TEAM INNOVATION: THE ROLE OF INTANGIBLE ASSETS AND EXPLORATORY SEARCH

by

ERIKA HARDEN

A Dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in

Industrial Relations and Human Resources

written under the direction of

David Lepak

and approved by

_____

_____

_____

_____

_____

New Brunswick, New Jersey

May, 2009

ABSTRACT OF THE DISSERTATION

Team Innovation: The Role of Intangible Assets and Exploratory Search

By ERIKA HARDEN

Dissertation Director:
David Lepak

This dissertation examines the impact of team intangible assets on *radical* and *incremental* innovation through the process mechanism of exploratory search. A research framework is developed that examines the unique effects of team social capital (*intra-relational* and *inter-informational*), human capital (*level* and *heterogeneity*), and *codified capital* on exploratory search activities. Further, the complex dynamics of the interrelationships between intangible assets and exploratory search are delineated. The results indicate that the intangible assets, human capital and codified capital individually have a positive relationship with exploratory search activities. Additionally, by examining the combination of codified capital and human capital, we are better able to understand the factors which stimulate exploratory search. Finally, exploratory search was identified as a process mechanism between intangible assets and innovation outcomes. However, the direction and magnitude of the results were unexpected - exploratory search being positively related to incremental innovation and no relationship to radical innovation. The results were discussed and explanations provided for unexpected and non-significant results.

ACKNOWLEDGEMENTS AND DEDICATION

There are many colleagues, friends, and family who have contributed to this dissertation and supported me throughout my academic endeavors. First, I would like thank my dissertation committee David Lepak, Susan Jackson, Mark Huselid, and Mark Youndt. Their continuous support, guidance, and encouragement made the long dissertation journey manageable. I would also like to acknowledge Doug Kruse and Joseph Blasi for contributing to developing a framework that spans outside of Human Resource Management, but most importantly helping to keep me grounded during the dissertation process. I owe special thanks to my colleagues at Rutgers University, Saba Colakoglu, Yuan Jiang, Ying Hong, and the Abbas family, for your friendship and support during my graduate studies.

I could not have completed this dissertation without the generous financial support from The School of Management and Labor Relations and Parker Hannifin Corporation. I would also like to thank the 1,320 employees who participated in the study, providing perceptions of their workplace. I hope this study provided practical contributions for employees and business units on how to staff teams to support innovation. Additionally, Dan Serbin, Pat Gardner, and the Learning & Organizational Effectiveness Team at Parker Hannifin deserve special thanks for assisting in the survey administration and report generation process.

My mom and dad have been extremely supportive throughout all these years. I would like to acknowledge my mom, Pat Ryan, for believing in me in the face of numerous educational obstacles and challenges. While correcting my homework each night at the kitchen table was painful for you and me both, it laid the foundation for my success in this dissertation.

I would like to dedicate this dissertation to my husband, Geoff Harden. You are the ultimate “binder finder” as well a constant source of encouragement, support, and laughter. You have enriched my life in so many ways – thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The environment organizations face today features a composition of external forces such as rapidly changing technology, low cost competition, expanding markets, and ever changing customer demands (Barney, 1997; Ireland & Hitt, 1999). One strategy increasingly pursued to address these challenges is to create unique value for customers through product, service, or process innovations. Recent popular business press reiterate this point with articles such as, "Connected innovator", "Innovation all the time", "The innovation game", "Innovation scorecard", "The 10 faces of innovation", and "The world's 25 most innovative companies". It is through this form of value creation that organizations can continuously adapt and survive in today's competitive landscape (Schumpeter, 1934).

The ability for organizations to successfully implement a strategy of innovation requires a workforce that has unique knowledge and expertise (Smith, Collins & Clark, 2005; Subramanian & Youndt, 2005). The unique knowledge and knowing capabilities of a social unit have been identified as intellectual capital or *intangible assets* (Bontis, 1996; Edvinsson & Malone, 1997; Nahapiet & Goshal, 1998; Lev, 2001; Stewart, 1999). Intangible assets are valuable for innovation because specialized knowledge is critical to the generation of creative performance at an individual level of analysis (Obstfeld, 2005; Perry-Smith, 2006; Rodan & Galanic, 2004) and innovative performance at an organizational level of analysis (Ahuja, 2000; Tsai, 2001; Tsai & Ghosal, 1998; Smith, et al., 2005; Subramaniam & Youndt, 2005; Yli-Renko, Autio, & Sapienza, 2001). Additionally, as opposed to tangible factors required for industrial production, intangible factors of production cannot be easily sold, traded, or substituted. Instead, they are often

rare and socially complex, thereby making them difficult to acquire or develop quickly (Barney, 1991; Hitt, Bierman, Shimizu, & Kochar, 2001).

Recognizing the value of intangible assets, organizations are seeking ways to fully capitalize on the knowledge and knowing capabilities available to them. One mechanism that is of increasing importance is project teams (Jackson, 1996; Jackson, Chuang, Harden, & Jiang, 2006). Project teams are assembled with people from different disciplines and functions that have pertinent assets in the proposed organizational initiative (Early & Mosakowsi, 2000). For example, past research has found *level of human capital* (labeled *HC-level*) and the heterogeneity of human capital (labeled *HC-heterogeneity*) on a team as an important predictor of team innovation (Bantel & Jackson, 1989; Curral, Forrester, Dawson, & West, 2001; Drach-Zahavy & Somech, 2001; Hammerschmidt, 1996; Keller, 1986; Somech, 1996; West & Anderson, 1996).

Likewise, a team's *intra-relational social capital*, or the strength of social relations between team members, have been argued to support collaboration and knowledge exchange (Balkundi & Harrison, 2006; Coleman, 1990), yet may reduce creativity and innovation as strong social relations will hinder constructive challenging of ideas and increase the "not-invented-here" syndrome (Hayes & Clark, 1985; Katz & Allen, 1988). Another form of social capital, *inter-informational social capital*, or the social relationships that span outside of the teams boundaries, provides benefits to teams through access to diverse knowledge and perspectives (Ancona & Caldwell, 2002b), as well as instrumental benefits, such as financial or political resources (Burt, 1992).

Finally, recent work recognizes that teams develop and utilize a form of documented or codified knowledge. Such *codified capital* is a team's preserved knowledge and

reinforces the current ways of getting work done (Alavi and Leidner, 2001; Hass & Hansen, 2005; Schulz, 2001; Subramaniam & Youndt, 2005).

At the same time, researchers in the team's literature seek to understand the means through which team characteristics impact team innovation (Bunderson & Sutcliffe, 2002; Jackson, May, Whitney, 1995; Jehn, Northcraft, Neale, 1999). For example, in the functional heterogeneity literature, past theory and research suggests that HC-heterogeneity impacts team innovation through team process mechanisms such as task and process conflict (Jehn, et al., 1999), decision quality (Jackson, et al., 1995), opposing opinions (Pelled, Eisenhardt, & Xin., 1999), motivating (Drach-Zahavy & Somech, 2001), information sharing (Bunderson & Sutcliffe, 2002), and learning (Drach-Zahavy & Somech, 2001).

Not withstanding past literature, research related to knowledge and innovation has pointed out the importance of *exploratory search* as a means for organizations to generate unique and rare product, process, or service innovations (Katila & Ahuja, 2002; March, 1991; Miller, Zhao, Calantone, 2006; McGrath, 2001; Rosenkopf & Nerkar, 2001; Taylor & Greve, 2006). These activities which are characterized by behaviors such as search, discovery, experimentation, and free association are often argued as the mechanisms which facilitate innovation. Recognizing the value of exploratory search activities for innovation, researchers have begun to investigate the antecedents and outcomes of such behavior (see Academy of Management Journal Special edition, 2006). Interestingly, the research on exploratory search and teams remains limited (Perretti & Negro, 2006) despite recent calls for the value such work could provide (Gupta, Smith, & Shalley,

2006). In the context of project teams, exploratory search may act as the mechanism through which team intangible assets impact team innovation (Taylor & Greve, 2006).

Finally, research at a team level of analysis has tended to view innovation as a one size fits all construct – "team innovation" (i.e., Ancona & Caldwell, 1992; De Dreau, 2006; Drach-Zachavy & Somech, 2001, 2002; West, 2006). However, from the innovation management literature we know that innovation comes in various forms (Gatignon, Tushman, Smith, Anderson, 2002), such as *radical* and *incremental* (Dewar & Dutton, 1986), and the determinants of each form vary (Damanpour, 1991). Bridging the possibility that exploratory search may support certain types of innovation, such as radical innovation, while hindering others, incremental innovation.

In this dissertation, I attempt to address these issues and extend our understanding of the intangible assets – innovation link. To do so, I draw upon the theory and empirical evidence of past work that has examined intangible assets at the team and organizational level in an effort to develop new insight surrounding their specific associations. Broadly, from the human capital, functional heterogeneity, social capital, and codified capital literature, I develop arguments for how intangible assets have the potential to impact team innovation through exploratory search. Moving beyond the main effects of intangible assets, I develop a research framework that conceptually delineates how the interrelationships between intangible assets differentially influence exploratory search. Finally, I examine the possibility that exploratory search may support radical innovation, while hindering incremental innovation.

This dissertation has both practical and theoretical relevance in today's knowledge-based economy. Theoretically, I bring intangible assets to the team level of analysis and

propose to examine how such assets influence team innovation. Additionally, I present a possible process mechanism through which intangible assets impact team performance, exploratory search. Practically, the results of this dissertation may provide managers with important information about staffing project teams. The proposed hypotheses suggest that staffing decisions should consider individual abilities and experience as well as the composition of the project teams. Additionally, reliance on any one intangible asset should be considered in combination with the other intangible assets available to the team.

EXPLORATORY SEARCH

Theoretical Background

First introduced by March (1991) as a process through which firms learn and adopt, exploratory and exploitative search activities continue to be influential in understanding innovation (Gupta, et al., 2006). According to March, individuals who are unfamiliar with knowledge present in a social unit are likely to employ *exploratory* search. Exploratory search creates value through new knowledge being created and is achieved by combining information, resources, or perspectives previously unassociated[1]. Other scholars have paralleled exploration with double-loop learning and paradigmatic change (Napaiet & Ghosal, 1998). In contrast, individuals who are familiar with knowledge present within a social unit are likely to search out solutions to problems

[1] While exploratory and exploitative search is widely accepted, the literature has no clear consensus on if this theoretical perspective is two ends of the same continuum (continuity) or two distinct constructs (orthongonality). However, recent work by Gupta, Smith, & Shalley (2006) argues the relationship between exploratory and exploitative search depends on factors such as level of analysis, scarcity of resources, and domain in which this perspective is applied. Following other team level research on exploratory and exploitative search activities (Perretti & Negro, 2006; Taylor & Greve, 2006; McGrath, 2001) I conceptualize exploratory and exploitive search activities as two ends of the same continuum. However, recognizing the possible value, in supplemental hypotheses, I develop rational for testing if exploratory and exploitative search, at a team level of analysis, is one-dimensional (continuity) or two distinct constructs.

through exploitative search activities. *Exploitative* search is characterized as the creation of value through search activities that refine or deepen existing knowledge. It is identified by localized and in-depth search.

Past literature has actively identified process mechanisms which impact team innovation, such as team conflict (Jehn, et al., 1999), team cohesion (Williams & O'Reilly, 1998), or team learning (Drach-Zahavy & Somech, 2001). Not withstanding the contributions of past research, this dissertation extends the current literature by examining one process mechanism underdeveloped in the team's literature, exploratory search (Perretti & Negro, 2006). In fact, in their recent review of the exploratory search research, Gutpa, et al., state "studies that examine exploration and exploitation at a micro level are relatively scarce and such research would provide a beneficial contribution to the literature" (2006: 703). In the context of team innovation, exploratory search is of particular importance (Taylor & Greve, 2006), as characteristics of exploratory search such as experimentation, broad search for new routines, free association, discovery, and risk taking may act as a mechanism through which team intangible assets impact team innovation (Baum, Li, & Usher, 2000; He & Wong, 2004; Holmqvist, 2004; Katila & Ahuja, 2002).

In the section that follows, I develop specific hypotheses for the important role exploratory search plays in achieving radical and incremental innovation.

Exploratory Search & Team Innovation

Organizational researchers have difficultly agreeing on a single definition of innovation (Bantel & Jackson, 1989; Janssen, van de Vliert, & West, 2004). Part of the difficulty in defining innovation consistently across studies is due to the many "faces" of

innovation. Broadly speaking, innovation can be distinguished by level of analysis, such as individual (Amabile, 1996), team (West & Anderson 1996), organizational (Angle & Ven de Ven, 2000), or industry (Schumpeter, 1934). It can be further distinguished by type of innovation, such as radical or incremental (Dewar & Dutton, 1986), architectural or modular (Henderson & Clark, 1990), and technical or administrative (Daft & Becker, 1978). Additionally, innovations can be examined as an input (such as creative/innovative individuals), a process (such as creative/innovative problem solving), or an outcome (such as innovative products, processes, or services).

Recognizing this, exploratory search activities may be drivers of only certain types of innovation. For example, in a meta-analysis of the innovation literature, Damanpour (1991) found differential drivers of radical and incremental innovation. Thus, in the present study I will examine the impact of exploratory search on "radical" and "incremental" innovation (Dewar & Dutton, 1986). And while the conceptualizations of radical and incremental innovation vary, including descriptions such as "variation" and "reorientation" (Normann, 1971), "routine" and "radical" (Nord & Tucker, 1987), "ultimate" and "instrumental" (Grossman, 1970), consistent themes can be identified throughout these scholars work. Drawing on this past theoretical and empirical work, I define *radical innovation* as the generation, promotion, and realization of fundamentally new products, services, or processes, which introduce relatively major changes in the existing processes of a team. Alternatively, I define *incremental innovation* as the generation, promotion, and realization of relatively minor change in current products, services, or processes that introduce slight modifications in existing processes of a team. Innovation is operationalized by managerial and team member reports of radical and

incremental innovativeness of project teams (Burningham & West, 1995) and objective measures of radical and incremental innovation.

Radical innovation. I expect that teams with higher levels of exploratory search activities will have a positive association with measures of radical innovation. A review of the exploratory search literature reveals it has been defined as behavior characterized by broad search, discovery, experimentation, free association, and pursuit of things that might come to be known (Baum, et al., 2000; He & Wong, 2004; Holmquist, 2004; Katila & Ahuja, 2002; McGrath, 2001; Miner, Bassoff, Moorman, 2001). It is the process through which teams search broadly for resources and perspectives, experimenting with them, integrating and associating them, with the expectation that such activities generate unique solutions and valuable products and services (Taylor & Greve, 2006). Underlying these descriptions and definitions of exploratory search activities is the possibility of new value creation.

It is expected that exploratory search positively effects radical innovation through at least two mechanisms. First, exploratory search enriches the team's knowledge domain, as team member's search broadly using discovery, experimentation, and free association. It is through this process that teams add distinctive new variation and generate unique solutions (Taylor & Greve, 2006). Such variation in solutions is likely to produce new changes in team products – radical innovation.

Second, exploratory search increases radical innovation through enhanced recombinatory search (Katila & Ahuja, 2002). For example, Katila and Ahuja (2002) state "There is a limit to the number of new ideas that can be created by using the same set of knowledge elements" (p. 1185). As teams search broadly, they augment the number

of new "elements" available for combining, increasing the possibility of radical innovation. Recognizing this, Kang, Morris, & Snell (2007) argue that "exploration involves the pursuit of new knowledge that does not exist within a firm or is more valuable than existing knowledge…Hence, exploration is linked to creating new customer value", such as product or service innovation (p. 237). Supporting this, McGrath (2001) found that exploratory search activity in 56 project teams was positively associated with learning effectiveness. Additionally, at an organizational level of analysis, Rosenkopf & Nerkar (2001) in their study of optical disk technology firms and patenting, found that the greatest impact on new product development was by firms that did two types of exploration (between organizations and within organization). Taken together, hypothesis 1 states:

Hypothesis 1: Exploratory search activities will be positively associated with radical innovation.

Incremental innovation. It is expected that exploratory search will have a negative relationship with incremental innovation for at least three reasons. First, teams high on exploratory search are less likely to use the same knowledge elements repeatedly (Katila & Ahuja, 2002). The reuse of knowledge elements decreases variation and increases the development of routines, facilitating incremental innovation. Thus, those teams high on exploratory search are less likely to produce incremental innovations.

Second, teams high on exploratory search are searching broadly, experimenting with new pieces of knowledge and information (Wadhwa & Kotha, 2006). The act of exploratory search comes at the cost of gaining a deeper understanding on the current concepts within the team (Holmqvist, 2004). Exploratory search should reduce a team's

ability to synthesize valuable knowledge elements within the team, to develop unique links among them, and to recombine them in new and potentially significant ways.

Finally, past research and theory at an organizational level of analysis highlights the role of knowledge resources and risk taking as factors that distinguish radical from incremental innovation. In particular, Dewar and Dutton (1986) argue that innovations can be identified as radical or incremental by assessing the "degree of departure of the innovation from the state of knowledge prior to its introduction" (p. 1423). Incremental innovations are expected to see less of a degree of departure from current knowledge prior to its introduction. Since exploratory search requires broad search for new information and perspectives, it is expected that exploratory search will have a negative association with incremental innovation. Likewise, Ettlie, Bridges, and O'Keefe (1984) argue that "one aspect of this dimension [radical/incremental innovation] appears to be whether or not the innovation incorporates technology that is a clear, risky departure from existing practice" (p. 683). Along similar lines, the exploratory search theory argues that exploratory search is characterized by risk taking (Lavie & Rosenkopf, 2006), thus is would be expected that exploratory search will have a negative relationship with incremental innovation.

Consequently, as indicated in the hypothesis below, I propose that exploratory search will have a negative relationship with incremental innovation.

Hypothesis 2: Exploratory search activities will be negatively associated with incremental innovation.

DETERMINANTS OF EXPLORATORY SEARCH

The above discussion suggests exploratory search activities are valuable for the generation of team innovation. It is equally or even more important to understand how

teams can stimulate exploratory search activities. In this dissertation I argued intangible assets - human capital, social capital, and codified capital – are a means for understanding how teams can stimulate exploratory search activities.

Team Human Capital & Exploratory Search

Human capital refers to employee's knowledge, abilities, and experience, often operationalized as education, functional expertise, and tenure (Becker, 1964). It has long been argued as a critical resource for generating value in organizations (Hitt, et al., 2001; Pfeffer, 1994). At an organizational level of analysis, human capital has been associated with a firm's ability to create a competitive advantage through enhanced performance (Florin, Lubatkin, & Schulze, 2003; Hitt, et al., 2001; Skaggs & Youndt, 2004) and innovation (Smith, et al., 2005; Subramanian & Youndt, 2005). At a team level of analysis, past research also supports the important role human capital plays for complex decision making and innovation (Bantel & Jackson, 1989; Keller, 1986). Finally, at an individual level of analysis, research shows that employee's human capital such as knowledge, skills, and abilities are positively related to individual outcomes such as creative achievement, innovative behaviors, and idea generation (Amabile, 1983; Amabile & Gryskiewicz, 1989; Amabile, 1988; Woodman, Sawyer, & Griffin, 1993).

