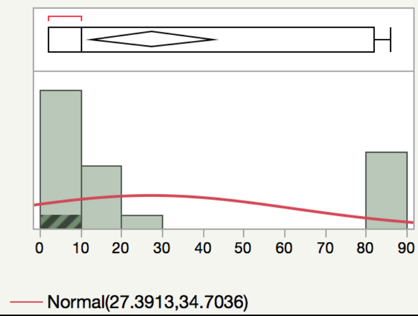


Figure 12. Regression: Team Manager Only Boundary Score to Team Output and Team Member Only Boundary Score to Team Output

However, looking further into these results, one can find some interesting possibilities for future exploration. Contrary to common sense, most managers rated themselves relatively low in boundary spanning behavior frequency (see Figure 13), even lower than did their team members (see Figure 14). There were a small minority of managers who rated themselves very highly in boundary spanning activities, but almost no one was in the middle range. This is in contrast to team performance itself, which takes on a distribution much closer to what might be considered normal (see Figure 15).

Distributions

Manager Only Boundary Score



Quantiles

100.0%	maximum	86
99.5%		86
97.5%		86
90.0%		84.8
75.0%	quartile	82
50.0%	median	10
25.0%	quartile	2
10.0%		2
2.5%		2
0.5%		2
0.0%	minimum	2

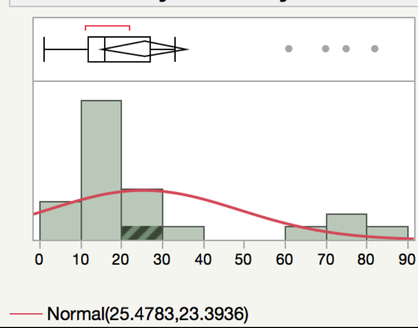
Summary Statistics

Mean	27.391304
Std Dev	34.703601
Std Err Mean	7.236201
Upper 95% Mean	42.398267
Lower 95% Mean	12.384342
N	23

Figure 13. Distribution: Team Manager Only Boundary Scores by Team

Distributions

Member Only Boundary Score



Quantiles

100.0%	maximum	82
99.5%		82
97.5%		82
90.0%		73
75.0%	quartile	27
50.0%	median	16
25.0%	quartile	12
10.0%		2.4
2.5%		1
0.5%		1
0.0%	minimum	1

Summary Statistics

Mean	25.478261
Std Dev	23.393607
Std Err Mean	4.8779044
Upper 95% Mean	35.594415
Lower 95% Mean	15.362106
N	23

Figure 14. Distribution: Team Member Only Boundary Scores by Team

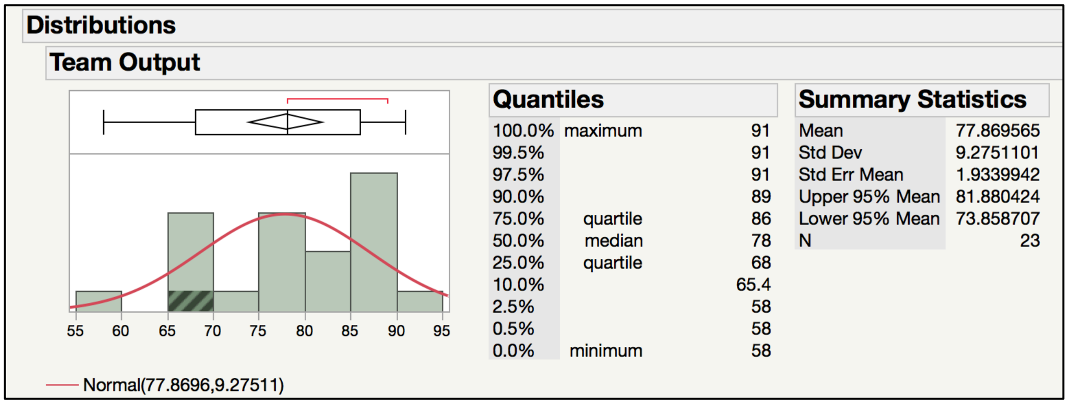


Figure 15. Distribution: Team Performance

Boundary Spanning Categories

The survey contained questions that were designed to measure the frequency of different categories of boundary spanning activities, categories described as Ambassador, Task Coordinator, and Scout activities (See Table 2) (Ancona & Caldwell, 1992). Do we see the survery results differently if boundary acitivities are broken out into those categories? Are some categories of boundary spanning behaviors more associated with team results than others? The short answer is no. The survey respondents answered very similarly in all categories, but not very similary across teams, as illustrated by Figure 16. Again, the results indicate that none of these categories can lend any support for H1 or H2, see Figure 17 below.

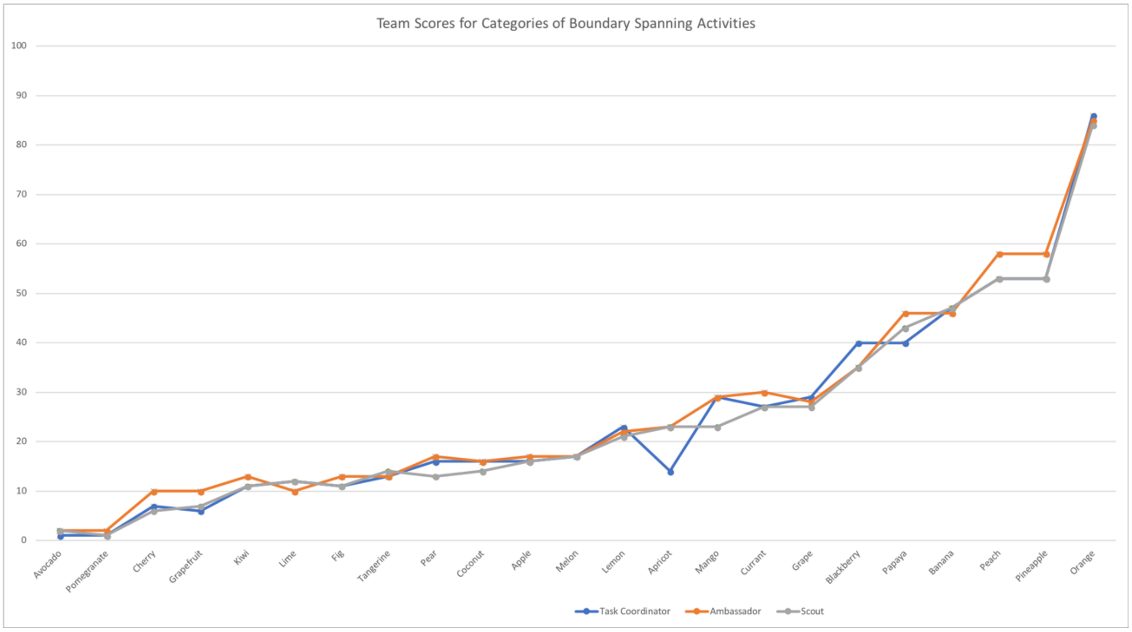


Figure 16. Team Boundary Spanning Scores by Category of Boundary Spanning Activity

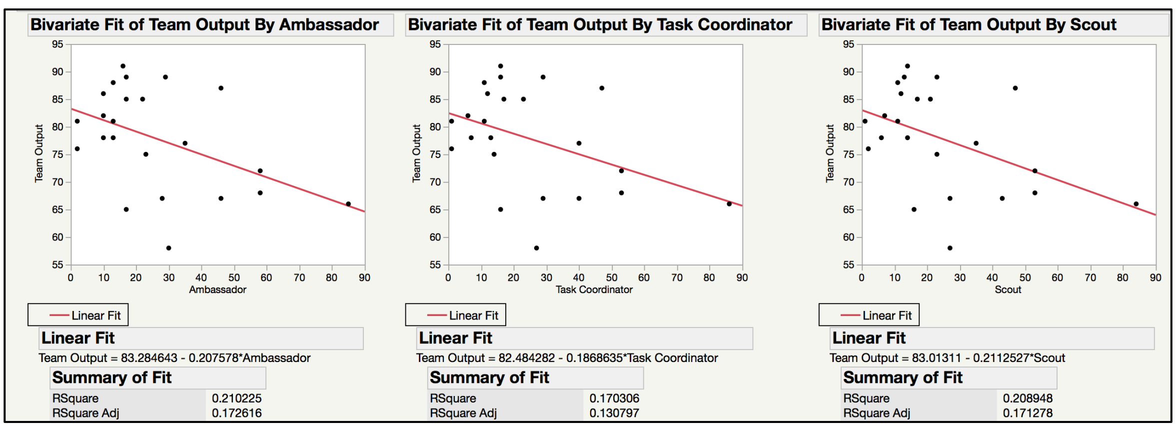


Figure 17. Regression: Team Boundary Spanning Scores by Category of Boundary Spanning Activity

Discussion

I believe there are two possible inferences that can be made from the results of this data. Either boundary spanning is not significantly important to the performance of globally distributed technology teams or that boundary spanning as measured here is not significantly important to globally distributed software teams.

To construct the survey, I used a previously created boundary spanning scale produced by Ancona and Caldwell (1992) and used in other studies of team boundary spanning (Choi, 2002; Faraj & Yan, 2009; Marrone et al., 2007). That scale used the constructs of modeling, gathering information, gathering resources, detecting, feedback seeking, opening communication channels, informing, coordinating, negotiating, molding, allowing entry, translating, filtering, classifying, delivering, and protecting categorized into the framework of Ambassador, Task Coordinator and Scout boundary spanning activities. Ancona and Caldwell used their scale to measure the frequency of boundary spanning activities in product development and marketing teams in the late 1980’s and early 1990’s. This is well before modern software development teams as we now know them were formed. These methods were also not used in globally diverse teams. None of the studies that subsequently used a variation of the Ancona and Caldwell model looked specifically at the issue concerning globally distributed software development teams. Perhaps the types of boundary spanning activities used in this survey are not relevant to these teams at all.

Conclusions and Limitations

A major limitation of these results is that this sample is not large enough to come to any solid conclusions about the counter-intuitive results of Study One. For that reason, and for the reasons stated in the previous Discussion section, I don't believe we can assume that there is not a significant relationship between manager boundary spanning and software development team performance. To do so requires further exploration of the types of boundaries faced by those managers. Perhaps boundary spanning is so implicit and tacit that both the managers and members of these teams are not consciously aware that boundary spanning activities are even being undertaken. This is where I will turn my attention next. In the next phase of my research, Study Two, I undertook an effort to better understand the specific boundaries faced by managers of these teams and if they find those boundaries at all relevant to team outcomes.

CHAPTER 4

STUDY TWO: MANAGER PERSPECTIVES ON BOUNDARIES TO EFFECTIVE TEAM PERFORMANCE

Conceptual Background, Study Context, & Framing

The first study in this work, Study One, was based on the work of Ancona and Caldwell (Ancona & Caldwell, 1992), and their measure of boundary spanning activities. The results of Study One did not support a relationship between boundary spanning as measured by this scale to overall software development team performance. Based on these results and the lack of relationship to team performance, I took a step back in order to better understand what boundaries are important to these specific team managers, those running software development teams with members in both the U.S. and India. The managers themselves are also located in both the U.S. and in India and will likely see boundary issues differently. In this second study, I took a more exploratory approach, using qualitative methods to gain greater insights into the boundaries and boundary behaviors and how they may be viewed differently by different managers of these team.