Given the important role of human capital for complex decision making, creativity, and innovation, an important contribution can be made by examining the role of team human capital on exploratory search activities. While the level of human capital can be an important contributor to team performance, another important aspect of team innovation is the diversity of the human capital within a team (Bantel & Jackson, 1989; Drach-Zahavy & Somech, 2001; Keller, 1986; Somech, 2006). Diversity and breadth of

knowledge and expertise provide teams with unique information and perspectives, which may stimulate team innovation. Thus, this dissertation will also examine *Human capital-heterogeneity*, which is defined as a team's breath and balance of knowledge and expertise relating to organizational issues (Bunderson & Sutcliffe, 2002; Hammerschmidt, 1996)[2].

Level of human capital. In this dissertation, I expect that higher mean levels of team human capital should be associated with a team's ability to explore broadly for solutions to team problems. The act of searching broadly for a solution to a team problem is likely to require higher levels of human capital. Researchers at an individual and team level of analysis provide support for this argument. Exploration is characterized by actions such as moving away from current routines, pursuit of things that might come to be known, experimentation, discovery, and free association (He & Wong, 2004; Katila & Ahuja, 2002; Taylor & Grieve, 2006). Teams with higher levels of human capital are likely to have the "raw materials" that are necessary to perform such search activities.

At an individual level of analysis Amabile and colleagues (i.e., Amabile, 1988; Amabile & Gryskiewicz, 1987) have argued and found support for the importance of "domain-relevant skills" as an important contributor to creative performance. Such domain-relevant skills are consistent with human capital as they encompass the facts, principle, attitudes toward various issues in the domain, knowledge of paradigms, and performance scripts for problem solving. As noted by Amabile, domain-relevant skills

[2] Team diversity has been measured using various approaches (Harrison & Sin, 2006), including each demographic variable being treated separately (Klein, Conn, Smith, & Sorra, 2001), a global composite index across various diversity variables (Chatman & Flynn, 2001), or a configural approach that looks at specific patterns of diversity characteristics (Josi, 2002). In this dissertation, I examine the unique effects of educational diversity, functional diversity, tenure in organization and industry experience diversity. Additionally, I develop a rational for a composite measure of HC-heterogeneity.

constitute the individual's 'raw material' for creative productivity (1988). Additionally, work by Keller and Holland (1978; 1983) found R&D professionals who had a higher "innovation orientation" (a cognitive style) were significantly more likely to produce innovative outcomes such as patents and journal publications. Likewise, at an organizational level of analysis, researchers have consistently argued for and in many cases found a positive association between the level of human capital and organizational performance (i.e., Florin, et al., 2003; Hitt, et al., 2001; Takeuchi, Lepak, Wang, & Takeuchi, forthcoming; Subramaniam & Youndt, 2005).

Finally, at a team level of analysis, using top management team educational level, Bantel and Jackson (1989) find that the higher average education level is positively associated with the adoption of banking innovation. The authors suggest that their findings support the importance of average level of human capital for complex problem solving. Likewise, using 30 R&D project teams Keller (1986) found that a team's mean level of "innovation orientation" was positively and significantly related to manager reported ratings of project team quality, but had no relationship to project team's ability to maintain budgets/schedules. The author argues that high levels of innovation orientation aids teams in producing better products as opposed to more efficient performance. Taken together, it is expected that the average level of human capital on a team should be positively associated with exploratory search activities. This leads to the following hypothesis:

Hypothesis 3a: There will be a positive linear association between level of team member's human capital and exploratory search.

Human capital-heterogeneity (dispersion). One of the major reasons that organizations rely on team work is to create value not attainable through individual performance. Differences between team members' human capital is theoretically important because diversity may increase the task-related knowledge, skills, and abilities that create value (Simons, Pelled, & Smith, 1999).

While there may be a variety of perspectives to shed insight on team diversity, often applied to explain diversity of human capital is the *Cognitive Resource Perspective*[3] (Hambrick & Mason, 1984; Wiersema & Bental, 1993). This perspective argues that a team member's cognitive base is their knowledge or assumptions about future events, knowledge of alternatives, and knowledge of the consequences associated with each alternative (Pelled, 1996). Team member characteristics such as cognitive style, functional background and education are good reflections of a team member's cognitive base (Bantel, 1993). As the diversity in a team's cognitive base increases with respect to knowledge, skills, and perspectives, teams are espoused to be more effective solving complex, non routine problems (Bantel, 1993; Jackson, et al., 1995).

The cognitive resource perspective suggests that as HC – heterogeneity among team members increases so too does the diversity of information, resources, and perspectives available for the team to utilize. As HC-heterogeneity increases, so too does

[3] Early research on team diversity tended to use a "broad brush stroke" approach to the application of theory. Specifically, researchers applied one theoretical perspective to explain observable attributes (such as age, gender, and ethnicity) and task oriented diversity (such as education, functional areas of expertise, and organizational tenure). For example, Wiersema & Bantel (1993) in their study of diversity in top management teams used cognitive resource perspective to propose a positive relationship between observable diversity, task oriented diversity and organizational performance. More recent work has progressed our understanding of how different forms of diversity, differentially impact team processes and team outcomes (i.e., Pelled, 1996; Jehn, Northcraft, & Neale, 1999). Recognizing the importance of clear theoretical development, I draw on the work of Pelled (1996) and others in the application of cognitive resources perspective to team HC-heterogeneity. Please see Figure 2 for a depiction of team diversity and past theoretical rational.

the team's cognitive resources available for more complex problem solving, such as exploratory search (Hambrick & Mason, 1984; Webber & Donahue, 2001; Wiersema & Bentel, 1992). As stated by Simons, et al. (1999) relating to HC- heterogeneity, "[it] is an important property because it determines whether a particular type of diversity constitutes an increase in a group's total pool of task-related skills, information, and perspectives. The magnitude of this pool, in turn, represents a potential for more comprehensive or creative decision making" (p. 662-663). Additionally, the wider cognitive perspectives and knowledge available within a team is likely to generate alternative suggestions and multiple interpretations of information (Hambrick & Mason, 1984; Keck, 1997), stimulating team members to search beyond their current knowledge base for a solution. For example, Keck (1997) states, "a team composed of members with different backgrounds will scan the environment more broadly and will make the solution set broader and more complex" (p. 145).

Finally, HC-heterogeneity is likely to stimulate exploratory search as the diverse cognitive styles and functional backgrounds fosters conflicting perspectives on team tasks. Researchers characterize such conflict as "intellectual opposition [as opposed to emotion] among participants deriving from the content of the agenda" (Pelled, 1996). This job-related conflict as been found to impact team cognitive task performance and organizational performance (Jehn, Chadwick, & Thatcher, 1997; Pelled, et al., 1999; Simons, et al., 1999;). Supporting this, Pelled, et al., (1999) demonstrated that members of functionally heterogeneous teams expressed more opposing opinions about task issues, including goals, key decision areas, procedures, and the appropriate choice for action, which was positively associated with team performance. Additionally, in the team

innovation literature, constructive conflict is strongly associated with team innovation (Woodman, et al., 1993).

Taken together, the theoretical support of the cognitive resource perspective and the empirical evidence presented above I expect that HC - heterogeneity will have a positive impact on exploratory search activities. Thus, following hypothesis states:

Hypothesis 3b: Team HC – Heterogeneity will have a positive linear relationship to exploratory search activities.

Human capital-heterogeneity (composite). This dissertation proposes the potential impact of HC-heterogeneity on exploratory search. I have used HC-heterogeneity as a general term to capture the expected effects of informational diversity in the form of cognitive style, functional background, education background, company experience, and industry experience. This approach to team diversity is associated with two assumptions. First, this approach assumes that the same theoretical arguments can be applied to explain how different forms of HC-heterogeneity impact exploratory search. Second, this approach assumes that the impact of each form of HC-heterogeneity is independent of the other forms. However, research on team diversity suggests an alternative view is plausible (Harrison & Sin, 2006). This alternative perspective suggests that team diversity may best be assessed through a lens that includes a multidimensional approach to HC-heterogeneity. Up to this point, I have argued that the different forms of HC-heterogeneity will individually provide the diverse knowledge and perspectives to stimulate exploratory search. However, based on a composite approach to HC-heterogeneity, it maybe that the different forms of HC-heterogeneity together influence exploratory search. Stated differently, in project teams, one form of HC-heterogeneity alone may not be sufficient to predict exploratory search. Instead, it may be the combined

effects of educational background, functional background, company experience, and industry experience that together impact exploratory search.

Supporting this, Jehn, et al., (1999) combined three forms of HC-heterogeneity (cognitive, functional, educational, and positional diversity) as their composite measure. Using a sample of 92 workgroups from the household goods moving industry, the authors find that the composite measure of HC-heterogeneity positively influenced group performance through the mediating variable of task conflict. Given this evidence for the potential value of a composite approach to HC-heterogeneity an additional hypothesis is included to investigate the impact of a composite measure of HC-heterogeneity.

Hypothesis 3c: There will be a positive linear association between a composite measure of HC-heterogeneity and exploratory search.

Team Social Capital & Exploratory Search

Social capital, in the form of social networks, is considered one of the defining concepts of the modern era (Kilduff & Tsai, 2003). While the origins of social networks comes from multiple sources, a foundational study often cited is Jacobs (1961) who studied the social relationships in communities to examine the role of relational resources embedded in personal ties. Recognizing the value of network approaches, management scholars have summarized the concept of social networks as social capital or the potential resources inherent in a set of social ties (Kilduff & Tsai, 2003). Broadly, the concept of social capital has been applied by management scholars to the resources available for individual employees (Perry-Smith, 2006; Rodan & Galunic, 2004), teams (Oh, Chung, & Labianca, 2004; Oh, Labianca, & Chung, 2006) as well as organizations (Nahapiet & Ghosal, 1998; Subramaniam & Youndt, 2005; Yli-Renko, et al., 2001).

While definitions of social capital vary greatly, it is generally agreed that social capital can be viewed from two perspectives (Adler & Kwon, 2002). The first perspective, the bridging view, helps to explain the success and failure of individuals and groups based, in part, on their direct and indirect links to other actors in the social network (Burt, 1992). Researchers applying the bridging view to teams argue that a team's boundary spanning activities provide access to different information and resources than that which is within the team's boundaries (Ancona & Caldwell, 1992b; Oh, et al., 2004).

The second form of social capital, the bonding view, focuses on the collectivity of a social unit. According to this perspective, the internal structure of the collective unit (in the form of social ties) provides benefits through mechanisms such as collaboration, knowledge sharing, and knowledge exchange. The work by Coleman (1990) provides a strong theoretical foundation for the importance of this perspective. Researchers examining the bonding view at a team level of analysis argue for the benefits of knowledge sharing and collaboration that accrue through bonding relations among team members within the team's boundaries (Balkundi & Harrison, 2006).

Given the informational benefits of bridging social capital and the knowledge sharing and collaboration benefits of bonding social capital in this dissertation I will examine both bridging social capital (inter-informational social capital) and bonding social capital (intra-relational social capital). I define *inter-informational social capital* as task-related contacts between a team and members in the broader organization, which provide access to disparate task-related information. It is measured as the frequency and disparateness of task-related contacts outside of the team's boundaries. Alternatively, I

define *intra-relational social capital* as the enduring relations among team members (Hansen, Mors, & Lovas, 2005) and it is measured as the density of relational ties between team members[4].

Inter-informational social capital & exploratory search. Since teams reside within a broader social unit, it is important to consider a team's boundary spanning activity (Ancona & Caldwell, 1992b; Oh, et al., 2006). For instance, when confronted with the task at hand, project teams may want to gain access to knowledge and resources that reside outside of their boundaries. Those teams that have frequent contact with individuals outside the team boundaries are likely to benefit from inter-informational social capital through access to information from disparate arenas and instrumental benefits such as access to political resources (Burt, 1992; Oh, et al., 2004). As explained below, it is expected that inter-informational social capital, through access to such informational and instrumental resources, is likely to stimulate exploratory search activities.

First, project teams that interact more often with individuals outside the team's boundary have increased access to information and resources (Ancona & Caldwell, 1992b; Hansen, 1999). Supporting this, Tsai (2001) finds that informal lateral relations between subunits, in the form of social interaction, have a significant positive effect on knowledge sharing.

While access to information may stimulate exploratory search activities, from Burt's (1992) perspective, the boundary spanning is most effective when external ties are non-redundant. Thus, teams with non-redundant or disparate individuals outside of the

[4] As noted recently by Balkundi and Harrison (2006) in their review of team social capital, network density is conceptually different from another team-level construct, group cohesion. Network density, unlike group cohesion captures the pattern of interaction between team members.

teams boundaries are expected to gain access to information and resources that are not present within the team. It is through such inter-informational social capital that teams are confronted by ideas and perspectives that are likely to stimulate exploratory search activities.

Second, as project teams socialize with individuals outside the team they gain insight into different aspects of the organization and develop social relationships. The result is an instrumental benefit, such as access to political resources and referrals from others (Ancona & Caldwell, 1992b; Oh, et al., 2006). As noted above, exploration is characterized by search, discovery, and experiment of uncertain value, all of which require resources (i.e., emotional, financial, or political) to undertake (Amabile, 1996; Damanpour, 1991; Payne, 1990). Teams with inter-informational social capital are more likely to have access to a broad base of emotional, financial, and political support through ties with other individuals in the organization (Burt, 1992). Access to such support maybe a critical means to stimulate exploratory search.

Taken together, inter-informational social capital is expected to stimulate exploratory search activities through the informational and instrumental benefits that can be gained. Thus, hypothesis 3a states:

Hypothesis 4a: Inter-informational social capital will have a positive linear relationship with exploratory search activities.

Intra-relational social capital & exploratory search. Intra-relational social capital is characterized by benefits such as cooperation and knowledge exchange between team members (Balkundi & Harrison, 2006). While intra-relational social capital may facilitate interactions between team members, it may diminish team exploratory search activities for at least three reasons.

First, intra-relational social capital may be associated with the "not-invented-here" syndrome, often mentioned by innovation scholars (Hayes & Clark, 1985; Katz & Allen, 1988). Specifically, team members with strong intra-relational social capital may perceive the knowledge within the team as more valuable than that which can be found outside of the team. When confronted with a problem, teams high on intra-relational social capital are expected to value the knowledge currently available more so than knowledge which could be obtained by searching broadly (Hansen, Mors, Lovas, & 2005). If this happens, team members may limit their search activities to solutions closely related to their current knowledge domain.

Second, teams with strong intra-relational social capital are likely to actively exchange knowledge, information, and perspectives with one another (Balkundi & Harrison, 2006; Coleman, 1990). Through this processes teams develop a common knowledge base (Hansen, et al., 2005; Homan, 1950) and shared cognition/mindset (Fiore & Schooler, 2004), which are expected to negatively impact exploratory search activities. Supporting this, Homan (1950) in his famous study of groups at Western Electric found that "the more frequently persons interact with one another, the more alike in some respects both for their activities and their sentiments tend to become" (p. 120). While shared knowledge and cognitions can make work more efficient (Salsa & Fiore, 2004), it is likely to reduce a team's exploratory search as a common knowledge base will not trigger broad search activities.

Third, past research has identified that stronger internal relationships can be problematic to innovative team performance as it reduces the propensity of team members to challenge team members different ideas and perspectives (Homans, 1950;

Woodman, et al., 1993). Strong intra-relational social capital is likely to reduce the constructive challenging of other team members ideas and suggestions (Homans, 1950). Constructive challenging of team member's ideas and suggestions is a significant facilitator of team innovation. For example, Dougherty (1992) found the constructive disagreements helped functionally diverse teams recognize their different interpretations and the importance of incorporating their different perspectives and ideas into the product their team designed.

Teams with strong intra-relational social capital may therefore reduce exploratory search activities, directing problem solving efforts to local search activities and refining existing knowledge. The density of intra-relational social capital (i.e., the number of ongoing established relations among team members, divided by the total possible number of relations) and the average strength of relations (i.e., the frequency and intensity of interactions) may negatively impact exploratory search activities (Hansen, et al., 2005). Given this evidence, I expect that team intra-relational social capital will be negatively related to team exploration. This relationship is detailed in the following hypotheses:

Hypothesis 4b: Intra-relational social capital will have a negative linear relationship with exploratory search activities.

Team Codified Capital & Exploratory Search

Past management scholars have defined codified capital (i.e., structural capital, organizational capital, etc.) as an organization's institutionalized knowledge and codified experience stored in databases, routines, patents manuals, and structures (Youndt, Subramanian, & Snell, 2004), an organization's routines and structures that support employees' quest for optimum intellectual performance (Bontis, 1996), an organization's patents, trademarks, copyrights, (Lev, 2001), an organization's legal rights of ownership

(technologies, publications and processes that can be patented) and elements of culture, structures, and systems, organizational routines and procedures (Stewart, 1999), to name a few (see Table 2 for complete definitions).

Insert Table 2

Regardless of how they are conceptualized, the above approaches to structural capital have tended to view such capital as the property of an overall firm, rather than that of a team (Hass & Hansen, 2005). While not withstanding their contribution, limiting the examination of structural capital to an organizational level of analysis ignores the possibility that within the same organization, project teams will vary on their level of codified capital. For example, project teams use and create team databases, knowledge sharing websites, manuals, and documents, all of which act as a form of specialized team codified capital. While such forms of codified capital have been linked to organizational innovation (Subramaniam & Youndt, 2005), what is the impact of codified capital on exploratory search activities?

Given this, in this dissertation I examine the impact of team codified capital on exploratory search. I define *codified capital* as the articulated artifacts such as manuals, images, team databases, team sites, product specifications, and other documents. It is expected that team codified capital will have a negative impact on exploratory search for at least two reasons.

First, preserved knowledge is a proven form of capital which reinforces status que. It is particularly effective for completing routine or standardized work, as it

reinforces the use of preexisting or established ways of solving problems (Subramaniam & Youndt, 2005). Such stabilized knowledge predisposes the team to do (at least some) things the same the next time around. Coombs and Hall (1998) argue that such a stabilized knowledge is a form of path dependency, making it more likely for teams to take on activities in a consistent manner as to what they have done before.

Second, codified capital is likely to reduce a team's perceptions of freedom and self-determination, stifling exploratory search. Social-cognitive psychologists argue that creative and innovative behavior has defining characteristics that make it distinct from other behavior – it is dependent on intrinsic motivation (Amabile, 1983; Deci & Ryan, 1985). When employees perceive situations as controlled, (such as through codified or latent knowledge) feelings of freedom and self-determination will be stifled, inhibiting the intrinsic motivation necessary for innovative and creative work. Extending this logic, codified capital will reduce a team's propensity to freely associate, experiment, and take risk, behaviors that are associated with exploratory search. This leads to hypothesis 5:

Hypothesis 5: Codified capital will have a negative linear relationship with exploratory search activities.

INTERACTIONS AMONG INTANGIBLE ASSETS

As argued above, I expect human capital, social capital, and codified capital to have main effects on a team's exploratory search behaviors. However, as past research and theory reveals (Coleman, 1988; Florin, et al., 2003; Subramaniam & Youndt, 2005), examining one form of intangible asset in isolation may ignore the unique explanatory power of intangible assets working in tandem. Thus, the following section addresses the moderation of human capital (level and heterogeneity) with social capital and codified capital.

Team Social Capital

Inter-informational social capital. Teams and their associated human capital may encourage exploratory search with their ability to solve complex problems (Bantel & Jackson, 1989) and "raw materials" for creative work (Amabile, 1988). However, a team's ability to fully utilize its human capital for exploratory search may vary by the flow of disparate information from outside the team's boundary. Inter-informational social capital encourages the sharing of disparate information, resources, and perspectives (Ancona & Caldwell, 1992b; Hansen, 1999). Such informational ties further leverage the stimulating role of human capital on exploratory search. While human capital provides a foundation for exploratory search, external information ties further stimulates exploratory search through the presence of disparate ideas, resources, and perspectives.

Coleman (1988) provides support for the interaction of social capital and human capital, arguing that the combination of such resources, opposed to resources in isolation, can produce different system level behavior. Supporting this, at an organizational level of analysis, Subramaniam & Youndt (2005) found that human capital in isolation had a negative impact on radical innovation. However, when human capital was interacted with social capital (combined both internal and external social capital) the combination of the two positively influence radical innovation. The authors reason that social capital is a means to combine previously unconnected intangible assets, thus enabling radical innovations. As depicted in Figure 2, I expect the impact of human capital on exploratory search will be magnified when inter-informational social capital is high and reduced when inter-informational capital is low.

Insert Figure 2

Hypothesis 6a: The stronger the inter-informational social capital of the team, the greater the influence of human capital-level on exploratory search.

As argued above, a team's access and exposure to disparate information, resources, and perspectives, through inter-informational social capital, is likely to stimulate exploratory search activities. But in order for the disparate knowledge to stimulate exploratory search, teams need to have the capacity to absorb and apply it for their own use. For example, Tsai (2001) found that a business unit's ability to absorb knowledge from outside the unit was positively and significantly related to business unit innovation and business unit performance.

Teams are not identically capable of acquiring disparate information, resources, and perspectives. Cohen and Levinthal (1990) labeled such ability as "absorptive capacity". In discussing how it impacts innovation, the authors argue that absorptive capacity builds on prior related knowledge. Thus, all else being equal, teams that possess relevant prior knowledge are more likely to harness new knowledge from inter-informational social capital, ultimately stimulating exploratory search.

Teams high on HC-heterogeneity are characterized by diversity and breadth of knowledge and expertise (Bunderson & Sutcliffe, 2002). Teams that have such a diverse and broad knowledge domain are more likely to have the prior related knowledge needed to absorb disparate information, resources, and perspectives from outside the team's boundaries. Without simultaneously considering the HC-heterogeneity and external social capital, a team is likely to encounter what Tsai (2001) called a "search-transfer

problem" or the situation where a team cannot utilize the disparate knowledge obtained through inter-informational social capital. Additionally, those teams that have a greater ability to absorb knowledge from outside the firm's boundaries can encourage a greater diversity of knowledge elements or stimuli within the team, enabling less rigid thought patterns so that more novel combinations are created (Wadhwa & Kotha, 2006).

Thus, HC-heterogeneity will act as a means to effectively absorb the disparate knowledge from outside the team's boundaries. To the extent that teams develop external social relations with non-redundant ties, they will receive disparate information that is likely to further magnify the positive relationship between human capital and exploratory search. Thus, when inter-informational social capital is coupled with high levels of HC-heterogeneity, teams will maximize the diverse informational benefits available to the social unit. As depicted in Figure 3, I expect the impact of human capital-heterogeneity on exploratory search will be magnified when inter-informational social capital is high and reduced when inter-informational social capital is low.

Insert Figure 3

Hypothesis 6b: The stronger the inter-informational social capital of the team, the greater the influence of human capital-heterogeneity (disparate & composite) on exploratory search.

Intra-relational social capital. Although human capital is an important element for complex problem solving, creativity, and innovation (Amabile, 1983; Amabile, 1988; Amabile & Gryskiewicz, 1989; Bantel & Jackson, 1989; Woodman, et al., 1993), human capital's exploratory potential may be partially determined through its interaction with

intra-relational social capital. This is especially important in functionally diverse project teams, where line of authority differs from team member-to – team member, making collaboration and knowledge sharing more problematic.

Teams with high levels of human capital, but lack the willingness to share and exchange such human capital, are not likely to realize the potential benefits of human capital. In fact, it may actually reduce exploratory search activities as team members return to what they have always done. Alternatively, when high levels of human capital are paired with willingness for team members to collaborate and exchange knowledge, the potential benefits of human capital maybe realized. Thus, intra-relational social capital is expected to magnify the positive effects of human capital when intra-relational social capital it high and diminish its effects when it is low.

Insert Figure 4

Hypothesis 6c: The stronger the intra-relational social capital of the team, the greater the influence of human capital on exploratory search.

Intra-relational social capital may also influence the impact of HC-heterogeneity on exploratory search. Team members with diverse ideas and perspective need to be tied to one another in order to stimulate exploratory search. As a number of studies have revealed, the exchange of diverse ideas and perspectives leads to constructive challenging of project plans and increased intrinsic motivation for the project itself (Amabile, et al., 1996; Woodman, et al., 1993). Intra-relational social capital encourages the sharing of diverse ideas and perspectives within a team (Balkundi & Harrison, 2006).

Intra-relational capital may further enhance the importance of HC – heterogeneity for exploratory search. While HC – heterogeneity, in and of itself can stimulate exploratory search, intra-relational social capital may aid in combing the unique ideas and perspectives of team members, thereby creating a situation that fosters constructive challenging of ideas that are likely to stimulate exploratory search.

Diverse knowledge structures can elicit a type of learning and problem solving which stimulates exploratory search. However, the ability to capitalize on this diversity of knowledge and perspectives assumes team members have an adequate knowledge overlap (Cohen & Levinthal, 1990). This overlap helps to ensure effective communication and interactions across individuals who posses diverse and different knowledge structure. This is especially important in the context of team innovation, where the transfer of tacit or complex information is of utmost importance for stimulating team innovation (Kogut & Zander, 1992).

A possible means to overcome this is through intra-relational social capital. Team intra-relational social capital supports the exchange and transfer of information, knowledge, and perspectives (Coleman, 1990). Thus, as HC-heterogeneity increases and the overlap of knowledge becomes smaller, all else being equal, those teams with strong internal social capital will be more likely to exchange and transfer their diverse information, knowledge, and perspectives (Balkundi & Harrison, 2006). Supporting this, Uzzi (1997) and Hansen (1999) have found that strong internal social capital and dense social networks are a necessary condition needed for fine grained knowledge transfer, such as the type of knowledge needed to stimulate exploratory search activities. Teams with HC-heterogeneity when paired with strong intra-relational social capital are more

likely to stimulate exploratory search, reaping the benefits of HC-heterogeneity. Thus, I expect the impact of human capital-heterogeneity on exploratory search will be magnified when inter-informational social capital is high and reduced when intra-relational social capital is low.

Insert Figure 5

Hypothesis 6d: The stronger the intra-relational social capital of the team, the greater the influence of human capital-heterogeneity (disparate & composite) on exploratory search.

Team Codified Capital

As stated above, human capital, on average is expected to have a positive linear relationship with exploratory search as it provides the raw materials needed for complex problem solving and decision making associated with exploratory search (Amabile, 1983; Woodman, et al, 1993). However, it is expected that the positive effect of human capital on exploratory search will vary by level of team codified capital.

On the one hand, as codified capital increases, teams may be more likely to rely on past procedures that have proved successful (Nelson & Winter, 1982). This type of scenario may lead to a tendency to rely on the status quo (Dougherty and Hardy, 1996). When considering the influence of codified capital on the relationship between human capital and exploratory search, it is conceivable that, while high levels of human capital are associated with the ability to use complex decision making toward innovative solutions to tasks, the presence of extensive codified capital may increase team's reliance on what has worked in the past rather than what they are potentially capable of doing.

On the other hand, teams with low levels of codified capital are not in a position to rely on preserved knowledge and prevailing routines for problem solving (Subramaniam & Youndt, 2005). As a result, under conditions of low levels of codified capital, teams are more likely to be forced to rely on their own complex decision making skills toward solutions that are not steeped in past practice. The end result isthat lower levels of social capital could increase team's reliance on exploratory search activities to solve problems. As depicted in Figure 6, I expect that the impact of human capital on exploratory search will be magnified when codified capital is low and reduced when codified capital is high.

Insert Figure 6

Hypothesis 7a: The greater the codified capital of the team, the less of an influence human capital-level will have on exploratory search.

Additionally, it is expected that the positive impact of HC-heterogeneity is likely to vary by the level of codified capital within the team. HC-heterogeneity plays a substantial role in providing diverse perspectives and insight to a team (Hambrick & Mason, 1984; Webber & Donahue, 2001; Wiersema & Bentel, 1992). However, existing preserved knowledge is expected to moderate the relationship between HC-heterogeneity and exploratory search for two reasons.

First, exploratory search is concerned with creating variety in experience and thrives on free association and discovery between unassociated knowledge domains (Holmquist, 2004). While codified capital reinforces prevailing knowledge and processes

(Nelson & Winter, 1982; Subramanian & Youndt, 2005), HC-heterogeneity provides a diversity of ideas and perspectives (Hambrick & Mason, 1984; Webber & Donahue, 2001; Wiersema & Bentel, 1992). When HC-heterogeneity is combined with codified capital, teams will have a context where team members may be more likely to turn to routines and processes – the accepted and established ways of solving problems, even in the presence of diverse knowledge and perspectives.

Second, a team's HC-heterogeneity enhances the diversity of knowledge and perspectives among team members (Hambrick & Mason, 1984; Webber & Donahue, 2001; Wiersema & Bentel, 1992). In fact, its value lies in how it exposes team members to a greater variety of unusual ideas, constructively challenging their current perspectives (Amabile, et al, 1996), ultimately stimulating exploratory search. When HC-heterogeneity is augmented with codified capital, the impact of HC-heterogeneity on exploratory search is likely to be reduced. The use of preserved knowledge and prevailing practices is likely to decrease the constructive challenging of a team member's ideas and perspectives since the established way of doing things is less likely to provoke debate or reflection from team members.

Taken together, as depicted in Figure 7, I expect that team codified capital will moderate the negative relationship between HC-heterogeneity and exploratory search activities and leads to the following hypotheses:

Insert Figure 7

Hypothesis 7b: The greater the codified capital of the team, the less of an influence HC-heterogeneity will have on exploratory search

METHODS

Research Sample

Company ABC is a Fortune 500 organization with a diversified product and service portfolio, specializing in the design and manufacturing of motion and control technology, such as hydraulic and automation systems. Company ABC has over 60,000 employees world-wide, but this survey covered teams within United States locations. The company is organized into eight business units, with each business unit targeting multiple customer segments and markets. Business units are composed of multiple divisions, each having a unique charter and product line. Divisions often have multiple locations in the U.S. and abroad.

Engineering teams, the sample used to test the hypotheses, are located at each location. Team members design product specifications based on customer needs, test products to ensure quality of components and systems, and modify existing product lines to new customer requirements. Team members report to the engineering manager at each location, who coordinates the projects within their location.

The ideal sample to test the proposed model is project teams, with team members that provide a diversity of perspectives to team problems such as functional backgrounds, educational backgrounds, diversity in experience, or diversity in organizational tenure. In this sample, all team members were engineers, however diversity existed in the type of engineer (software, mechanical, civil, etc.), functional experience, work experience (cross-business unit experience and cross-company experience), and industry experience.

Survey Procedure

Pilot study. Survey measures were tested at an individual level of analysis, with a sample of 150 master's students at a public university in the Northeast. Respondents completed the survey (minus team social network questions) and this data was utilized to check the reliability and validity of survey measures (Aguinis, Henle, & Ostroff, 2001; Hinkin, 1995; Hinkin, 1998; Scandura & Williams, 2000).

Main study. Engineering teams were identified at each location by the human resources (HR) representative responsible for that location. HR representatives were asked to review engineering team members with the location's engineering manager prior to submitting the participants for the study. Team member names were submitted and used to create the employee roster for the social capital variables.

The primary sources of data for this study came from surveys. Surveys were distributed to work teams via their HR representative. Respondents completed the 10 to 15 minute survey during breaks at work, while at home, or during staff meetings. Each survey included an envelope to seal and return the completed survey. Surveys were collected by the HR representative at each location and sent to the primary researcher to ensure confidentiality.

Descriptions of Individual Respondents

Surveys were distributed to 1,723 engineers. Six surveys were returned because the employees had left the organization or were on a leave of absence. Of the remaining 1,717 surveys 1,320 were returned for an overall response rate of 76.6 percent. On average, engineers had worked in the company for 12.9 years and 37.6 percent of respondents had direct reports. Demographically, the average of respondents was 43.9

years old, 91.0 percent of respondents were male, and 12.4 percent were an ethnic minority (Asian, Black, Hispanic, or Native American). Educationally, 37.9 percent of the sample had no college degree, 48.0 percent had a four-year degree, and 14.1 percent had a master's degree or higher. The characteristics of nonrespondents and respondents were generally similar with one exception. Nonrespondents were slightly older $F(1, 1709) = 4.03$, $p > .05$.

Description of Engineering Teams

Team inclusion criteria. Engineering teams were defined as having four or more members who reported to the same manager and were in the engineering function at a specific location. Of the teams originally sampled, they were included in the final analysis if they met two criteria:

(1) Response Rate: Network analysis requires a high response rate to gain meaningful insight into the analysis (Wasserman & Faust, 1994). Typically, response rates in the social network literature range between 65 and 95 percent (Stork & Richards, 1992). Following past team-based social network research, teams with less than 70 percent response rate on the social network questions were excluded from the analysis. This excluded 29 out of 107 teams or 27.1 percent of the teams.

(2) Aggregation Statistics: Aggregation statistics were calculated for each team (aggregation statistics for measures is reported in following section). The average r_{wg} and medium r_{wg} were calculated for each team, for each measure (codified capital, exploratory search, radical innovation, incremental innovation and work group interdependence). Teams that had average r_{wg} statistics lower than 0.56

were removed from further analysis (Bliese, 1998; James, Demaree, & Wolf, 1984). This included 24 out of 107 or 22.4 percent of the teams.

Please see Table 6 for aggregation statistics.

Description of engineering teams. Exclusion of teams that did not meet these two criteria reduced the final sample from 107 to 60 (56.1 percent of the locations in the population), with an average size of 14.2 members and an average number of respondents of 14.5. For each included team, missing social network data was replaced with the median value for the team[5]. For the average team, 50 percent to 60 percent of their projects were sustaining their current products over development of new products.

Survey

Please see Appendix 1 for the original survey items from the proposal and Appendix 2 the company specific revisions to the items. The following section will discuss the survey instrument for the human capital and social capital variables. The remaining survey items are discussed in the "independent variables" section.

Human capital. Human capital was captured using five variables functional experience (functional area experience), industry experience, cross-business unit experience, organizational experience (number of organizations worked for), and education (level and degree). Functional experience was solicited by asking team members to indicate the functions they have previous worked in from a list of nine functional areas (see Appendix 2 for a list of functional areas). Industry experience was solicited by asking respondents to indicate the industries they had experience working in

[5] For example, if a 10 member team had 8 members respond, the median value for the network variables were imputed for the two missing cases. This process was utilized for all network measures except the index of qualitative variation (IQV). The IQV is calculated as a proportion of those team members who have outgoing ties to specific locations, making it impossible to calculate an average.

from a list of 12 (see Appendix 2 for a list of industries). Cross-business unit experience was solicited by asking team members to identify the business units within their current organization they have had experience working in from a list of eight business units. Organizational experience was assessed by asking respondents to indicate how many organizations they have worked for doing similar work, values could range from this organization only to 6+ organizations. Education was solicited by two questions. First, respondents indicated the educational background that most closely represents their undergraduate university degree from a list of 18 degrees (see Appendix 2 for a list of degrees) (Wiersema & Bantel, 1993). Additionally, respondents indicated their highest degree completed from the following: high school or less, college undergraduate (no degree), two-year college degree, four-year college degree, master's degree, or doctoral degree.

Social capital. The network data was collected through a sociometric instrument (using fixed roster approach) and free recall approach (Wasserman & Faust, 1994). For the fixed roster, the network survey presented an individual respondent with an alphabetical list of each location's engineering team members as well as the engineering team members at the other locations within their business unit (see Marsden [1990] for a discussion of roster method approach). The names of engineering team members were gathered from human resource management professionals at each location (see Appendix 2 for an example survey) and aggregated to create a business unit wide fixed roster. Respondents were asked to "Place a mark next to the engineers within the [enter business unit name] you go to or interact with in order to solve work problems" (Wasserman &

Faust, 1994). This response format produces dichotomous relationships (they are present or not) instead of valued responses that identified the strength of the ties.

The free recall approach was utilized to identify individuals, outside their business unit, but within the organization that respondents went to in order to solve work related problems (Wasserman & Faust, 1994). Respondents were asked "Please list the first and last names of other Company ABC engineers or other technically trained employees (i.e., chemist, R&D scientists, etc.) outside of [enter business unit name] whom you interact with in order to solve work problems." No constraint was up on the number of people that an individual respondent could list in the free recall approach.

Independent Variables

Human capital -level. *Human capital-level*, was calculated using seven variables, the average of team member's: (1) functional experience-level, (2) industry experience-level, (3) cross business unit experience-level, (4) organizational experience-level, and (5) education-level. As indicated in Table 3, on average engineering teams had experience in only a single business unit at Company ABC (mean=1.03, s.d.=0.14), worked for an average of 1.5 organizations, outside of Company ABC (mean=1.47, s.d.=0.50), and held a four-year degree (mean=3.38; s.d.=0.64). The average engineering team had worked in 2 different functions (mean=2.03, s.d.=0.49) and 1.5 different industries (mean=1.67, s.d.=0.41).

Human capital-heterogeneity. Drawing on the categorization of diversity in the previous literature (Bunderson & Sutcliffe, 2002; Harrison & Klein, 2007) diversity as variety was assessed by examining seven forms of human capital-heterogeneity: (1) business unit-heterogeneity, (2) organizational experience-heterogeneity, (3) educational-

heterogeneity, (4) functional experience-heterogeneity, (5) industry experience-heterogeneity. Variables were calculated using three different diversity measures based on the item's response scale. The following discussion, of the five independent variables, is organized by type of diversity measure.

For categorical variables (educational background and organizational experience), *Blau's (1977) heterogeneity index* was used to calculate HC-heterogeneity. For example, educational-heterogeneity was computed by identifying their dominant educational background (their undergraduate degree) and then computing the heterogeneity index proposed by Blau (1977) heterogeneity index:

$$(1-\sum p_i^{\,2}),$$

where p_i is the proportion of the group in the i^{th} category. A high score on the index indicates variability in the educational background among team members or educational heterogeneity. The maximum value corresponds to 1 and the minimum value corresponds to 0. The measure is a function of the distribution of team members across different educational areas. Dominate educational level was defined as the respondents highest degree received and organizational experience was indicated by the number of previous organizations the respondent has worked at[6]. A score was calculated for each engineering team for educational heterogeneity (mean=0.76, s.d.=0.15) and organizational heterogeneity (mean=0.65, s.d.=0.14).

[6] For interval data (cognitive style, organizational experience, and level of education), diversity of disparity was also employed using Allison 's (1978) coefficient of variation (the standard deviation divided by the mean) . This provides the most direct and scale invariant measure of dispersion (Allison, 1978). For example, to assess the relative heterogeneity in team's organizational tenure, each team's standard deviation of tenure will be divided by the group mean. With the coefficient of variation, a higher value means greater heterogeneity.