In this second study, I explore the research question: *What do software development team managers, both line and senior, in the U.S. and in India, see as boundaries to effective team performance?*

To frame this work, I turned back to the boundaries assembled as part of the Literature Review Section (see Table 1). They include boundaries of Global Business, Culture, Virtual Team, and Organizational Structure. I will expand on this framework in the next section on Methodology.

Methodology

To better understand the boundaries existing in global software development teams, I undertook a series of semi-structured interviews of line and senior managers of such teams. From a total sample of 25 teams, data was gathered from the interviews of 20 of the team managers. Five team managers were not available to participate for various reasons. All teams are globally distributed software development teams in a U.S. based company that has outsourced a significant part of its daily work to an off-shore consulting company in India. Managers were based both in the U.S. and in India. Interviews were conducted by a qualified impartial interviewer during this process to remove any biases that I may bring.

This method allowed me to explore the views of boundary spanning held by each of the software development team managers. In the first study, I used an existing framework for boundary spanning activities and I did not find support for a relationship between boundary spanning and team performance. In Study Two I used a more open framework for the basis of conducting semi-structured interviews, allowing managers to use their own language on this subject as much as possible (Myers, 2013). Semi-structured interviews promoted in-depth communication, with the opportunity to ask probing and clarifying questions, with an eye to creating a more detailed view of boundaries and boundary spanning by managers (Djenarni, 2014).

I returned to the same teams used in Study One. Each team has members located in both the U.S. and India and works in a similar Agile software development methodology. Interviews were conducted with 20 senior and line managers of software development teams, both in the U.S. and in India, a total of approximately 20 managers in all. Additionally, we interviewed several team members, asking similar questions about what they see as boundaries to effective team performance. I created survey questions designed to explore boundary areas as theorized in the previous Literature Review Section (see Table 1 and Figure 18). Questions focused specifically on the boundaries of Global Business (technological innovation, geopolitics, environment, emerging markets), Culture (power distance, time orientation, masculinity, individualism, uncertainty avoidance), Virtual Team (time, distance, technology, communication, skills), and Organization (structure, relationships, hierarchy, tasks, reward).

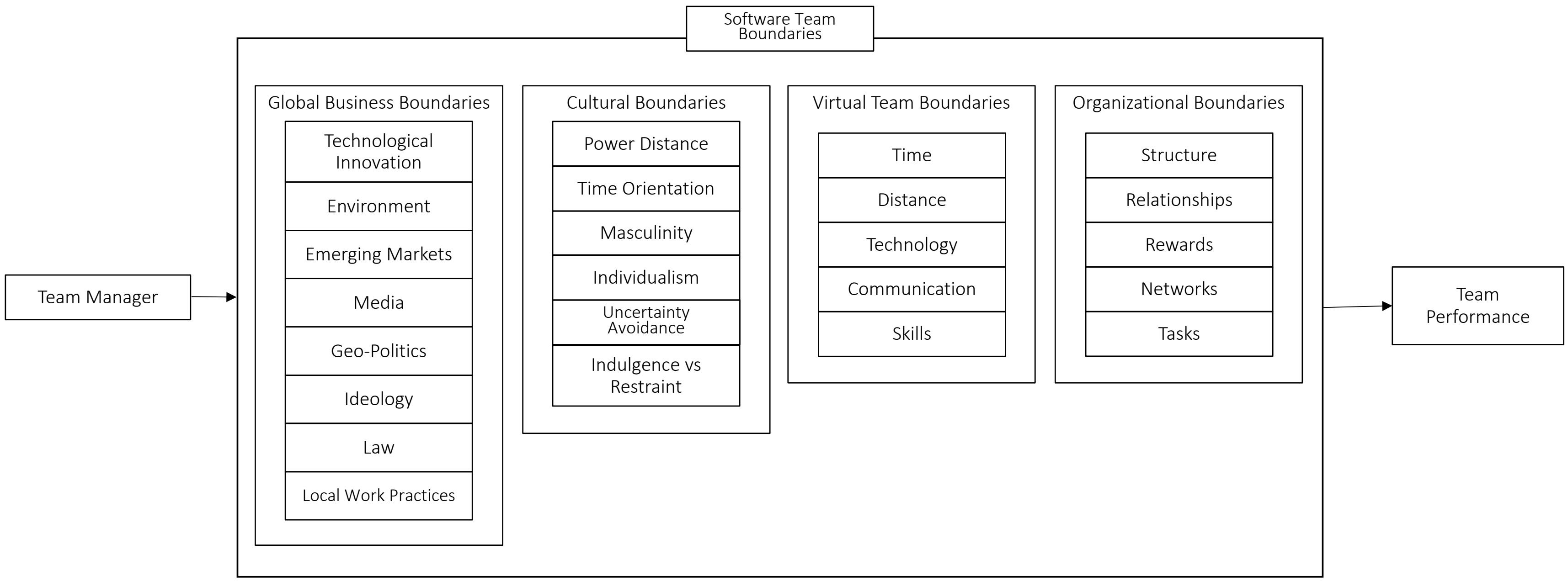


Figure 18. Boundaries Faced by Managers of Software Development Teams in the U.S. and India

The interview questions were designed to explore all categories at least once. Several questions touched on multiple categories at once. The interview guide below illustrates the categorization of the questions. Questions explored the frequency, importance, and internal or external nature of these boundaries. Additional open-ended questions were asked to allow for the discovery and exploration of boundary areas not uncovered in the theoretical review of the subject. Each interview took between 30 and 45 minutes. Each interview was recorded and transcribed, with the interviewee's permission.

Interview Guide: Semi-structured Interviews

Introduction Script:

Thank you for agreeing to speak with me today about managing a global software development team. The interview should take about 30 to 45 minutes. Please remember that everything you share with me will be kept strictly confidential. None of your information or information you share about your team will be shared with anyone outside of this study. Please know that there are no right or wrong answers to these questions, I am only interested in your opinions. If you find any of these topics difficult, please let me know. If you wish to decline to answer, you may do so, and you do not have to give any explanation. If you would like to take a break or have any questions at any time, please let me know. Before I begin, do I have permission to audio-record our conversation? Do you have any questions before we begin the interview? (Start Audio Recording).

This is interview (ID number) on (Date) in (Location). Interviewee understand that he/she is being recorded. Is that correct?

Demographic & Qualifying Information

- Do you manage a software development team?
- Does someone you manage manage a software development team?
- Does that team have members in both the U.S. and India?
- Does that team use Agile Software Development methodology?
- How long have you been managing this team?
- Have you managed any other similar teams?
- How long did you manage those teams?

Table 10. Semi-Structured Interview Questions

Umbrella Question	**Drill Down Question**	**Boundary Type Construct Explored**
Do you feel your team is conducting technologically innovative work?	Do you ever find that the team in U.S. or the team in India has access to better technological innovation than the other? (Prompts: Give Example of Blockchain, Personal Computing Hardware, Mobile Devices, Cloud Computing, IoT, Team Workspace)	Global: Technological Innovation, Environment Virtual Team: Technology
Do you feel there are differences in accommodations between the U.S. and Indian teams?	Is commuting to the office more or less difficult? Do you have access to better facilities? Are work at home situations possible?	Global: Environment
How often do your or the team members meet face to face? Do you think this is important?	Are issues of immigration or travel visas of concern to you in managing your team? If yes, please give examples? Has this concern grown or lessened in the past 12 months?	Global: Geopolitical, Media, Law Virtual: Distance Organizational: Networks
What is the right balance of location for team members? Why?	Have you considered expanding or shrinking your team in India (or U.S.)? If so why?	Global: Emerging Markets All other categories depending on answer.

Table 10, continued

Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Do you feel team members find it easy or difficult to tell you their opinions about things, even if those opinions may differ from your own? Is there a difference in this willingness between the team in the U.S. and India, or is it mixed?	Cultural: Power Distance Organizational: Relationship & Networks
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Are all team members prompt for all meeting? If no, please give examples. Do all team members consistently meet their deadlines? If no, please give examples.	Cultural: Time Orientation Cultural: Indulgence vs. Restraint Global: Ideology
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Why is it important to do a good job?	Global: Ideology
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Do you find team members to be very competitive? If yes, do you observe differences in this behavior between the team members in the U.S. and India?	Cultural: Masculinity Cultural: Individualism
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Do team members come up with their own solutions to issues? Do they take initiative to solve problems?	Cultural: Masculinity Cultural: Individualism Cultural: Uncertainty Avoidance
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	In general, is the team comfortable with not knowing all details of any development story? What do team members do to understand those details? Do you observe differences in this behavior between team members in the U.S. and India?	Cultural: Uncertainty Avoidance
Do you perceive differences in team member behavior in team meetings between those based in the U.S. and in India?	Do you find the team in the U.S. and the team in India have different methods of implementing coding solutions?	Global Business Boundaries: Local Work Practices Virtual Team Boundaries: Skills
Do you perceive difference in manager behavior between you and your counterparts in the U.S (India)?	How do you handle ambiguous situations? How is this different or the same as your counterparts?	Cultural: Uncertainty Avoidance Cultural: Masculinity

Table 10, continued

What special accommodation or changes do you make for team members in the remote location?	Do team members in the U.S. often shift their hours to accommodate team members in India? Do team members in India often shift their hours to accommodate team members in the U.S.? If yes, how often does this shifting occur?	Virtual: Time Cultural: Time Orientation
Do you feel the distance between team members has presented difficulties to the team? If so, can you give some examples?	How often have you traveled to India (to the U.S.)? How often have team members traveled to India (to the U.S.)?	Virtual: Distance Organizational: Relationships
Do you feel the distance between team members has presented difficulties to the team? If so, can you give some examples?	Have there been occasions when team members have had difficulty making themselves understood by others on the team? Or have had difficulty understanding others on the team? Can you give examples?	Virtual: Communication Cultural
How is work divided between team members located here and remotely?	Do you find some members of the team more skilled in your development stack than others? Is there a substantial differential in this area between the team members in the U.S. and India?	Virtual: Skills Organizational: Structure, Tasks
Do differences in team structure and reward systems present a challenge to you?	Is the team member hierarchy in the U.S. and India similar? (If needed give examples of hierarchy – Associate Software Engineer, Software Engineer, Sr. Software Engineer, Expert Software Engineer) If there are differences, have they presented any difficulty to you as a manager? Can you give examples?	Virtual: Skills Organizational: Structure, Tasks
Do differences in team structure and reward systems present a challenge to you?	Are all team members eligible for bonuses? Are all team members eligible for the same paid time off?	Organizational: Rewards
How is work divided between team members located here and remotely?	Do team members in the U.S. and India perform different types of tasks? If so, why?	Organizational: Tasks
What do you consider your top three challenges in working with the remote team?	Do you have specific examples?	Open Ended

Closing Questions

- In all of the subject areas that we have just discussed, do any of them present particular difficulty to you as manager? If yes, how so?
- Are there any areas that we not discuss that present difficulty to you as a manger? If yes, how so? Can you please give examples?