A *modified Blau's heterogeneity index*[7] was employed to calculate business unit experience-heterogeneity, functional experience-heterogeneity, and industry experience-heterogeneity, respondents had the option to select more than one response per question. Traditional diversity as variety measures, such as Blau's diversity index, assumes that each respondent identifies a single dominate category. Thus, to overcome this limitation Blau's diversity index was modified to account for a respondent selecting from multiple categories. To do this, maximum diversity is defined as all team members having, for example, worked in all functional areas and minimum diversity is when no team members have worked in any of the functional areas. Which corresponds to the following:

$$\frac{(\Sigma p_k)}{k}$$

where *p* is the proportion of team members in *k*th category. The maximum value corresponds to 1 and the minimum value corresponds to 0. A score was calculated for each engineering team for business unit-heterogeneity (mean=0.13, s.d.=0.02), functional experience- heterogeneity (mean=0.22, s.d.=0.05), and industry experience-heterogeneity (mean=0.14, s.d.=0.03).

A location's engineering team's *composite index of human capital* was calculated by summing the five human capital-heterogeneity variables (business unit- heterogeneity, organizational experience- heterogeneity, educational- heterogeneity, functional

[7] Additionally, diversity of these three measures was also assessed by assigning a 1 to teams that had someone with experience in, for example a certain functional area, and 0 to teams that did not have any one who had experience in that functional area. The measure was calculated using the same formula listed above. Analysis using this index did not vary from the Modified Blau's Heterogeneity Index mentioned above.

experience- heterogeneity, and industry experience- heterogeneity). Values range from a minimum of 0.97 to a maximum of 2.32 with an average of 1.91 (s.d.=2.4).

Intra-relational social capital. A location's engineering team's intra-relational social capital was calculated as the density in their problem solving network. Consistent with other team social network research (e.g., Hansen, et al., 2005), network density was calculated as the number of existing relations divided by the number of possible relations, which is given by *N*N-1* , $N \times (N-1)$ where *N* is the number of engineering team members at that location (Wasserman & Faust, 1994). The measure has a range of 0 to 1, with 0 indicating "no relations exist" and 1 indicating "all relations possible exist." Values range from a minimum of 0.31 to a maximum of 0.92 with an average of .64 (s.d.=0.52).

Inter-informational social capital. A location's engineering team's inter-informational social capital was calculated using a network range approach. Network range is defined as the extent to which a location's network links to diverse other networks (Burt, 1983). Range was measured by three variables: (1) inter-informational social capital 1, (2) inter-informational social capital 2, and (3) inter-informational social capital 3. For each, the three measures were operationalized as follows:

Intra-informational social capital 1. To identify the variety of a group's inter-informational social capital, a variation of the Blau's Index was employed. Blau's index identifies the spread of members (team member ties) across qualitatively different or novel categories (business unit locations). However, the maximum possible value of this measure increases as the number of novel categories increases (Harrison & Klein, 2007) making it inappropriate for comparison across business units that vary in their number of

locations. The index of qualitative variation (IQV) is consistent with Blau's Index in that it identifies the spread of team member's ties across business unit locations. However, it standardizes Blau's index by dividing by its theoretical maximum (Agresti & Agresti, 1978). A variation of the IQV index was utilized to calculate inter-informational social capital 1:

$$\frac{(\sum_{i}^{k} p_i)}{(1-k)}$$

where, *p* is the proportion of team members in a particular location to ties in *i* locations in a certain business unit, and *k* is the total number of locations within a certain business unit. For each respondent, it was identified if they had a tie across *i* locations within their business unit. The proportion of individuals who have ties in location *i* were identified and then summed across the number of locations within their business unit. To control for the number of locations within a business unit, it was divided by the maximum possible value: $(1-k)$. Values were calculated for each team and vary from a minimum of 0.02 to a maximum of 0.56 (mean=0.17, s.d.=0.09).

Inter-informational social capital 2. A second measure was calculated for inter-informational social capital. Following past research (Oh, et al., 2004), this measure was a simple count of ties in a location to others in the business unit. It was calculated as the sum of employee's ties within that location to others in that business unit (excludes those in their location). For those employees who did not complete the survey the average of the ties at their location, who did complete the survey was imputed for the missing value. This value was standardized taking into account the total possible number of ties. Values for inter-informational social capital 2 range from a minimum of 4.40 ties to a maximum of 25.44 ties (mean=15.01, s.d.=5.33).

Inter-informational social capital 3. A third measure was calculated for inter-informational social capital. This measure was a simple count of ties to others in the organization. It was calculated as the sum of ties within that location to others outside their business unit but within the organization. For those employees who did not complete the survey the average of the ties at their location, who did complete the survey was imputed for the missing value. Values for inter-informational social capital 3 range from a minimum of 0.00 to a maximum of 3.22 (mean=0.71, s.d.=0.71).

Codified capital. Drawing on past measures of codified capital (Schulz, 2001; Subramaniam & Youndt, 2005) *codified capital* was measured with three items, using a 7-point Likert-type response scale. Team members responded to questions using a scale ranging from 1, anchored in "strongly disagree" to 7, anchoring on "strongly agree." Team codified capital items are listed in the Appendix 2 and descriptive statistics listed in Table 3 (alpha = .71, mean=4.87, s.d.=0.51).

Exploratory search. Following recommendations by Gupta, et al. (2006) exploratory search was assessed by items specific to the context. Project team members evaluated the team's exploratory search activities, using a scale ranging from "strongly disagree", 1, to "strongly agree", 7. The average and standard deviation for each team was calculated (alpha=0.91, mean=4.87, s.d.=0.52). Team exploratory search items are listed in Appendix 2 as well as a description of the multi-stage process will be used to ensure the reliability and validity of the items in Appendix 3.

Perceived radical and incremental innovation[8] was measured on the basis of scales from Gatignon, et al. (2002) and Subramanian & Youndt (2005). From interviews with engineering managers, scales were modified to ensure clarity and relevance for the

[8] Objective measures of radical and incremental innovation were collected from division controllers. This study was designed for a team level of analysis instead of a division, making the division objective measures not applicable.

context. Both team members assessed innovation using six-items, 5-point Likert type response scale ranging from "very poor", 1, to "excellent", 5. Radical and incremental innovation items are listed in Appendix 2 and the descriptive statistics listed in Table 3 (alpha = .76, mean=2.55, s.d.=0.35 and alpha = .87, mean=3.77, s.d.=0.27, respectively).

Control variables[9]**.** Previous research suggests that *group size* influences team dynamics and performance (Moreland and Levine, 1992; Shaw, 1981) and larger teams have more potential for heterogeneity (Bantel & Jackson, 1989). Team size was controlled for by including the number of team members as a control variable (mean=14.49, s.d=10.57). Also, following past research (Oh, et al., 2004) the *size of the team's network* was controlled for. Size of the team's network was calculated as the sum of the total number of ties for each group (mean=141.49, s.d.=179.72). By controlling for the size of the network, it is possible to address the possibility that results are due to the "extensivity" of the network (Burt, 2000). Interviews with engineering manager's revealed *type of engineering project* (such as product modification or new product development) and *project interdependence* (the extent that team members are dependent on other divisions or business unit teams) were two additional variables which could influence team dynamics and performance. Type of engineering project was measured by percentage of time engineering team modified existing products or developed new products (mean=3.55, s.d.=0.95). Project interdependence was measured using three items modified by Campion, Medsker, & Higgs (1993) (alpha = .76, mean=5.11, s.d.=0.46) and are listed in Appendix 2. *Gender diversity* and *ethnic diversity* was also taken into consideration. Gender and ethnic diversity was calculated using Blau's

[9] This study also collected a measure of culture for innovation (Sundgren, Selart, Ingelgard, & Bengtson, 2005). Post hoc analysis included this measure, as a control variable, and did find it to have a significant and positive relationship with exploratory search and incremental innovation. The sign and direction of the results did not change and therefore removed from this write-up.

diversity index (1977) for each engineering team (mean=0.14, s.d.=0.14 and mean=0.13, s.d.=0.16, respectively).

RESULTS

Psychometrics & Descriptive Statistics

Factor analysis. Principle components factor analysis with Quartimax rotation was utilized it identify the extent to which survey items form coherent subsets of dimensions that are relatively independent of each other (Tabachnick & Fidell, 1996). As indicated in Table 4, the analysis identified five factors (exploratory search, radical innovation, incremental innovation, project interdependence, and codified capital), with all items loading on expected factors with a few cross-loadings greater than .10 and no cross-loadings greater than .30. The five factors individually accounted for 10.30 percent of variance to 23.70 percent of variance, with the total variance accounted for reaching 69.74 percent.

Correlations. Table 5 includes the correlations for the variables included in testing this model. In general, correlations were in the expected direction. An exception is the negative and significant correlation between educational-heterogeneity and exploratory search. Another result to note is the highly significant correlation between team size and size of team network ($r=0.96$; $p<.001$). Given this, size of network was removed from the initial regression analysis to reduce the multicolinarily and increase statistical power (Cohen, 1988).

Aggregation statistics. Aggregation statistics were calculated for measures and for each location. Table 6 reports the aggregation statistics for measures (codified capital, exploratory search, radical innovation, incremental innovation and work group

interdependence) which include average r_{wg}, medium r_{wg}, ANOVA, ICC1, and ICC2. The results reported include the original 107 teams. The aggregation results from the ANOVA indicated there were not significant differences between locations, not providing support for aggregation of measures (Bliese, 1998). The average r_{wg} and medium r_{wg} was greater than .56 (except for codified capital and work group interdependence) warranting aggregation of these variables (Bliese, 1998; James, Demaree, & Wolf, 1984). The ICC(1) values ranged between 3 percent and 8 percent of responses that are due to team level effects (Bliese, 2000). The ICC(2) values ranged by 0.23 and 0.46 (Bliese, 2000). Given this, teams that did not have average r_{wg} greater than .56 were excluded from the study.

Exploratory Search Results

Radical innovation. Table 7 (Models 1 and 2) shows the results of the regression analysis used to test Hypothesis 1, which predicts that exploratory search will be positively related to radical innovation. Model 1 includes the control variables: size of location, work team interdependence, type of task, gender diversity, and ethnic diversity. Of these, only work team interdependence had a positive and significant relationship with radical innovation. Model 2 extends Model 1 by introducing exploratory search into the equation. Support for Hypothesis 1 was not found as exploratory search had a positive but not significant relationship with radical innovation. The entire model, including control variables accounted for 4.6 percent of the variance in radical innovation.

Incremental innovation. As reported in Table 7 (Model 3 and 4) Hypothesis 2 proposes a negative relationship between exploratory search and incremental innovation. Model 3 takes into consideration the five control variables: size of location, work team

interdependence, type of task, gender diversity, and ethnic diversity. Two control variables, type of task and ethnic diversity, had a significant and positive relationship with incremental innovation. Model 4 extends Model 3 by introducing the influence of exploratory search on incremental innovation. The analysis indicates the exploratory search has a positive and significant relationship with incremental innovation (b = .164, t = 2.36, ΔR^2 = .073, F = 5.56, n = 60). The entire model accounted for 20.9 percent of variance in incremental innovation.

Human Capital Results

Human capital-level. Hypothesis 3a tested the relationship between level of human capital and exploratory search, proposing a positive linear associated between level of team member's human capital-level and exploratory search. The result of this hypothesis can be found in Table 8 (Model 1 and 2). Model 1 includes the control variables, size of location, interdependence, type of task, gender diversity, and ethnic diversity. The analysis revealed that size of location had a negative and significant relationship with exploratory search, while type of task and gender diversity has a positive and significant relationship with exploratory search. Next, in Model 2 human capital-level variables where entered into the equation, including business unit experience-level, organizational experience-level, education-level, functional experience-level, and industry experience-level. The results indicate that business unit experience-level, organizational experience-level, and functional experience-level have a positive, but non-significant ($p < .05$) coefficient. Alternatively, education-level and industry experience-level had a negative but non-significant coefficient with exploratory search. When the p value is relaxed ($p < .10$) functional experience has a marginally significant

positive association with exploratory search, while level of education has a marginally significant negative association with exploratory search. The entire model including the control variables and the five human capital-level variables is non-significant at $p < .05$, accounting for an additional 9.6 percent of the variance in exploratory search.

Human capital-heterogeneity. Hypothesis 3b proposes a positive linear relationship between HC-heterogeneity and exploratory search. To test this hypothesis, exploratory search was regressed on business unit-heterogeneity, organizational experience-heterogeneity, educational-heterogeneity, functional experience-heterogeneity, and industry experience-heterogeneity. After taking the control variables into consideration, the results are similar to the human capital-level results. As indicated in Table 8 Model 3, business unit-heterogeneity, organizational experience-heterogeneity, and functional experience-heterogeneity had a positive but non-significant relationship with exploratory search. Educational-heterogeneity and industry experience-heterogeneity had a negative but non-significant relationship with exploratory search. The entire model with the five control variables and five human capital-heterogeneity variables was not significant, accounting for less than 6.7 percent of the variance in exploratory search.

Human capital-heterogeneity (composite). Hypothesis 3c tests the relationship between a composite measure of human capital-heterogeneity and exploratory search. As indicated in Table 8 (Model 4), support for Hypothesis 3c, or a positive impact of the human capital-heterogeneity composite index on exploratory search was not found. After taking the control variables into consideration, human capital-heterogeneity composite index had a negative but non-significant relationship on exploratory search.

Social Capital Results

Inter-informational social capital. Table 9 (Model 1) examines the results of the regression analysis used to test Hypothesis 4a, which proposed a positive and significant relationship between inter-informational social capital and exploratory search. Model 1 includes the five control variables and the three inter-informational social capital variables. Support for Hypothesis 4a was not found. Inter-informational social capital 1 and inter-informational social capital 3 had a positive but non-significant coefficient with exploratory search. Inter-informational social capital 2 had a slightly negative and non-significant coefficient.

Intra-relational social capital. Table 9 (Model 2) shows the results of the regression analysis to test Hypothesis 4b, which proposes a negative and significant linear relationship between intra-relational social capital and exploratory search. Support for this hypothesis was not found, as intra-relational social capital had a negative but non-significant relationship with exploratory search.

Codified Capital Results

Hypothesis 5 proposed a negative and significant relationship between codified capital and exploratory search. As indicated in Table 9 (Model 3), Hypothesis 5 was not supported. After taking control variables into consideration, codified capital has a positive and significant relationship with exploratory search ($b = .339$, $t = 3.01$, $\Delta R^2 = .10$, $F = 9.07$, n = 60), accounting for an additional 10 percent of variance in exploratory search.

Interaction Results

The above analysis examined the unique main effects of intangible assets (human capital, social capital, and codified capital) on exploratory search. However, by examining one form of intangible asset, such as human capital, in isolation may ignore the unique impact that intangible assets have on exploratory search when they work together (Coleman, 1988; Florin, et. al., 2003; Subramaniam & Youndt, 2005). Hypothesis 6a through 7b examines the interaction between intangible assets to identify if additional explanatory power exists when intangible assets are examined in combination with each other. In each regression analysis, predictors of exploratory search were entered in three steps. Step 1 included the five control variables, Step 2 included the independent variables, and Step 3 included the interaction between the independent variables. This process allows the variance due to control variables and main effects to be removed from the equation prior to examining the interaction effects (Cohen & Cohen, 1983). Given the number of interaction conducted, only interactions that were significant are included in Table 10.

Human capital. Hypothesis 6a through 6d examines the interaction of human capital and social capital on exploratory search. Hypothesis 6a argues that the stronger the inter-informational social capital of the team, the greater the influence of human capital-level on exploratory search. This hypothesis was tested using the five human capital variables (business unit experience-level, organizational experience-level, education-level, functional experience-level, and industry experience-level) and three inter-informational social capital variables, for a total of 15 models. None of the models approached significance. Thus, no support was found for Hypothesis 6a.

Hypothesis 6b argues that the stronger the inter-informational social capital of the team, the greater the influence of human capital-heterogeneity on exploratory search. This hypothesis was tested using the six human capital-heterogeneity variables (includes the composite index) and the three inter-informational social capital variables, for a total of 18 models. Support for Hypothesis 6b was not found since none of the models approached significance.

Hypothesis 6c proposes that the stronger the intra-relational social capital of the team, the greater the influence of human capital on exploratory search. This hypothesis was tested using the five human capital variables and the intra-relational social capital variable, for a total of five models. None of the five interactions had a significant impact on exploratory search. Given this, no support was found for the interaction of intra-relational social capital and human capital on exploratory search.

Hypothesis 6d argues that the stronger the intra-relational social capital of the team, the greater the influence of human capital-heterogeneity on exploratory search. This hypothesis was assessed using the six human capital-heterogeneity variables and the intra-relational social capital variable, for a total of six interactions. Consistent to the results in Hypothesis 6c, none of the six interactions had a significant impact on exploratory search. Thus, no support was found for Hypothesis 6d.

Codified capital. Hypothesis 7a through 7b examines the interaction of human capital and codified capital on exploratory search. Hypothesis 7a argues that the greater the confided capital of the team, the less of an influence human capital-level will have on exploratory search. This was tested using the five human capital-level variables, for a total of 5 models. As indicated in Table 10 (Model 1), only the interaction of education-

level and codified capital was significant. For interpretation, Figure 8 plots the significant interaction of education-level and codified capital on exploratory search.

Hypothesis 7b examines the interaction of human capital-heterogeneity and codified capital on exploratory search. This hypothesis argues that as codified capital increases, the less of an influence human capital-heterogeneity will have on exploratory search. None of the six interactions had a significant impact on exploratory search. Thus, no support was found for Hypothesis 7b.

DISCUSSION AND CONCLUSIONS

This dissertation examined the impact of team intangible assets (human capital, social capital, and codified capital) on radical and incremental innovation through a process mechanism of exploratory search activities. While many of the results are non-significant, this dissertation still holds important implications for both theory and practice, which are detailed below.

This section is organized as follows. First, a summary of the empirical findings will be presented. Second, the contributions and implications of this research study for theory and practice will be discussed. Third, a review of this study's limitations and suggestions for future research will be provided.

Summary of the Empirical Findings

Hypothesis 1 and Hypothesis 2 examined the influence of exploratory search on radical and incremental innovation. The results of this analysis do not lend support to the proposed hypothesis for a positive relationship between exploratory search and radical innovation (Hypothesis 1) and a negative relationship with incremental innovation (Hypothesis 2). Instead, the results indicate no relationship between exploratory search

and radical innovation and a positive and significant relationship between exploratory search and incremental innovation. The significant relationship would suggest that as a team's exploratory search activities increases so too will there propensity to innovate by making modifications to current product offerings.

These findings could be accounted for by the current strategy for Company ABC as it relates to radical and incremental innovation. Company ABC has traditionally been an organization that acquires other companies to achieve their 5 percent a year growth targets. Newly acquired organizations provide a supply of products that are quickly incorporated into Company ABC product lines. However, true internally grown radical innovations, ones that disrupt the organizations current product lines or existing capabilities, are limited. This may restrict the range of the radical innovation variable making it difficult to assess the true relationship between exploratory search and radical innovation.

At the same time, incremental changes in current product lines are Company ABC's core capabilities. The company's performance management system, variable compensation system, and promotional requirements are aligned with making current product lines more effective. In the process of making incremental changes to existing product lines, engineering teams that search broadly for solutions, may gather diverse information and perspectives (Taylor & Greve, 2006). However, the related human resource management system of practices is not aligned to support radical innovation (Huselid, 1995). It is possible that exploratory search activities result in the gathering of diverse information and perspectives being incorporated into incremental changes to existing product lines, rather than radical changes.