Closing Script

We have completed this interview. Again, I appreciate your time today. None of your answers or information will be shared with anyone outside of this study. Thank you very much.

Results and Analysis

From a total population of 25 managers, a total of 20 interviews were conducted, 12 with managers in the U.S. and 8 with managers in India. 10 managers interviewed were senior in position, meaning they were managing several teams. 10 managers interviewed were line managers. Additionally, six team members, three in the U.S. and three in India, were interviewed. This was done as a check to see if managers' views were radically out of step with the teams they are managing. All managers lead teams with members located in both the U.S. and India. Managers' tenure in these or similar positions varied from one to fifteen years.

A qualified third-party interviewer was used to prevent researcher bias. Subjects were not identified by name during the interviews and were discourage from using names of colleagues during the interviews. Audio files were coded by subject order and date and uploaded by the interviewer to a private shared drive. All interviews were recorded and transcribed via Temi software. From there, I conducted two different types of analysis.

Matrix Analysis

First, I analyzed the items managers discussed as their top boundary challenges, with an eye to comparing the responses from those managers based in the U.S. or India, as well as managers who are senior or direct line managers. These answers were in direct response the question “What are your top three challenges managing or working with a remote team?” In many cases, respondents presented only two challenges. This data is shown in Table 11 below. Areas presenting particular difficulty to interviewees, meaning 30% of the respondents in that category mentioned it as such, are coded in red. Those items that were of some difficulty, meaning between 10% and 30% of the respondents in that category mentioned the item as a difficulty, are coded in yellow. All items registering below 10% of respondents are coded in green.

This analysis shows that the groups studied, U.S. Managers, Indian Managers, Sr. Managers, Line Managers, and Team Member, all had one strong shared area of concern. The chief boundary to effective team management was listed by all four groups as that of time, the number of working hours that the U.S. and Indian team members share each day. This is despite that fact that both the U.S. and Indian teams work a modified hours to increase their overlapping working time. The teams in the Indian generally start at noon local time and work until 9:00pm. Teams in the U.S. vary, but often start their working day at 8:00am local time. This gives the team members roughly three hours each day of overlapping working hours, depending on time of year (India does not observe daylight saving time).

All U.S. managers listed this lack of overlapping time as one of their top three concerns. As one U.S.-based line manager put it, “It’s just that we try and crunch everything into the morning, which adds complexity because they’ve been working all day and now they’re waiting for us if they have questions.” Although only 25% of Indian managers express overlapping working time as a top concern, one manager in India expressed similar concerns in this very concrete way, “The only thing that tends to bother me most of the time is the overlapping time... because of this it feels we are not getting the information all of the time,” expressing the boundary of time difference as a barrier to information gathering.

Another boundary that was consistently reporting across the group of respondents in the U.S. was their perception that their Indian team members are often reluctant to voice their concerns or ideas. As one U.S. team member put it, “It’s always a challenge for our counterparts. Speak up. Whether good or bad, right? Speak up.” And from a U.S-based line manager, in talking about his Indian team members noted “… (there) an employee is more subservient and will give you a yes answer regardless of what the answer should be…where it’s detrimental to what you’re trying to do.” Seemingly on the flipside of this issue, one manager in India noted that “If someone is not located with the business then it is difficult to convince the onsite team that they have the appropriate business knowledge.”

There was some divergence of concerns in the groups. For example, managers in the U.S. were more concerned about the difficulties in communication presented by accents and dialects than were any other group. Additionally, the team members themselves were the most concerned about general cultural understanding.

Table 11. Interview Matrix Analysis

Challenge	Managers in India	Managers in U.S.	Senior Managers	Line Managers	Team Member
Offering junior people in India opportunity for advancement (those with seniority have priority)	0%	20%	8%	10%	17%
Lack of sufficient crossover time that the U.S. and Indian teams share working hours	25%	100%	50%	50%	50%
The off-shore team has business knowledge that is often overlooked	25%	0%	0%	0%	0%
Timeliness and ease of collaboration	13%	17%	10%	10%	0%
Indian team members need to be more vocal about concerns and ideas	0%	50%	20%	30%	33%
Turnover of Indian team members	0%	17%	8%	10%	0%
Communication and understanding (accents and dialect)	13%	42%	20%	20%	0%
Skill set of Indian team members	0%	25%	30%	0%	17%
General cultural understanding	0%	17%	0%	0%	33%
Indian teams understanding of company proprietary technology	0%	8%	10%	0%	0%
Physical distance between teams	13%	25%	10%	20%	0%
Follow through of team members in India	0%	8%	0%	10%	0%
U.S. managers don't keep Indian team members as informed about company and project information as they should	25%	8%	0%	0%	17%
Off-shore team has different goals	0%	8%	10%	0%	0%
Indian team members are split across teams	13%	8%	10%	10%	0%
We need to be able to give the Indian teams more technologically difficult work	0%	8%	10%	10%	0%
Coming to a common process	13%		10%	0%	0%

Flexible Pattern Matching

For my second approach to an analysis of the data, I used the technique of flexible pattern matching. Flexible pattern matching is well suited to the exploratory nature of the semi-structured interviews in Study Two. This method allowed me to form initial an analytical framework and research question, but also gave me the freedom to uncover additional dimensions that may emerge during the analysis (Sinkovics, 2018).

Using an initial top down approach, from my review of the literature and the creation of the model in Figure 18, I created an initial template to use as the basis for the coding the respondents' interviews and for use as the foundation of the flexible pattern matching approach. Using NVivo software, I then analyzed and coded the text of my interviews for areas that conflicted with, supported, or detailed my initial template. The initial coding of the text was done by creating a node for each of the constructs of the initial template. Then, as I found new themes in the text, I would create a new node as these themes developed. The coding of the interview text was used to create the final template analysis (King, 2013), creating a comparison of my initial template with the new template. This is shown in Table 11 below.

Starting with the category of Global Business Boundaries, the constructs of Media, Geo-Politics, Ideology, and Law were not explicitly mentioned as boundaries by any of the respondents. As such they were removed from the final template. In the area of Cultural Boundaries, both Individualism and Indulgence vs. Restraint were not explicitly mentioned. For Virtual Team Boundaries, all initial constructs were mentioned in the interviews. In the category of Organizational Boundaries, Networks were not mentioned by the interviewees. Several respondents mentioned issues of concerns over the differences between full-time employees and contractors. I added this construct to the list of Organizational Boundaries. Staff turnover was also listed as a concern, primarily by U.S. Managers concerning their India-based team members. This seemed to be best suited to the area of Organizational Boundaries as well. One last boundary construct was added to the category of Organizational Boundaries, that of Process. Several respondents noted the difficulty in establishing shared processes between the U.S. and Indian teams, particularly with new teams.

In addition to the changes in my original template categories, I created one entirely new category. Many of the interviewees responded to questions concerning the constructs as issues, but not as issues that were necessarily based on the location, culture, or organization of the team members. As an example, the construct of Work Ethic was mentioned by several respondents, but not as it related in particular to U.S. or India-based team members. From one U.S. team member, "I believe that the skill level and the tenacity and the work ethic of the individual is what's important, not necessarily the geographic location" and from an India-based manager about his team members' own work ethic, " They would like to explore, they would like to analyze why they are doing this. If the work is innovative, they are very excited and they will talk more, talk to BA (Business Analyst) to understand...how it will benefit the end user." As such, I created a new category in the final template called *Boundaries Created by Individual Differences*, for constructs such as Work Ethic that may present boundaries to effective performance but did not seem to be related to the mixed on and off-shore nature of the team.

I also added four other constructs to the category of Boundaries Created by Individual Differences. All of these constructs were mentioned in other categories as areas of concern as it related to the on and off shore make-up of the team, while at the same time, other interviewees reported that those boundaries to success were relevant for all teams and not dependent on this particular team model. These constructs are Time Orientation, Masculinity, Uncertainty Avoidance, and Skills. To quote one U.S. manager in the construct of Masculinity, “Competitiveness is about function, not location,” referring to the naturally competitive relationship between software developers and test engineers, who are located in both the U.S. and India. As for Time Orientation, several respondents in the U.S. said that people were late regardless of location.

Table 12. Flexible Pattern Matching Template Analysis

Global Business Boundaries		**Cultural Boundaries**		**Virtual Team Boundaries**		**Organizational Boundaries**		**Boundaries Created by Individual Differences**	
Initial Template	**Final Template with Examples**	**Initial Template**	**Final Template with Examples**	**Initial Template**	**Final Template with Examples**	**Initial Template**	**Final Template with Examples**	**Initial Template**	**Final Template with Examples**
Technological Innovation	Technological Innovation: *Teams in the U.S. are given the more innovative projects*	Power Distance	Power Distance *Team members in India hesitate to voice their concerns or their ideas.*	Time	Time *Limited overlapping time in the office.*	Structure	Structure *Indian team members are more respectful to the chain of command*		Work Ethic *Lack of follow up*
Environment	Environment *Team members in India have more difficult commutes*	Time Orientation	Time Orientation *Indian Team members are sometimes late – "IST"*	Distance	Distance *Travel between offices is very time consuming and expensive.*	Relationships	Relationships *Difficulty of collaboration and formation of personal bonds.*		Time Orientation *People are late regardless of location*
Emerging Markets	Emerging Markets *The same numbers of talented workers cannot be found in the U.S.*	Masculinity	Masculinity *Team members in India compete with each other. Team members in the U.S. compete with U.S. and Indian team members.*	Technology	Technology *Latency on developers' workstations in India causes delays.*	Rewards	Rewards *Seniority is more rewarded in India than in the U.S..*		Masculinity *Competitiveness is about function, not location or culture*
Media		Individualism		Communication	Communication *Accent can be difficult to interpret. U.S. Managers do not impart enough project context to Indian teams.*	Networks			Uncertainty Avoidance *All team members are uncomfortable with ambiguity.*

Table 12, continued

Geo-Politics		Uncertainty Avoidance	Uncertainty Avoidance *The Indian team members need more hand-holding*	Skill	Skills *Indian team members are sometimes not as skilled as U.S. team members.*	Tasks	Tasks *Similar and related tasks should be co-located*		Skills *It's not about on or off-shore, it's about finding quality people regardless of location*
Ideology		Indulgence vs Restraint					Contractors *Off-shore teams are contractors and may not understand the corporate culture and the business in general.*		
Law							Staff Turnover *Members of the team in India seem to leave abruptly.*		
Local Work Practices	Local Work Practices *The Indian teams take more holidays than do the U.S. teams.*						Process *It is difficult establishing shared processes for new teams*		

CHAPTER 5

DISCUSSION AND LIMITATIONS

Discussion

The expected outcome and goal of this work is to help guide managers of these teams on how the frequency and type of their boundary spanning activities may help their teams to succeed. I believe these findings give us a direction to pursue.

In Study One, neither of my hypotheses , *H1 – Team performance is positively affected by the boundary spanning activities engaged in by line managers* and *H2 - Team performance is positively affected by the boundary spanning activities engaged in by senior managers* were supported. Despite this, I do believe the analysis yielded some interesting results, particularly in light of the data produced in Study Two.