Hypothesis 3a proposed a positive and significant relationship between level of human capital and exploratory search. The results for this hypothesis were mixed, depending on the type of human capital-level. Marginal support was found for the positive relationship between functional experience-level and exploratory search. Those teams that have greater levels of functional experience-level (regardless of the diversity in functional experience) perceived the search activities of their team as more exploratory. Alternatively, education-level had a negative and marginally significant relationship with exploratory search. A closer examination of the analysis revealed a zero-order correlation between education-level and exploratory search as 0.05, a partial correlation of -0.27, and a part correlation of -0.22. This pattern of correlations is indicative of multicollinarity between the independent variables. Multicollinarity leads to substantial fluctuations in the size and directions of the regression coefficients, making interpretation of the results misleading (Pedhazur, 1997).

The remaining human capital-level variables (business unit experience, organizational experience, and industry experience) had no relationship with exploratory search. Taken together, the partial support for Hypothesis 3a would indicate that human capital-level may influence exploratory search activities in a team. As a team gains more members with more than a single functional experience their tendency to search broadly for a solution increases too. Interestingly, no relationship was found for the other human capital-level variables. These results would indicate that for teams seeking to enhance exploratory search behavior, staffing to enhance level of experience such as working in multiple business units, working for multiple organizations, and working in multiple industries may not be a factor that drives such behavior.

Hypothesis 3b and 3c argues as the diversity of human capital increases on a team, so too does exploratory search activities. The results for the five human capital-heterogeneity variables and the HC-heterogeneity composite index were consistent with no significant impact of human capital-heterogeneity on exploratory search. Thus, no support was found for the positive influence of human capital-heterogeneity on exploratory search.

A possible explanation for the non-significant findings could be that the relationship between human capital-heterogeneity and exploratory search may depend upon other factors unaccounted for in this study. One possible factor is the location's human resource management system (Huselid, 1995). For example, as stated in Hypothesis 3b and 3c, the cognitive resource perspective suggests that as HC – heterogeneity among team members increases so too does the diversity of information, resources, and perspectives available for the team to utilize. As HC-heterogeneity increases, so too does the team's cognitive resources available for more complex problem solving, such as exploratory search (Hambrick & Mason, 1984; Wiersema & Bentel, 1993; Webber & Donahue, 2001).

At the same time, the benefit gained from heterogeneity of knowledge requires a knowledge overlap to ensure effective integration. For example, Cohen & Levinthal (1990) argues that a consistent base of background knowledge is needed for effective exchange of diverse perspectives. They state "the group as a whole must have some level of relevant background knowledge, and when knowledge structures are highly differentiated, the requisite level of background may be rather high" (p. 132). This evidence could suggest that locations with human resource management systems that do

not support knowledge sharing and collaboration , will not have the mechanisms needed to capitalize on the diverse information and perspectives. In fact, if no human resource management practices are present to ensure such knowledge sharing and collaboration, the relationship between HC-heterogeneity and exploratory search is likely to be negative as HC-heterogeneity becomes too great for team members to actively exchange diverse knowledge and perspectives.

Hypothesis 4a and 4b examined the impact of social capital on exploratory search. Hypothesis 4a was not supported, as intra-relational social capital did not have a significant negative relationship with exploratory search. Likewise, Hypothesis 4b was not supported, as inter-informational social capital did not have a significant positive relationship with exploratory search. A possible explanation for the non-significant results could be failing to take into consideration the quality of information and instrumental resources gained from network ties that span outside of the team's boundaries (Ancona & Caldwell, 1992b; Oh, et al., 2006). The arguments made for Hypothesis 4b argued that when teams are confronted with a task at hand, access to disparate knowledge and resources outside of a team's boundaries (inter-informational social capital) will stimulate exploratory search activities. However, this argument assumes that the information and instrumental resources gained from inter-informational social capital is valuable and disparate enough to stimulate exploratory search. This study did not assess the extent to which project teams felt their inter-informational social capital was valuable contributors to solving problems or the extent to which the inter-informational social capital varied from their own team's knowledge and resources. Thus,

the inter-informational social capital measure quantifies the presence of a boundary spanning network, instead of the perceived value and disparity of the network.

Hypothesis 5 proposed that codified capital will have a negative and significant relationship with exploratory search. Contrary to the proposed relationship, codified capital had a positive and significant relationship on exploratory search; such that those engineering teams that ensure their knowledge is captured and can be accessed by others are more likely to search broadly for solutions to work related problems.

While the current dissertation has proposed a negative relationship between codified capital and exploratory search, past theory and research provides support for a positive relationship between codified capital and exploratory search. In particular, both organizational learning and knowledge based perspectives suggest positive benefits of codified knowledge through encoding. Codification facilitates knowledge flows through the speedy dissemination, storage, and retrieval (Von Krogh, Ichijo, & Nonaka, 2000). For example, team members can post feedback to project plans on team websites, providing their unique perspectives to the entire team in an efficient manner. The unique perspectives or team members provided by readily available codified capital are likely to stimulate exploratory search. Supporting this, using a sample of 182 sales teams, Haas & Hansen (2005) found that for teams with little experience working together the use of codified capital had a positive effect on team performance. Schulz (2001) examined interunit codified knowledge flows and found that codification of knowledge was positively related with horizontal and vertical outflows of knowledge. He stipulates that, "codification is a powerful means to intensify knowledge flows in organizations" (p. 675).

Likewise, Alavi and Leidner (2001) in a review of the knowledge management literature describe the positive role information technology (groupware and internet technologies) plays in facilitating knowledge creation, knowledge transfer, and knowledge application. Additionally, Coff, Coff, & Eastvold (2006) argue that the degree of knowledge codification has a positive influence on the speed of knowledge transfer. Finally, Von Krogh, Ichijo, & Nonaka (2000) argue that codified capital can help in the structure and retrieval of information. Thus, theory and evidence suggest that codified team capital could be a means to enhance exploratory search as it facilities the rapid dissemination, storage, and retrieval of team member's information resources.

Hypothesis 6a through 7b examines the interaction between intangible assets to identify if additional explanatory power exists when intangible assets are examined in combination with each other. Of the 55 interactions modeled for Hypothesis 6a through 7b, only one interaction was significant. As indicated by the plotted interaction in Figure 8, education-level and codified capital provided significantly more explanatory power for exploratory search. For interpretation, Figure 8 plots the significant interaction of education-level and codified capital on exploratory search. Plotting the interaction reveals that the pattern of results is consistent for teams with high and low codified capital. The difference is that the influence of codified capital on exploratory search is greater for those teams that have higher levels of education.

A possible interpretation of the results could be that teams with high levels of human capital are better able to use complex decision making toward innovative solutions to tasks. As codified capital increases, teams with high levels of human capital, such as level of education, may better be able to utilize the codified capital as a means to

stimulate the team to search more broadly for diverse information and perspectives. While teams with lower levels of human capital may not have the complex decision making capabilities to utilize codified capital as a means to stimulate exploratory search. Instead, the preserved knowledge and prevailing routines may be utilized as the solution to the problem as opposed to a point to start exploratory search (Subramaniam & Youndt, 2005).

Contributions to Theory & Empirical Implications

This research study makes several noteworthy contributions to the literature. First, human capital theory provides the foundation for the importance of team intangible assets such as team members knowledge, skills, and expertise (Becker, 1964). While recognizing the value of individual knowledge, skills, and expertise, in the context of project teams, I combined human capital theory with the cognitive resource perspective to identify the importance of level of human capital and the diversity of human capital, or HC-heterogeneity, for achieving innovation (Hambrick & Mason, 1984; Wiersema & Bental, 1993). Recognizing the importance of human capital-level for complex problem solving and decision making (Amabile, 1983; Amabile, 1988; Amabile & Gryskiewicz, 1989; Bantel & Jackson, 1989; Woodman, et al., 1993), it was expected that human capital will be positively associated with exploratory search. The results provide partial support for the role human capital-level plays as a means to stimulate exploratory search activities in engineering teams.

Additionally, it is through the combination of divergent ideas and perspectives that innovative solutions to team tasks are revealed (Bental & Jackson, 1989; Drach-Zahavy & Somech, 2001; Somech, 2006). Thus, I also examined the role of diversity of

knowledge and perspectives as a means to stimulate exploratory search within teams. Interestingly, the results from this study did not provide empirical support for the role of diverse knowledge and perspectives in driving exploratory search. Future research may want to examine the team-based human resource management practices which, when present, provide a team the means to capitalize on the diversity of information and perspectives available to a team.

Second, I recognize that human capital is not the only intangible asset available to a team which might stimulate exploratory search activities. I contribute to the current literature by developing a theoretical model of the integral role team social capital (intra-relational and inter-informational) and team codified capital (latent and codified) plays as mechanisms which impact team innovation by stimulating exploratory search activities. Intra-relational social capital was expected to negatively impact exploratory search activities, as team member's knowledge domains will converge and they will be less likely to constructively challenge team members (Hansen, et al., 2005; Homan, 1950). Inter-informational social capital is expected to positively impact exploratory search as team members receive informational and instrumental benefits by spanning the boundaries outside of the team (Ancona & Caldwell, 1992b).

Interestingly, both inter-relational and inter-informational social capital was not associated with exploratory search activities. Future researchers interested in the impact of intra-relational and inter-informational social capital could benefit from using a more targeted approach to measuring and calculating team social capital variables. As an example, future research could assess a team's social network for the perceived value and

disparity in a team's inter-informational social capital as a means to better understand the role social capital plays in stimulating exploratory search activities.

Codified capital was expected to have a negative relationship to exploratory search as it reinforces the prevailing processes and preserved knowledge within the team (Subramaniam & Youndt, 2005). However, the results from this study revealed a positive and significant relationship between codified capital and exploratory search. As discussed above, a possible reason for these unexpected results is that past theory and research provide various definitions and related theoretical arguments for the role of codified capital. Past management scholars have defined codified capital as an organization's institutionalized knowledge and codified experience stored in databases, routines, patents manuals, and structures (Youndt, Subramanian, & Snell, 2004), an organization's routines and structures that support employees' quest for optimum intellectual performance (Bontis, 1996), an organization's patents, trademarks, copyrights, (Lev, 2001), an organization's legal rights of ownership (technologies, publications and processes that can be patented) and elements of culture, structures, and systems, organizational routines and procedures (Stewart, 1999), to name a few (see Figure 9 for complete definitions).

Insert Figure 9

Thus, it may benefit the management literature to further define the construct of codified capital. For example, it may be possible to identify different types of codified capital such as, latent capital and structural capital. Latent capital could be defined as a

tacit form of knowledge that is difficult or impossible to make explicit. It is the routines, processes, and organizational memory that is difficult to quantify. However, employees utilize these to make sense of particular problems. Alternatively, the second type, structural capital, while still difficult to qualify the value of, is a more explicit form of knowledge. It is documented artifacts, such as manuals, customer databases, patents, etc. which employees utilize to make sense of or solve particular problems.

Third, I argue that by examining team intangible assets in isolation, at best, tells only part of the story. Instead, it is how intangible assets work together that best explains their impact on team processes and team outcomes. Specifically, I examined the moderating role of team social capital (intra-relational and inter-informational) with human capital (level and heterogeneity) and team codified capital with team human capital (level and heterogeneity). Results from this study indicate that by examining intangible assets together may, in some cases, provide additional insights into the impact intangible assets play on team process mechanisms and team outcomes.

Forth, recognizing the value of exploratory search for achieving innovations (Gupta, et al., 2006; Taylor & Greve, 2006), I introduce exploratory search as a process mechanism through which intangible assets impact team innovation. This addresses the recent calls to investigate exploratory search at the team level of analysis (Gupta, et al., 2006), as well as the call to identify other process variables between team inputs and team performance (van Kippenberg, 2003). Appendix 3 provides a detailed description of the scale development and validation. Future work could extend this study's validation of the exploratory search measure with engineering teams by assessing its relationship to innovation outcomes with other types of teams.

In summary, theoretically this dissertation suggested that intangible assets vary within as well as between organizations. While intangible assets are expected to have a main effect on team processes, they can best be understood when examined together. Exploratory search activities are a possible mechanism through which team intangible assets impact team innovation. Empirically, the results from this study confirm, to some extent, these propositions. When proposed hypotheses were not supported, alternative explanations were provided, as well as directions for future research.

Contributions and Implications for Practice

The practical implications of the proposed theory and empirical results can best be understood by examining the ways through which managers can develop and leverage team intangible assets, such as human capital, social capital, and codified capital.

First, when staffing project teams, managers should consider the individual team member educational and career experiences for the unique knowledge and perspectives they can provide the team. Thus, rather than making staffing decisions based solely on individual abilities, managers should be equally concerned with the composition of the project teams. Supporting this, in a recent Harvard Business Review article, entitled "Creativity and the Role of the Leader," authors Teresa M. Amabile and Mukti Khaire discuss the importance of diversity of team members, "…based on interviews with people doing highly creative work in many fields –innovation is more likely when people of different disciplines, backgrounds, and areas of expertise share their thinking. Sometimes the complexity of a problem demands diversity" (Amabile & Khaire, 2008).

Second, this research empirically supported the important role of codified capital for stimulating exploratory search on project teams. This result underscores the

increasingly important role of knowledge management systems for ensuring that valuable information is documented and accessible to other individuals and teams in the organization.

Third, while the storage of codified capital was shown to be an important contributor to exploratory search, this result does not take into consideration the critical role social capital plays in leveraging this information. For example, in the late 1990's organizations heavily invested in applications to store information, hoping to later leverage this information to solve work related problems. However, organizations quickly found the challenges of updating, sorting, and accessing such information. Today, organizations are moving towards utilizing social networks as a means to leverage valuable codified capital stored in knowledge management systems. For example, Siemens introduced "ShareNet" which combines elements of a chat room, team rooms, a database, and a search engine. This application allows Siemens employees to store codified capital in a database as well as leverage this information using mechanisms such as chat rooms and team rooms (Ewing & Keenan, 2001). More recently, IBM has introduced a similar application called IBM Connections. IBM Connections extends Siemen's application by further aligning the storage of codified capital with the ability to leverage that information though social capital. For example, IMB Connections introduces the ability to "dogear" or value different types of information in a knowledge management system, "tag" information with individuals, as well as leverage this information through various social network tools such as instant messaging, team rooms, email, etc. http://www.cio.com/author/101055/C.G.+Lynch

A consistent theme throughout this dissertation is that managers should consider multiple forms of intangible assets simultaneously if they hope to achieve the greatest impact on team innovation. By focusing on one form of intangible asset, at the cost of other intangible assets, may hinder team innovation. Ideally, managers should seek ways to combine intangible assets to optimally balance the opportunities and challenges associated with team intangible assets.

Limitations

This study's results should be interpreted in light of its limitations. A limitation of the current study is the relatively small sample size. Even though data collection returned 1,301 responses to the survey (76.6 percent response rate), the empirical finding were assessed at a team level analysis based on 60 teams. The approximate determination of the sample size necessary to detect an effect, if indeed an effect is present can be achieved using power analysis (Cohen, 1988). Calculation of the necessary sample size requires the a researcher identify: (a) significance criteria, (b) degrees of freedom of the numerator of the F ratio, (c) degrees of freedom of the denominator of the F ratio, and (d) desired power.

Using the information collected in this dissertation, it is possible to calculate the approximate sample size needed to detect an effect, if one indeed existed. Specifically, using eight independent variables, an alpha of .05, and a desired power of .80, a large effect is expected to be detected with 50 teams, a medium effect is expected to be detected with 107 teams, and a small effect is expected to be detected with 757 teams. Taken together, although the sample size of this study is consistent with other team-level

studies (Stewart & Barrick, 2000), a power analysis revealed that the statistical power is limited.

A second limitation of the study is the range restriction of several human capital-heterogeneity variables. Range restriction limits a researcher's ability to assess an effect, as it reduces the correlation between the predictor and outcome variable (Murphy & Davidshofer, 2001). An example of range restriction in the current study is the business unit-heterogeneity. The average engineering team's business unit experience was 1.03 business units (standard deviation = 0.02), in other words on average each team member had worked in only one Company ABC business unit. When this variable was utilized to assess the heterogeneity of business unit experience on a team, the majority of business unit experience of team members was in the same business unit. Thus, the distribution of engineering team experience across a diversity of these business units was greatly restricted. Given this, readers should interpret the non-significant human capital-heterogeneity results with caution.

A third limitation of the study is the subjective, team member assessed, outcome measures of performance. Ideally, objective measures of engineering team performance would be utilized. However, at Company ABC, objective measures of engineering performance existed at a division level of analysis, instead of a team level of analysis. Given this, it is possible that same-source bias exists as only team member's data was collected and utilized in the analysis (Podsakoff & Organ, 1986).

Finally, this study is cross-sectional in design, limiting the ability to understand the impact of intangible assets on exploratory search and radical and incremental innovation. Ideally, a longitudinal design would have been utilized.

Conclusions

This dissertation contributes both theoretically and practically for today's organizations. Theoretically, intangible assets are brought to the team level of analysis and theory is developed to explain how team intangible assets individually and in combination influence team innovation. Exploratory search is identified as a possible process mechanism through which intangible assets impact team performance, exploratory search.

Empirically, the results indicate that the intangible assets, human capital and codified capital individually have a positive relationship with exploratory search activities. Additionally, by examining the combination of codified capital and human capital, we are better able to understand the factors which stimulate exploratory search. Finally, exploratory search was identified as a process mechanism between intangible assets and innovation outcomes. However, the direction and magnitude of the results were unexpected - exploratory search being positively related to incremental innovation and no relationship to radical innovation. The results were discussed and explanations provided for unexpected and non-significant results.

Practically, the theory and empirical evidence from this dissertation provide managers with important information about staffing and managing project teams. First, when staffing teams, managers should consider the individual background and experience team members bring as well as the overall profile of team members human capital. Second, organizations should seek to develop applications or mechanisms that will add in the codification of information about company's products, services, and processes. Third, value for the organization is not generated by codifying information alone, instead it

comes from enabling employees to access and leverage such information. Social capital, in the form of social networks, provides employees the means to know where to access codified capital and how to apply such valuable information.

REFERENCES

Adler, P. S., & Kwon, S. 2002. Social capital: Prospects for a new concept. ***Academy of Management Review***, 27(1): 17-40.

Aguinis, H., Henle, C. A., & Ostroff, C. 2001. Measurement in work and organizational psychology. In N. Anderson, D. Ones, H. K. Sinangil, & C. Viswesvaran (Eds.), ***Handbook of Industrial, Work and Organizational Psychology***, Vol. 1: 27-50. London, U.K.: Sage.

Agresti, A., & Agresti, B. 1978. Statistical analysis of qualitative variation. In K. F. Schuessler (Ed.), ***Sociological Methodology***: 204-237. San Francisco: Jossey-Bass.

Ahuja, G. 2000. Collaboration networks, structural holes, and innovation: A longitudinal study. ***Administrative Science Quarterly***, 45(3): 425-455.

Alavi, M., & Leidner, D. E. 2001. Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. ***MIS Quarterly***, 25(1): 107-136.

Allen, T. J. 1977. ***Managing the flow of technology: Technology transfer and the dissemination of technological information within the R&D organization***. Cambridge, MA: MIT Press.

Allison, P. D. 1978. Measures of inequality. ***American Sociological Review***, 43: 865–880.

Amabile, T. M. 1983. ***The social psychology of creativity***. New York: Springer-Verlag New York Incorporated.