In Study Two, my research question was *What do software development team managers, both line and senior, in the U.S. and in India, see as boundaries to effective team performance.* The one construct that consistently emerged as a boundary to team success was that of time, the temporal boundary. All of the U.S. respondents and 25% of India-based respondents reported this as a boundary to team success. From Study One, the time a team had served together, although minimally, was the only positive indicator of team success. It seems that the time a team can spend "together", even virtually, may have the greatest impact on team success. That may be true on both a daily level, as supported by Study Two, and on a longer-term team formation level, as suggested by Study One. By implication, it may be that those managers who work to span the boundary of time will be most likely to lead teams to positive outcomes. This idea of team engagement is supported by my own years of experience working with these teams.

Difficulties presented by temporal boundaries is also supported in previous research on synchronous and asynchronous work in virtual teams. Cummings (2011) put forth that temporal boundaries more often lead to coordination delay than did spatial differences, time is a more significant boundary than is distance. Teams who work synchronously across great distances will have fewer coordination delays than will teams work asynchronously, regardless of distance. The advancements in technology that have allowed virtual teams to communication asynchronously can also add boundaries to team effectiveness (Berry, 2011). Computer-mediated asynchronous process often fail to encourage shared understanding and team forming processes that are an important by-product of synchronous activities (Kirschner & van Bruggen, 2004).

My results suggests another boundary area on which managers, both in the U.S. and India, might concentrate. Many of the U.S.-based managers reported that team members in India are hesitant to challenge or share ideas. I believe the differential in Power Distance between the U.S. and India (see Figure 1) is at play here. This finding is supported by previous research discussed in the Literature Review section (Krishna et al., 2004; Pherwat & Rider, 2018). In general, many Indian team members are generally just not comfortable, or believe it is even disrespectful and unacceptable, to challenge the ideas of their U.S. counterparts and managers.

Practical Implications

How might managers span the boundary of time? First, this work suggests that keeping team members from both the U.S. and India, with the same manager, together on multiple projects for as long as possible will be beneficial. Rotating project members to different teams could be counter-productive. Secondly, asking workers to work more offhour shifts may be necessary. Although many of both the U.S. and Indian teams are already shift their working hours in these teams, it appears more could be done in this area. Offering both U.S. and Indian team members financial incentives to work earlier or later in the day may well be worth the money, expanding team productivity and furthering a shared understanding. Allowing team members to work from home will cut down commuting time, giving team members more time to be “virtually together”.

Additionally, it is important to encourage members of the team in India to speak more freely and be vocal about their ideas and their challenges. Related to the previous point about time, several managers in the U.S. reported that this behavior was alleviated as the team spent more time together. This suggests that building team member familiarity helps India-based team members express themselves. Although travel between the U.S. and India is time consuming and expensive, U.S. managers may be able to nurture that familiarity by visiting their teams in India. This notion is supported by previous studies (Gupta & Bhaskar, 2016; Heeks, Krishna, Nicholson, & Sahay, 2001; Levina & Vaast, 2008; Varma, Srinivas, & Stroh, 2005). In addition to travel to and from India, it is important for India-based managers to understand that the U.S.-based managers value open conversation and exchange of ideas and concerns. U.S.-based managers must give their Indian team members a safe, encouraging space, in which to do so.

Academic Relevance

Previous research on Leader-Member Exchange Theory (LMX) is supported by our results here. The boundaries discussed in this study certainly reduce the opportunity for meaningful exchange and contact between managers and team members, making the formation of special leader-follower relationships difficult. It seems logical that the growth of mutual respect and reciprocal influence, both concepts at the core of LMX, are hindered by boundaries of time and communication mentioned so often by the managers in this study. LMX proposes that based on the frequency and quality of leader-member exchange, some team members become part of an "in-group" with more influence and information than other team members. It seems it would be more difficult for team members in India to be a part of the in-group if their manager is in the U.S. and vice-versa.

Another idea supported by the template analysis in Study Two, is the notion that it is difficult to separate the boundaries faced by all software development teams from those encountered specifically by these globally distributed software development teams. Boundaries between team members concerning Time Orientation, Skills, and Work Ethic are likely of concern regardless of the geographic, and cultural, organizational location of the team members. Many of the Global Business boundaries that were proposed did not seem to be of concern to the team managers at all, presenting no immediate boundaries to success. These findings caused me to revise the model of Boundaries Faced by Managers of Software Development Teams in the U.S. and India shown in Figure 18. Figure 19 below compares this model with the new model that emerges as a result of the flexible pattern matching template analysis done in Study Two.

Although these finding do suggest a new set of boundaries and categories of boundaries faced by software development teams with members in both the U.S. and India, what is does not do is give us a scale by which to measure the boundaries or boundary-spanning behaviors. Previous scales, such as the one proposed by Ancona and Caldwell (1988) and use here in Study One, are no longer relevant. That scale was not created with virtual teams in mind and does not account for the processes handled in Agile Software Development Methodology such as SCRUM, used by the teams here. These methods provide pre-determined processes for many boundary spanning activities, such as the intake of work into the team and reporting of progress outside of the team.

Previous measures of boundaries and boundary spanning also do not take into account that many teams face both internal and external boundaries to team success, as do the teams in this study. As an example, the boundary of time is both internal to the team and external between other parts of the organizations. Team members themselves are working in different time zones and have little overlapping working time, creating an internal boundary. That same boundary exists when members of the remote team must work closely with their colleagues in other teams, such as the Product Development and Technology Infrastructure teams. Although the boundary classification is the same, the impact of spanning internal vs. external boundaries may well be different. We need new measure that take this added dimensions into account.

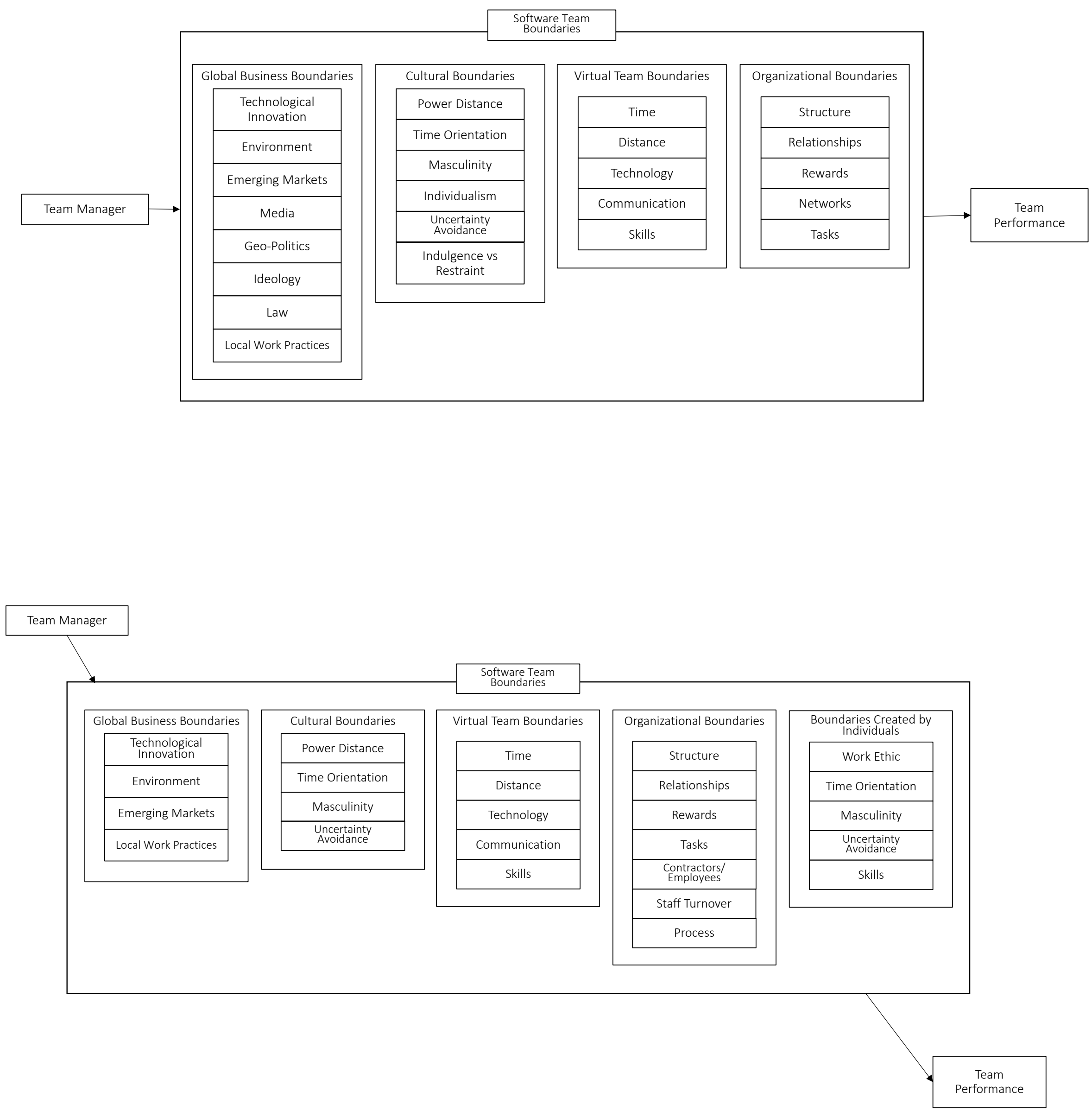


Figure 19. Comparison of Initial Study Two Model with Revised Model

Limitations and Further Areas of Study

This work concentrates entirely on the partnership between two relatively small, privately held, companies. The company in the U.S. has less than 3000 employees and the company in India has approximately 500. The firm in India considers itself to be a boutique off-shore software development partner. The senior executives of both companies are well-known to each other and have formed an enduring partnership that is well into its' second decade. In my experience, this close relationship between two such firms is unusual

Certainly, the jointly formed culture of these organizations is different than of some of the larger, more well-known, off-shore Indian development shops, such as Tata Consulting Services, Virtusa, and Cognizant. Larger companies on both sides of the world will likely have different boundaries for managers to navigate. The boundary of time that was so prominent in this work may be completely alleviated by larger outsourced partners through 24-hour working shifts in either or both locations. On the other hand, boundaries of organization are likely increased when larger organizations are at play. Comparison of this work with a similar partnership of larger U.S. and India based companies would be an interesting area of future study.

An immediate area of study that could explore the time overlap issue would be an action research study involving the same teams examined here. If the teams shift their hours to increase overlap even more, does team output improve? Further to understanding boundaries of time, a comparison of the boundaries presented by working with Indian off-shore teams with those of a closer time zone to their U.S. working partners, say Argentina or Columbia, may cause managers to re-examine where they are placing their outsourcing dollars. While some work has already been done in this area (Levina & Vaast, 2008), looking at this issue in more depth erthrough the lens of Leader-Member Exchange theory may be another way to advance understanding of global software development team boundaries.

As previously discussed, the constructs examined in this study are difficult to separate from one another and measure (Espinosa et al., 2003). Boundaries of culture, distance, and communication are inextricably linked (Pieterse, 2009; Schein, 2009). Understanding which particular boundary construct is presenting the most challenge to teams is difficult if not impossible. Focusing on the combined effects of these constructs may be the only route to improving boundary spanning activities and team output.

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