Amabile, T. 1988. A model of creativity and innovation in organizations. In B. M. Staw, & L. L. Cummings (Eds.), ***Research in Organizational Behavior***, Vol. 10: 123-167. Greenwich, CT: JAI Press.

Amabile, T. M. 1996. ***Creativity in context***. New York: Westview Press.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. 1996. Assessing the work environment for creativity. ***Academy of Management Journal***, 39(5): 1154-1184.

Amabile, T., & Gryskiewicz, N. D. 1989. The creative environment scales: Work environment inventory. ***Creativity Research Journal***, 2: 231-253.

Amabile, T. M., & Khaire, M. 2008. Creativity and the role of the leader. ***Harvard Business Review***, 86(10): 100-109.

Ancona, D. G., & Caldwell, D. F. 1992a. Demography and design: Predictors of new product team performance. ***Organization Science***, 3(3): 321-341.

Ancona, D. G., & Caldwell, D. F. 1992b. Bridging the boundary: External activity and performance in new-product teams. ***Administrative Science Quarterly***, 37(4): 634-670.

Angle, H. L., & Van de Ven, A. H. 2000. Suggestions for managing the innovation journey. In H. L. A. H. Van de Ven, & M.S. Poole (Ed.), ***Research on the Management of Innovation: The Minnesota Studies***: 663-697. New York: Oxford University Press.

Balkundi, P., & Harrison, D. A. 2006. Ties, leaders, and time in teams: Strong inference about network structure's effects on team viability and performance. ***Academy of Management Journal***, 49(1): 49-68.

Bantel, K. A. 1993. Top, team, environment and performance effects on strategic planning formality. ***Group and Organization Management***, 18(4): 436–458.

Bantel, K. A., & Jackson. S.E. 1989. Top management and innovations in banking: Does the composition of the top team make a difference? ***Strategic Management Journal***, 10: 107-124.

Barney, J. 1991. Firm resources and sustained competitive advantage. ***Journal of Management***, 17(1): 99-120.

Barney, J. B. 1997. ***Gaining and sustaining competitive advantage***. New York: Addison-Wesley Publishing Company.

Baum, J. A. C., Li, S. X., & Usher, J. M. 2000. Making the next move: How experimental and vicarious learning shape the locations of chains' acquisitions. ***Administrative Science Quarterly***, 45: 766-801.

Becker, G. S. 1964. ***Human capital: A theoretical and empirical analysis with special reference to education***. Chicago: The University of Chicago Press.

Beckman, C. M. 2006. The influence of founding team prior company affiliations on firm behavior. ***Academy of Management Journal***, 49: 741-758.

Benner, M. J., & Tushman, M. 2002. Process management and technological innovation: A longitudinal study of the photography and paint industries. ***Administrative Science Quarterly***, 47: 676-706.

Bentler, P. M. 1990. Comparative fit indexes in structural models. ***Psychological Bulletin***, 107: 238–246.

Bentler, P. M., & Bonett, D. G. 1980. Significance tests and goodness of fit in the analysis of covariance structures. ***Psychological Bulletin***, 88: 588-606.

Blau, P. M. 1977. ***Inequality and heterogeneity***. New York: The Free Press.

Bliese, P. D. 2000. Within-group agreement, non-independence, and reliability: Implications for data aggregation and analysis. In K. J. Klein, & S.W. Kozlowski (Ed.), ***Multilevel Theory, Research, and Methods in Organizations***: 349-381. San Francisco, CA: Jossey-Bass, Inc.

Bliese, P. D. 1998. Group size, ICC values, and group-level correlations: A simulation. ***Organizational Research Methods***, 1: 355-373.

Bontis, N. 1996. There's a price on your head: Managing intellectual capital strategically. ***Business Quarterly***, Summer.

"Borderless Thinking" Equals Innovation. 2006, February 2. *Business Week*.

Borgatti, S. P., Everett, M. G., & Freeman, L. C. 2002. ***Ucinet 6 for Windows: Software for social network analysis***. Harvard: Analytic Technologies.

Brown, M. W., & Cudeck, R. 1993. Alternative ways of assessing model fit. In K. A. Bollen, & J. S. Long (Eds.), ***Testing structural equation models***: 136-162. Newbury Park, CA: Sage.

Bunderson, J. S., & Sutcliffe, K. M. 2002. Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects. ***Academy of Management Journal***, 45: 875-893.

Burningham, C., & West, M. A. 1995. Individual, climate, and group interaction processes as predictors of work team innovation. ***Small Group Research***, 26: 106-117.

Burt, R. S. 1992. ***Structural holes: The social structure of competition***. Cambridge: Harvard University Press.

Burt, R. S. 2000. The network structure of social capital. In R. I. Sutton, & B. M. Staw (Eds.), ***Research in Organizational Behavior***. Greenwich: Jai Press.

Campion, M. A., Medsker, G. J. & Higgs, A. C. 1993. Relations between work group characteristics and effectiveness: Implications for designing effective work groups. ***Personnel Psychology***, 46: 823-850.

Chatman, J. A., & Flynn, F. J. 2005. Full-cycle organizational psychology research. ***Organization Science***, 16(4): 434-447.

Chen, G., Kirkman, B. L., Kanfer, R., Allen, D., & Rosen, B. 2007. A multilevel study of leadership, empowerment, and performance in teams. ***Journal of Applied Psychology***, 92(2): 331-346.

Coff, R. W., Coff, D. C., & Eastvold, R. 2006. The knowledge-leveraging paradox: How to achieve scale without making knowledge imitable. ***Academy of Management Review***, 31(2): 452-465.

Cohen, J. 1977. ***Statistical power analysis for the behavioral sciences***. New York: Academic Press.

Cohen, J. 1988. ***Statistical power analysis for the behavioral sciences*** (2nd ed.). Hillsdale, NJ: Erlbaum.

Cohen, J. 1992. A power primer. ***Psychological Bulletin***, 112: 155–159.

Cohen, J., & Cohen, P. 1983. ***Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences***. Hillsdale, NJ: Erlbaum.

Cohen, W. M., & Levinthal, D. A. 1990. Absorptive capability: A new perspective on learning and innovation. ***Administration Science Quarterly***, 35: 128-152.

Coleman, J. 1990. ***Foundations of Social Theory***. Cambridge, MA: Harvard University Press.

Coleman, J. S. 1988. Social capital in the creation of human capital. ***American Journal of Sociology***, 94: 95-120.

Coombs, R., & Hall, R. 1998. Knowledge management practices and path-dependency in innovation. ***Research Policy***, 27: 237-253.

Cortina, J. M., Chen, G., & Dunlap, W. P. 2001. Testing interaction effects in LISREL: Examination and illustration of available procedures. ***Organizational Research Methods***, 4: 324-360.

Cross, R., & Parker, A. 2004. ***The hidden power of social networks: Understanding how work really gets done in organizations***. Cambridge: Harvard Business School Press.

Curral, L. A., Forrester, R. H., Dawson, J. F., & West, M. A. 2001. It's what you do and the way you do it: team task, team size, and innovation-related group processes. ***European Journal of Work and Organizational Psychology***, 10: 187-204.

Daft, R. L., & Becker, S. W. 1978. ***Innovation in organizations***. New York: Elsevier.

Damanpour, F. 1991. Organizational innovation: A Meta-Analysis of effect of Determinants and Moderators. ***Academy of Management Journal***, 34(3): 555-590.

Deci, E. L., & Ryan, R. M. 1985. ***Intrinsic motivation and self-determination in human behavior***. New York: Plenum.

Deci, E. L., Koestner, R., & Ryan, R. M. 1999. A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. ***Psychological Bulletin***, 125: 627-668.

Dewar, R. D., & Dutton, J. E. 1986. The adoption of radical and incremental innovations: An empirical analysis. ***Management Science***, 32(11): 1422-1433.

Dougherty, D. 1992. A practice-centered model of organizational renewal through product innovation. ***Strategic Management Journal***, 13: 77-92.

Dougherty, D., & Hardy, C. 1996. Sustained product innovation in large mature organisations: Overcoming innovation to organisation problems. ***Academy of Management Journal***, 39(5): 1120-1153.

Drach- Zahavy, A., & Somech, A. 2001. Understanding team's innovation: The role of team processes and structures. ***Group Dynamics***, 5(2): 111-123.

Earley, P. C., & Mosakowski, E. 2000. Creating hybrid team cultures: An empirical test of transnational team functioning. ***Academy of Management Journal***, 43: 26-49.

Edmondson, A. 1999. Psychological safety and learning behavior in work teams. ***Administration Science Quarterly***, 44: 350-383.

Edvinsson, L., & Malone, M. S. 1997. ***Intellectual capital: Realizing your company's true value by finding its hidden roots***. New York: HarperCollins Publishers, Inc.

Ettlie, J. E., Bridge, W. P., & O'Keefe, R. D. 1984. Organization strategy and structural differences for radical versus incremental innovation. ***Management Science***, 30(6): 682-695.

Ewing, J., & Keenan, F. 2001. Sharing the wealth. ***Business Week***, March 19(3724): EB36-39.

Fiore, S. M., & Schooler, J. W. 2004. Process mapping and shared cognition: Teamwork and the development of shared problem models. In E. Salas (Ed.), ***Team cognition: Understanding the factors that drive process and performance***: 133-152. Washington, DC: American Psychological Association.

Florin, J., Lubatkin, M., & Schulze, W. 2003. A social capital model of high-growth ventures. ***Academy of Management Journal***, 46(3): 374-384.

Ford, J. C., McCallum, R. T., & Tait, M. 1986. The appreciation of exploratory factor analysis in applied psychology: A critical review and analysis. ***Personnel Psychology***, 39: 291-314.

Fornell, C., & Larcker, F. D. 1981. Evaluating structural equation models with unobservable variables and measurement error. ***Journal of Marketing Research***, 18(1): 39-50.

Gatignon, H., Tushman, M. L., Smith, W., & Anderson, P. 2002. A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. ***Management Science***, 28(9): 1103-1122.

Grossman, J. B. 1970. The Supreme Court and Social Change: A Preliminary Inquiry. ***American Behavioral Scientist***, 13: 535-551.

Gulati, R. 1995. Does familiarity breed trust - the implications of repeated ties for contractual choice in alliances. ***Academy of Management Journal***, 38(1): 85-112.

Gupta, A. K., Smith, K. G., & Shalley, C. E. 2006. The interplay between exploration and exploitation. ***Academy of Management Journal***, 49(4): 693-706.

Haas, M. R., & Hansen, M.T. 2005. When using knowledge can hurt performance: The value of organizational capabilities in a management consulting company. ***Strategic Management Journal***, 26: 1-24.

Hall, R. 1992. The strategic analysis of intangible resources. ***Strategic Management Journal***, 13: 135-144.

Hambrick, D. C., & Mason, P. A. 1984. Upper echelons: The organization as a reflection of its top managers. ***Academy of Management Review***, 9(2): 193-206.

Hammerschmidt, P.K. 1996. The Kirton adaption innovation inventory and group problem solving success rates. ***First Quarter***, 30(1): 61-75.

Hansen, M. T. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. ***Administrative Science Quarterly***, 44(1): 82-111.

Hansen, M., Mors, M. L., & Lovas, B. 2005. Knowledge sharing in organizations: multiple networks, multiple phases. ***Academy of Management Journal***, 48(5): 776-793.

Harrison, D. A., & Klein, K. J. 2007. What's the difference? Diversity constructs as separation, variety, or disparity in organizations. ***Academy of Management Review***, 32: 1199-1228.

Harrison, D. A., & Sin, H. P. 2006. What is diversity and how should it be measured? In P. Prasad, A. M. Konrad, & J. K. Pringle (Eds.), ***Handbook of Workplace Diversity***: 191-216. Thousand Oaks, CA: Sage.

Hayes, R. H., & Clark, K. B. 1985. Exploring the sources of productivity differences at the factory level. In K. B. Clark, R. H. Hayes, & C. Lorenz (Eds.), ***The uneasy alliance: Managing the productivity-technology dilemma***. Boston, MA: Harvard Business School Press.

He, Z.-L., & Wong, P.-K. 2004. Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. ***Organization Science***, 15(4): 481-494.

Henderson, R. M., & Clark, K. B. 1990. Architectural Innovation: The Reconfiguration of Existing. ***Administrative Science Quarterly***, 30: 9-30.

Hinkin, T. R. 1995. A review of scale development practices in the study of organizations. ***Journal of Management***, 21(5): 967-988.

Hinkin, T. R. 1998. A brief tutorial on the development of measures for use in survey questionnaires. ***Organizational Research Methods***, 1: 104–121.

Hitt, M. A., Bierman, L., Shimizu, K., & Kochhar, R. 2001. Direct and moderating effects of human capital on strategy and performance in professional service firms. A resource-based perspective. ***Academy of Management Journal***, 44: 13-28.

Holmqvist, M. 2004. Experiential learning processes of exploitation and exploration within and between organizations: An empirical study of product development. ***Organization Science***, 15(1): 70-81.

Homans, G. C. 1950. ***The human group***. New York: Harcourt, Brace & Company.

Huselid, M. 1995. The impact of human resource management practices on the turnover, productivity, and corporate financial performance. ***Academy of Management Journal***, 38: 635-672.

Ihlwan, M. 2006. Camp Samsung. ***Business Week***, July 3: 46-48.

Inkpen, A. C., & Tsang, E. W. K. 2005. Social capital, networks, and knowledge transfer. ***Academy of Management Review***, 30(1): 146-165.

Ireland, R. D., & Hitt, M. A. 1999. Achieving and maintaining strategic competitiveness in the 21st century: The role of strategic leadership. ***The Academy of Management Executive***, 13(1): 43-57.

Itami, H. 1987. ***Mobilizing invisible assets***. Cambridge: Harvard University Press.

Jackson, S. E. 1996. The consequences of diversity in multidisciplinary work teams. In M. A. West (Ed.), ***The Psychology of Groups at Work***: 53-76. Chichester, England: John Wiley & Sons.

Jackson, S. E., Chuang, C., Harden, E. E., & Jiang, Y. 2006. Toward developing human resource management systems for knowledge-intensive teamwork. In J. J. Martocchio (Ed.), ***Research in personnel and human resource management***, Vol. 25: 27-70. New York: Elsevier.

Jackson, S. E., May, K. E., & Whitney, K. (Eds.). 1995. ***Understanding the dynamics of diversity in decision-making teams***. San Francisco: Jossey-Bass.

Jacobs, J. 1961. ***The death and life of great American cities***. New York: Random Books.

Janssen, O., van de Vliert, E., & West, M. A. 2004. The bright and dark sides of individual and group innovation: A special Issue introduction. ***Journal of Organizational Behavior***, 25: 129-145.

James, L. R., Demaree, R. G. & Wolf, G. 1984. Estimating within-group interraterreliability with and without response bias. ***Journal of Applied Psychology***, 69: 85-98.

Jehn, K. A., Chadwick, C., & Thatcher, S. M. B. 1997. To agree or not to agree: The effects of value congruence, individual demographic dissimilarity, and conflict on workgroup outcomes. ***International Journal of Conflict Management***, 8: 287-305.

Jehn, K. A., Northcraft, G. B., & Neale, M. A. 1999. Why difference make a difference: A field study of diversity, conflict, and performance in workgroups. ***Administrative Science Quarterly***, 44: 741-763.

Joreskog, K. G., & Sorbom, D. 2004. LISREL, 8.7 ed. Chicago: Scientific Software International, Inc.

Joshi, A. 2002. How does context matter? Examining the process and performance outcomes of work team heterogeneity. ***Unpublished Dissertation***.

Kang, S.-C., Morris, S. S., & Snell, S. A. 2007. Relational archetypes, organizational learning, and value creation: Extending the human resource architecture. ***Academy of Management Review***, 32(1): 236-256.

Katila, R., & Ahuja, G. 2002. Something old, something new: A longitudinal study of search behavior and new product introductions. ***Academy of Management Journal***, 45(6): 1183-1194.

Katz, R. 1982. The effects of group longevity on project communication and performance. ***Administrative Science Quarterly***, 27: 81-104.

Katz, R., & Allen, T. J. 1982. Investigating the not invented here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R&D project groups. ***R&D Management***, 12(1): 7-19.

Keck, S. 1997. Top management team structure: Differential effects by environmental context. ***Organization Science***, 8(2): 143-156.

Keller, R.T. Predictors of performance of project groups in R&D organizations. ***Academy of Management Journal***, 29(4): 715-726.

Keller, R.T. & Holland, W.E. 1978. Individual characteristics of innovativeness and communication in research and development organizations. ***Journal of Applied Psychology***, 63: 759-762.

Keller, R.T. & Holland, W.E. 1983. Communicators and innovators in research and development organizations. ***Academy of Management Journal***, 26: 742-749.

Kilduff, M., & Tsai, W. 2003. ***Social Networks and Organizations***. London: Sage Publications.

King, N., & Anderson, N. 1990. Innovation at work: The research literature. In M. A. West, & J. L. Farr (Eds.), ***Innovation and Creativity at Work***: 15-59. New York: Wiley.

King, N., & Anderson, N. 1990. Innovation at work: The research literature. In M. A. West, & J. L. Farr (Eds.), ***Innovation and Creativity at Work***: 15-59. New York: Wiley.

Klein, K. J., Conn, A. B., Smith, D. B., & Sorra, J. S. 2001. Is everyone in agreement? An exploration of within-group agreement in employee perceptions of the work environment. ***Journal of Applied Psychology***, 86: 3-16.

Kogut, B., & Zander., U. 1992. Knowledge of the firm, combinative capabilities, and the replication of technology. ***Organization Science***, 3: 383-397.

Kozlowski, S. W. J., & Bell, B. S. 2003. Work groups and teams in organizations. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), ***Comprehensive handbook of psychology***, Vol. 12: 333-375. New York: Wiley.

Lavie, D., & Rosenkopf, L. 2006. Balancing exploration and exploitation in alliance formation. ***Academy of Management Journal***, 49(6): 797-818.

Lev, B. 2001. ***Intangibles: Management, measurement, and reporting***. Washington, D.C.: Brookings Institution Press.

Levinthal, D. A., & March, J.G. 1993. The myopia of learning. ***Strategic Management Journal***, 14: 95-112.

March, J. G. 1991. Exploration and exploitation in organizational learning. ***Organization Science***, 2(1): 71-87.

Marsden, P. V. 1990. Network data and measurement. ***Annual Review of Sociology***, 16: 435-463.

McGrath, R. G. 2001. Exploratory learning, innovative capacity, and managerial oversight. ***Academy of Management Journal***, 44(1): 118-131.

Miller, K. D., Zhao, M., & Calantone, R.J. 2006. Adding interpersonal learning and tacit knowledge to March's exploration-exploitation model. ***Academy of Management Journal***, 49(4): 709-722.

Miner, A. S., Bassoff, P., & Moorman, C. 2001. Organizational improvisation and learning: A field study. ***Administrative Science Quarterly***, 46(2): 304-337.

Moreland, R. L., & Levine, J. M. 1992. The composition of small groups. In E. Lawler, B. Markovsky, C. Ridgeway, & H. Walker (Eds.), ***Advances in Group Processes***, Vol. 9: 237-280. Greenwich, CT: JAI Press.

Mumford, M. 2000. Managing creative people: Strategies and tactics for innovation. ***Human Resource Management Review***, 10(2): 313-351.

Murphy, K., & Davidshofer, C. 2001. ***Psychological Testing***. New York: Prentice Hall.

Nahapiet, J., & Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. ***Academy of Management Review***, 23(2): 242-266.

Nelson, R. R., & Winter, S. G. 1982. ***An Evolutionary Theory of Economic Change***. Cambridge, Mass: Harvard University Press.

Nord, W. R., & Tucker, S. 1987. ***Implementing routine and radical innovations***. San Francisco: New Lexington Press.

Normann, R. 1971. Organizational innovativeness: product variation and reorientation. ***Administrative Science Quarterly***, 16: 203-215.

Nunnally, J. C. 1978. ***Psychometric Theory***. New York: McGraw-Hill.

Obstfeld, D. 2005. Social Networks, the tertius Iungens orientation, and involvement in innovation. ***Administrative Science Quarterly***, 50(1): 100-130.

Oh, H., Chung, M.-H., & Labianca, G. 2004. Group social capital and group effectiveness: The role of informal socializing ties. ***Academy of Management Journal***, 47: 860-875.

Oh, H., Labianca, G., & Chung, M.-H. 2006. A multilevel model of group social capital. ***The Academy of Management Review***, 31: 569-582.

Payne, R. 1990. The effectiveness of research teams: A review. In M. A. West, & J. L. Farr (Eds.), ***Innovation and Creativity at Work***: 101-122. Chichester, England: Wiley.

Pedhazur, E. J. 1997. ***Multiple regression in behavioral research*** (3rd ed.). Orlando, FL: Harcourt Brace.

Pelled, L. H. 1996. Demographic diversity, conflict, and work group outcomes: An intervening process theory. ***Organization Science***, 7: 615-631.

Pelled, L. H., Eisenhardt, K. M., & Xin, K. R. 1999. Exploring the black box: An analysis of work group diversity, conflict, and performance. ***Administrative Science Quarterly***, 44: 1-28.

Perretti, F., & Negro, G. 2006. Filling empty seats: How status and organizational hierarchies affect exploration versus exploitation in team design. ***Academy of Management Journal***, 49(4): 759-778.

Perry-Smith, J. E. 2006. Social yet creative: The role of social relationships in facilitating individual creativity. ***Academy of Management Journal***, 49(1): 85-101.

Pfeffer, J. 1983. Organizational demography. In B. Staw, & L. L. Cummings (Eds.), ***Research in Organizational Behavior***: 299-357. Greenwich, CT: JAI Press.

Pfeffer, J. 1994. Producing sustainable competitive advantage through the effective management of people. ***Academy of Management Executive***, 9(1): 55-69.

Podsakoff, P. M., & Organ, D. W. 1986. Self-reports in organizational research: Problems and prospects. ***Journal of Management***, 12(4): 531-544.

Price, J. L., & Mueller, C. W. 1986. Distributive justice. In J. L. Price, & C. W. Mueller (Eds.), ***Handbook of Organizational Measurement***: 122-127. Marshfield, MA: Pitman.

Reagans, R., & McEvily, B. 2003. Network structure and knowledge transfer: The effects of cohesion and range. ***Administrative Science Quarterly***, 48(2): 240-267.

Reagans, R., Zuckerman, E. W., & McEvily, B. 2004. How to make the team: Social networks vs. demography as criteria for designing effective teams. ***Administrative Science Quarterly***, 49: 101-133.

Rodan, S., & Galunic, C. 2004. More than network structure: how knowledge heterogeneity influences managerial performance and innovativeness. ***Strategic Management Journal***, 25(6): 541-562.

Rosenkopf, L., & Nerkar, A. 2001. Beyond local search: Boundary-spanning, exploration and impact in the optical disk industry. ***Strategic Management Journal***, 22: 287-306.

Rothaermel, F. T. 2001. Incumbent's advantage through exploiting complementary assets via interfirm cooperation. ***Strategic Management Journal***, 22: 687-699.

Rummel, A., & Feinberg, R. 1988. Cognitive evaluation theory: A meta-analytic review of the literature. ***Social Behavior and Personality***, 16: 147-164.

Salas, E., & Fiore, S. M. 2004. ***Team cognition: Understanding the factors that drive process and performance***. Washington, DC: American Psychological Association.

Scandura, T. A., & Williams, E. 2000. Research methodology in management: Current practices, trends, and implications for future research. ***Academy of Management Journal***, 43: 1248-1264.

Schulz, M. 2001. The uncertain relevance of newness: Organizational learning and knowledge flows. ***Academy of Management Journal***, 44(4): 661-681.

Schumacker, R. E., & Lomax, R. G. 2004. ***A beginner's guide to structural equation modeling***. Mahwah, NJ: Lawrence Erlbaum.

Schumpeter, J. A. 1934. ***The theory of economic development***. Cambridge, MA: Harvard University Press.

Shaw, M. E. 1981. ***Group dynamics: the psychology of small group behavior*** (3rd ed.). New York: McGraw-Hill.

Siggelkow, N., & Rivkin, J. W. 2006. When exploration backfires: Unintended consequences of multilevel organizational search. ***Academy of Management Journal***, 49(4): 779-796.

Simons, T., Pelled, L. H., & Smith, K. A. 1999. Making use of difference: Diversity, debate, and decision comprehensiveness in top management teams. ***Academy of Management Journal*** (42): 662-674.

Skaggs, B. C., & Youndt, M. 2004. Strategic positioning, human capital and performance in service organizations: A customer interaction approach. ***Strategic Management Journal***, 25(1): 85-99.

Smith, K. G., Collins, C.J., & Clark, K.D. 2005. Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. ***Academy of Management Journal***, 48(2): 346-357.

Somech, A. 2006. The effects of leadership style and team process on performance and innovation in functionally heterogeneous teams. ***Journal of Management***, 32(1): 132-157.

Sparrowe, R. T., Liden, R.C., Wayne, S.J., & Kraimer, M.L. 2001. Social networks and the performance of individuals and groups. ***Academy of Management Journal***, 44(2): 316-325.

Stewart, G. L. 2006. A meta-analytic review of relationships between team design features and team performance. ***Journal of Management***, 32(1): 29-54.

Stewart, G. L., & Barrick, M. R. 2000. Team structure and performance: Assessing the mediating role of intrateam process and the moderating role of task type. ***Academy of Management Journal***, 43(2): 135-148.

Stewart, T. 1999. ***Intellectual capital: The new wealth of organizations***. New York: Currency.

Stork, D., & Richards, W. D. 1992. Nonrespondents in communication network studies: Problems and possibilities. ***Group & Organization Management***, 17(2): 193-209.

Subramaniam, M., & Youndt, M. A. 2005. The influence of intellectual capital on the types of innovative capabilities. ***Academy of Management Journal***, 48(3): 450-463.

Sundgren, M., Selart, M., Ingelgard, A., & Bengtson, C. 2005. Dialogue-based evaluation as a creative climate indicator: Evidence from the Pharmaceutical Industry. ***Creativity and innovation management***, 14(1):84-98.

Szulanski, G. 1996. Exploring internal stickiness: Impediments to the transfer of best practice within the firm. ***Strategic Management Journal***, 17(Winter Special Issue): 27-43.

Tabachnick, B. G., & Fidell, L. S. 1996. ***Using multivariate statistics*** (3rd ed.). New York: Harper Collins.

Takeuchi, R., Lepak, D.P., Wang, H., & Takeuchi, K. 2007. An empirical examination of the mechanisms mediating between high performance work systems and the performance of Japanese organizations. ***Journal of Applied Psychology***, 92: 1069-1083.

Tang, S. H., & Hall, V. C. 1995. The overjustification effect: A meta-analysis. ***Applied Cognitive Psychology***, 9: 365-404.

Taylor, A., & Greve, H. R. 2006. Superman or the fantastic four? Knowledge combination and experience in innovation teams. ***Academy of Management Journal***, 49(4): 723-740.

Tsai, W. 2001. Knowledge transfer in interorganizational networks: effects of network position and absorptive capacity on business unit innovation and performance. ***Academy of Management Journal***, 44(5): 996-1004.

Tsai, W., & Ghoshal, S. 1998. Social capital and value creation: The role of intafirm networks. ***Academy of Management Journal***, 41(4): 464-476.

Tsui, A. S., Egan, T. D., & O'Reilly, C. A. 1992. Being different: Relational demography and organizational attachment. ***Administrative Science Quarterly***, 37: 549-579.

Uzzi, B. 1997. Social structure and competition in interfirm networks: The paradox of embeddedness. ***Administrative Science Quarterly***, 42: 35-67.

Van de Ven, A. H., & Yun-han, C. 1989. A psychometric assessment of the Minnesota innovation survey. In A. H. Van de Ven, H. L. Angle, & M. S. Poole (Eds.), ***Research on the Management of Innovation***. New York: Harper & Row, Publishers.

Van Knippenberg, D. 2003. Intergroup relations in organizations. In M. A. West, D. Tjosvold, & K. G. Smith (Eds.), ***International handbook of organizational teamwork and cooperative working***: 381-400. Chichester, U.K.: Wiley.

Von Krogh, G., Ichijo, K., & Nonaka, I. 2000. ***Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation***. Oxford: Oxford University Press.

Wadhwa, A., & Kotha, S. 2006. Exploration and knowledge creation through external venturing: Evidence from the telecommunication equipment manufacturing industry. ***Academy of Management Journal***, 49(4): 819-835.

Wasserman, S., & Faust, K. 1994. ***Social Network Analysis: Methods and Applications***. Cambridge: University Press.

Webber, S. S., & Donahue, L. M. 2001. Impact of highly and less job-related diversity on work group cohesion and performance: A meta-analysis. ***Journal of Management***, 27: 141-162.

West, M. A., & Anderson, N. R. 1996. Innovation in top management teams. ***Journal of Applied Psychology***, 81: 680-693.

West, M. A., & Farr, J. L. 1989. Innovation at work: psychological perspectives. ***Social Behaviour***, 4: 5-30.

West, M. A., & Wallace, M. 1991. Innovation in health care teams. ***European Journal of Social Psychology***, 21: 303-315.

Wiersema, M., & Bantel, K. 1992. Top management team demography and corporate strategic change. ***Academy of Management Journal***, 35: 91–121.

Wiersema, M., & Bantel, K. 1993. Top management team turnover as an adaptation mechanism: The role of the environment. ***Strategic Management Journal***, 14: 485-504.

Wiersma, U. J. 1992. The Effects of Extrinsic Rewards on Intrinsic Motivation: A Meta-Analysis. ***Journal of Occupational and Organizational Psychology***, 65: 101-114.

Williams, K. Y., & O'Reilly, C. A. 1998. Demography and diversity in organizations: A review of 40 years of research. In B. Staw, & R. Sutton (Eds.), ***Research in Organizational Behavior***, Vol. 20: 77-140. Greenwich, CT: JAI Press.

Woodman, R. W., Sawyer, J. E., & Griffin, R. W. 1993. Toward a theory of organizational creativity. ***Academy Management Review***, 18(2): 293-321.

Yli-Renko, H., Autio, E., & Sapienza, H. J. 2001. Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms. ***Strategic Management Journal***, 22(6-7): 587-613.

Youndt, M. A., Subramaniam, M., & Snell, S. A. 2004. Intellectual capital profiles: An examination of investments and returns. ***Journal of Management Studies***, 41(2): 335-361.

FIGURE 1. HYPOTHESIZED MODEL

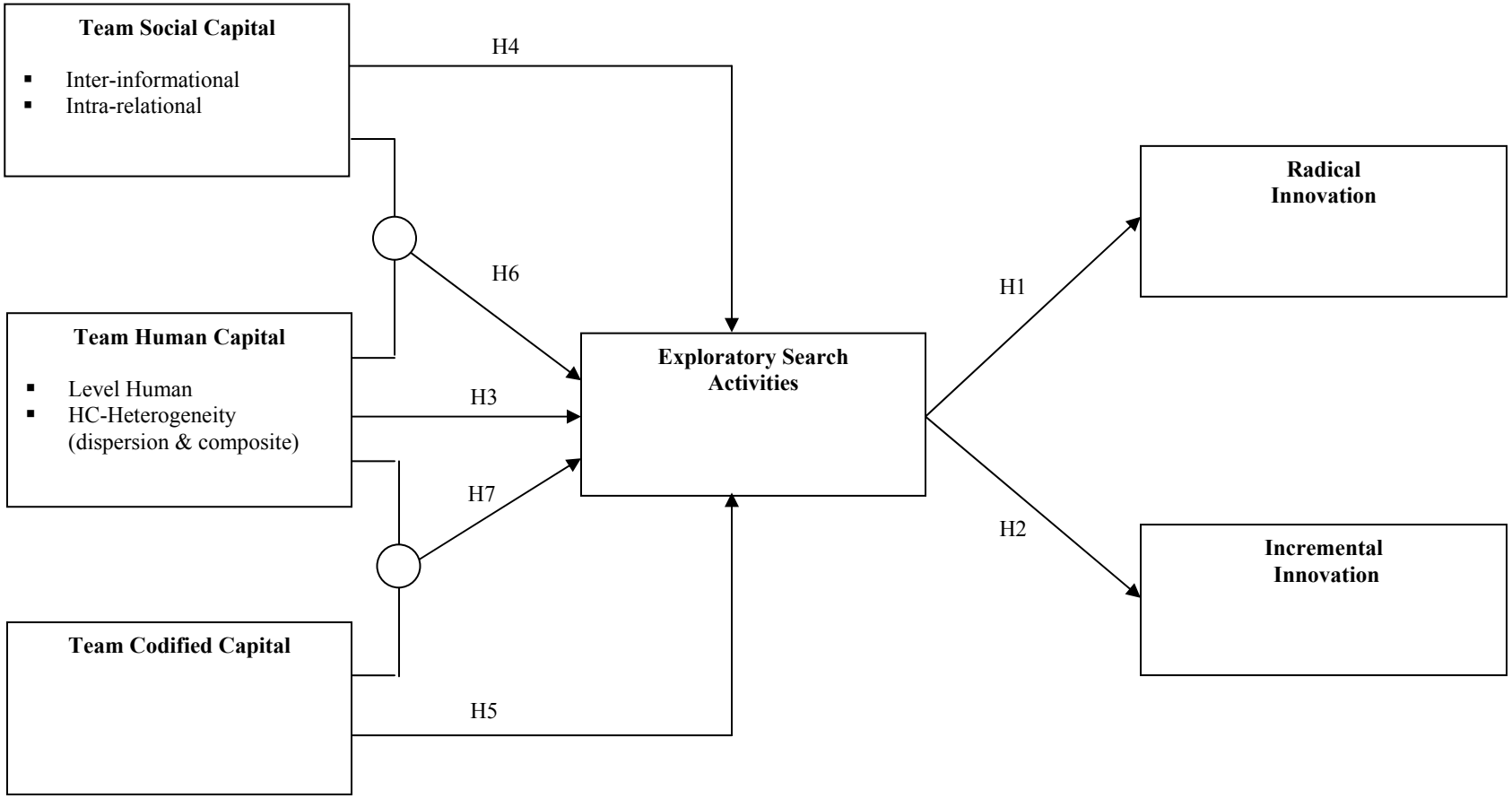

FIGURE 2. EXPECTED MODERATION OF INTER-INFORMATIONAL SOCIAL CAPITAL BETWEEN HUMAN CAPITAL AND EXPLORATORY SEARCH

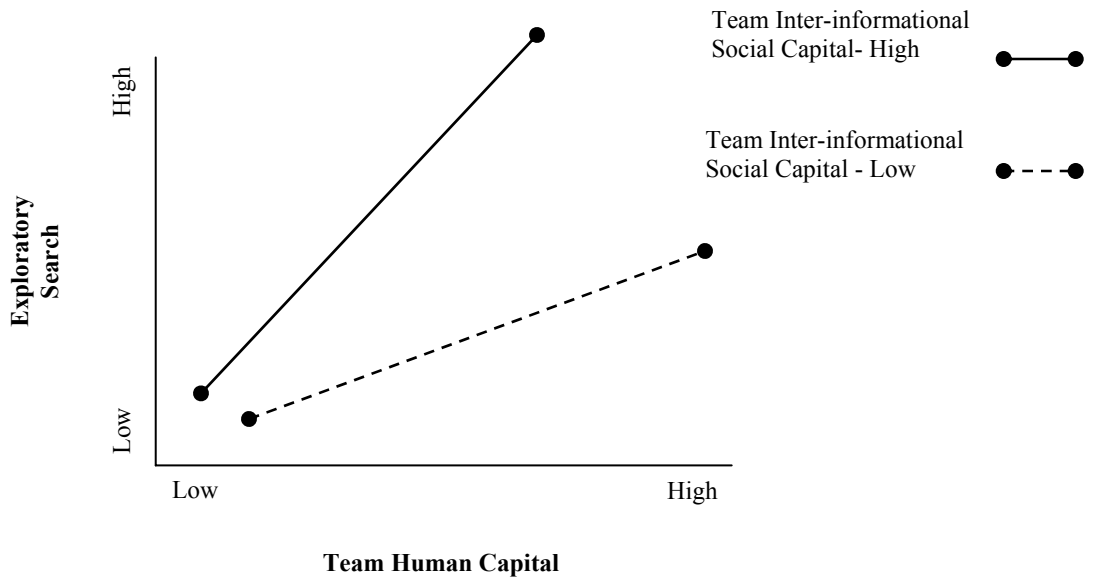

FIGURE 3. EXPECTED MODERATION OF INTER-INFORMATIONAL SOCIAL CAPITAL BETWEEN HUMAN CAPITAL – HETEROGENEITY AND EXPLORATORY SEARCH

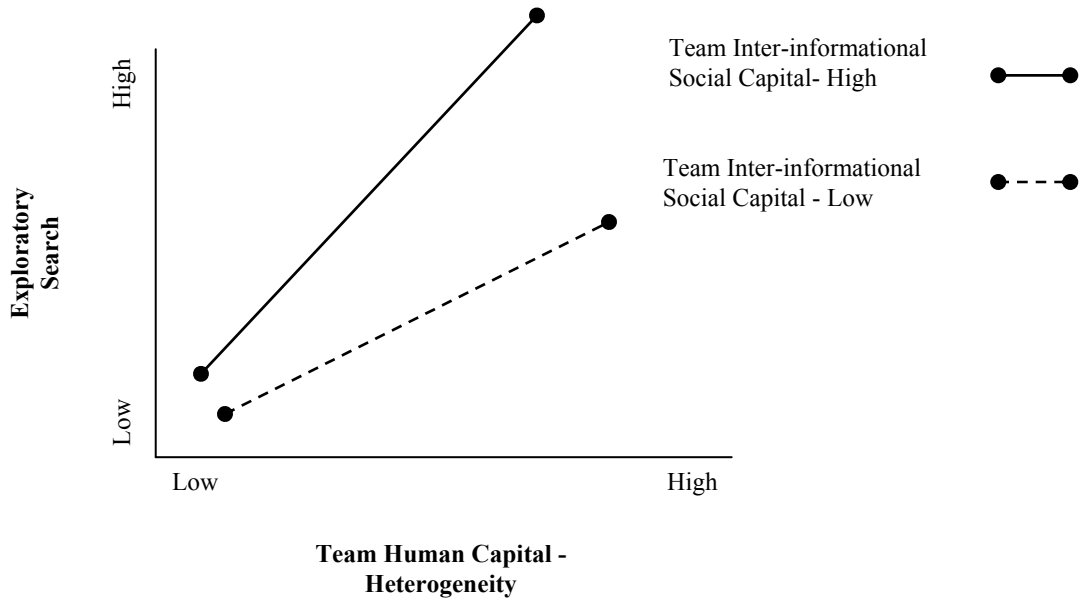

FIGURE 4. EXPECTED MODERATION OF INTRA-RELATIONAL SOCIAL CAPITAL BETWEEN HUMAN CAPITAL AND EXPLORATORY SEARCH

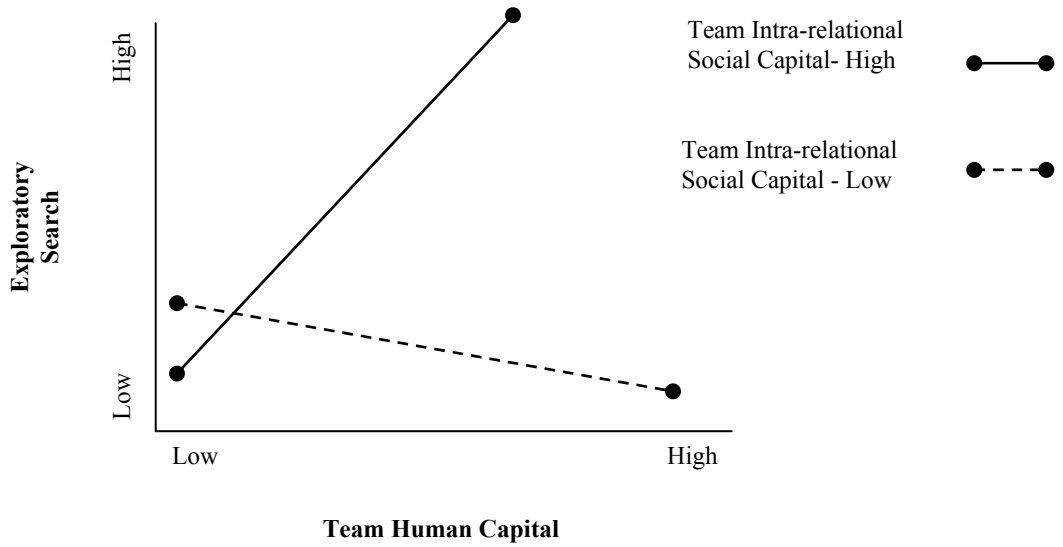

FIGURE 5. EXPECTED MODERATION OF INTRA-RELATIONAL SOCIAL CAPITAL BETWEEN HUMAN CAPITAL – HETEROGENEITY AND EXPLORATORY SEARCH

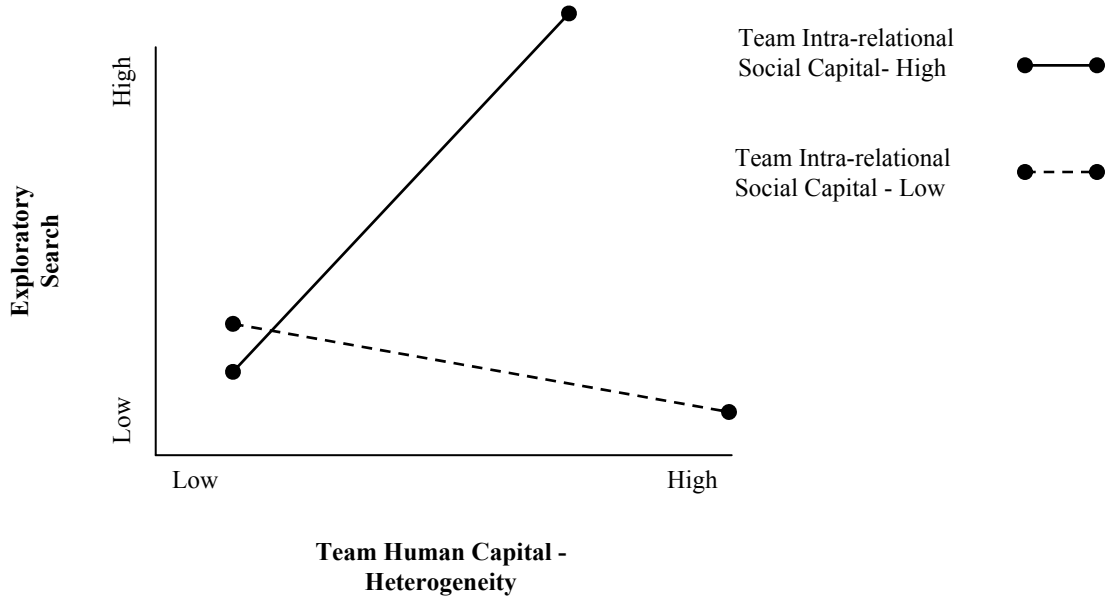

FIGURE 6. EXPECTED MODERATION OF CODIFIED CAPITAL BETWEEN HUMAN CAPITAL AND EXPLORATORY SEARCH

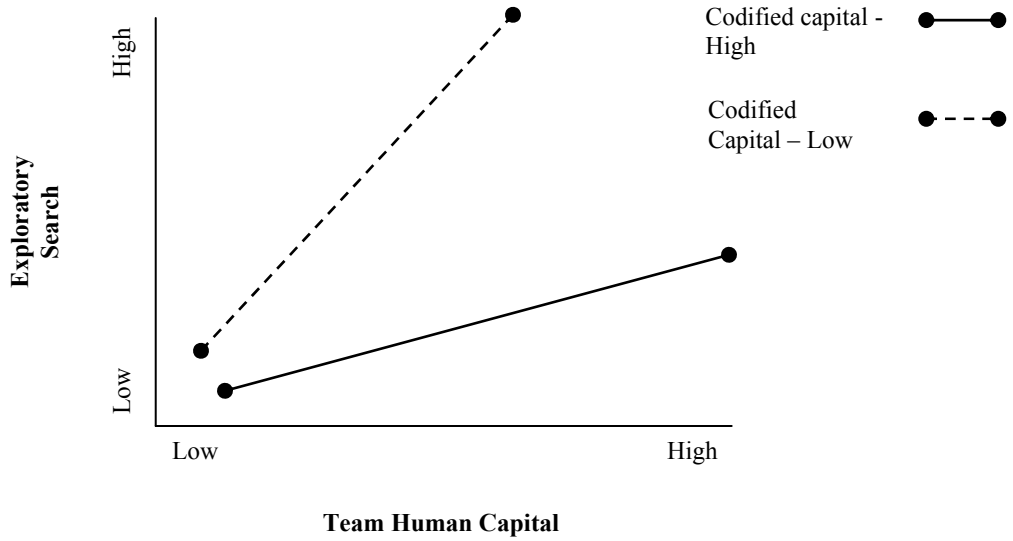

FIGURE 7. EXPECTED MODERATION OF CODIFIED CAPITAL BETWEEN HUMAN CAPITAL – HETEROGENEITY AND EXPLORATORY SEARCH

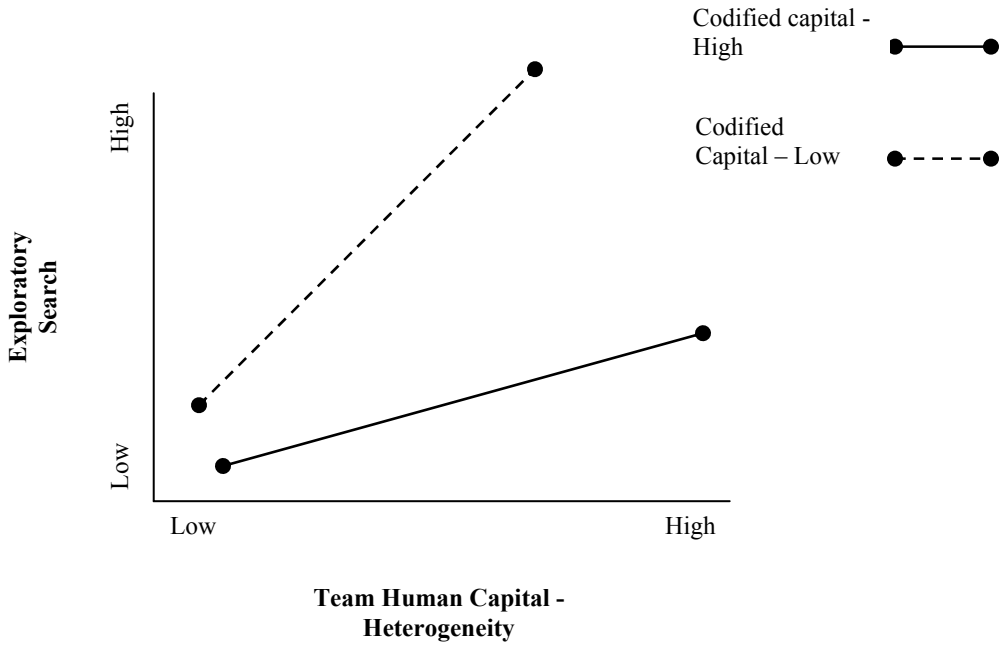

FIGURE 8. MODERATION OF CODIFIED CAPITAL BETWEEN HUMAN CAPITAL – LEVEL (EDUCATION LEVEL) AND EXPLORATORY SEARCH

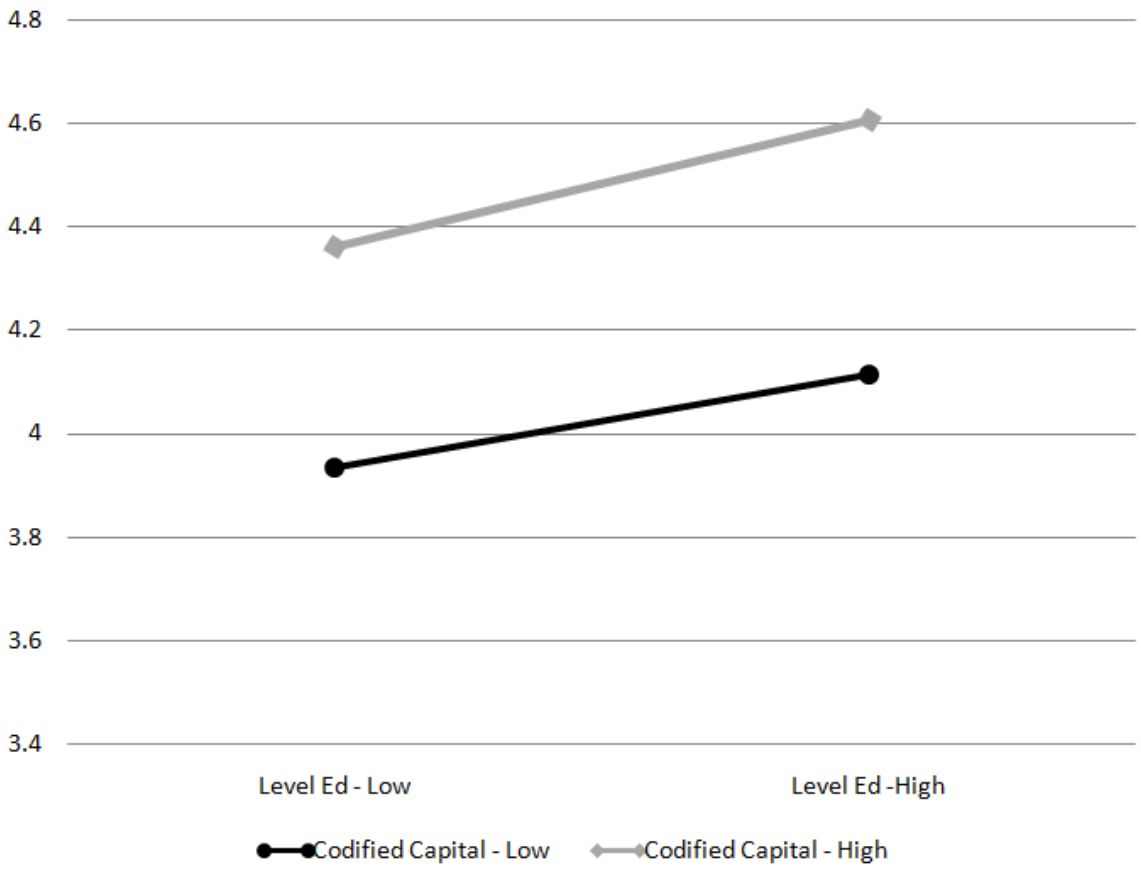

FIGURE 9. CONCEPTUALIZATION OF CODIFIED CAPITAL

CONCEPTUALIZATION OF CODIFIED CAPITAL

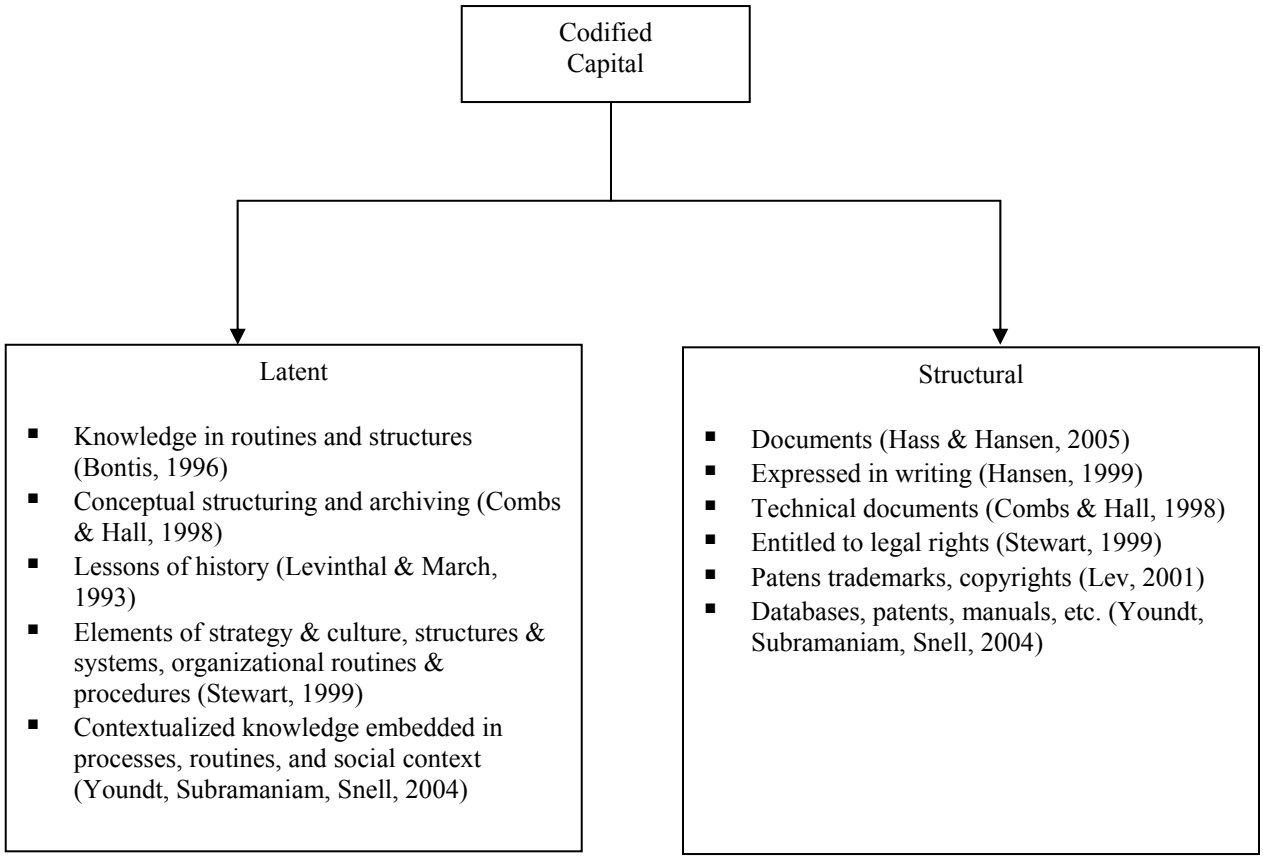

TABLE 1. SUMMARY OF PAST DEFINITIONS OF EXPLORE/EXPLOIT

Author (year)	Exploitation	Exploration
Baum, Li, & Usher (2000)	Refers to learning gained via local search, experimental refinement, and selection of existing routines.	Refers to learning gained through processes of concerted variation, planned experimentation, and play.
Miller, Zhao, & Calatone (2006)	Rapid learning from a code that quickly changes to reflect best practices in an organization. Exploitation produces rapid conformity to codified beliefs and practices throughout the organization.	Slow learning from the organizational code, resulting in greater diversity of beliefs over a longer period of time. Exploration occurs to the extent that nonconforming beliefs and practices persist despite information about proven best practices available from the code.
McGrath (2001)	N/A	Exploratory search (internal variety) is associated with exploration, involving the search for new organizational routines and the discovery of new approaches to technologies, businesses, processes, or products.
Holmqvist (2004)	Exploitation is about creating reliability in experience, and thrives on productivity and refinement.	Exploration is concerned with creating variety in experience and thrives on experimental and free association.
He & Wong (2004)	Exploitation implies firm behaviors characterized by refinement, implementation, efficiency, production and selection	Exploration implies firm behavior characterized by search, discovery, experimentation, risk taking and innovation
Katila & Ahuja (2002)	Exploitative search (search depth) is the degree to which firms use and reuse their existing knowledge. Search locally addressing problems by using knowledge that is closely related to their preexisting knowledge bases.	Exploratory search (search scope) is the degree to which firms explore new knowledge. A conscious effort to move away from current organizational routines and knowledge bases.
Rothaermel (2001)	Exploratory search (search scope) is the degree to which firms explore new knowledge. Search locally addressing problems by using knowledge that is closely related to their preexisting knowledge bases.	Exploration is the pursuit of knowledge, of things that might come to be known (organizational learning motivates this strategic alliance)
Taylor & Greve (2006)	Exploitation maintains and refines current activities using existing knowledge in well-understood ways.	Exploration introduces experiments of uncertain value into an organizations activities.

TABLE 1 (CONTINUED)

Author (year)	Exploitation	Exploration
Beckman (2006)	Exploitative behaviors, in contrast, are variance-decreasing and efficiency-oriented (March, 1991); exploitation involves incremental innovation, implementation, refinement, routinization, local search, and efficiency	Exploratory behaviors are those that increase variance and generate internal variety (McGrath, 2001; Tushman & Smith, 2002); Exploration involves radical innovation, creating new markets and products, experimentation, broad search, frequency change, and discovery (Miner, Bassoff, & Moorman, 2001)
Perretti & Negro (2006)	Exploitative team features/design. Proportion of new comers and proportions of new member combinations.	Exploratory team features. Proportion of new comers and proportions of new member combinations.
Siggelkow & Rivkin (2006)	Exploitative search is defined as search that is primarily conducted at the top of the organizations and solutions to problems trickle down to the rest of the organization.	Exploratory search is defined as search conducted at the lower level of the organization – moving away from Tayloristic management.
Lavie & Rosenkopf (2006)	Exploitation includes things such as refinement, choice, production, efficiency, selection, implementation, and execution. The authors examine three dimensions of the exploration – exploitation continuum: function, structure, and attribute).	Exploration includes terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. the exploration – exploitation continuum: function, structure, and attribute).
Wadhwa & Kotha (2006)	N/A	Exploration is a process of search, variation, experimentation, and discovery, it is closely aligned with distant search which generates recombinations of new, unfamiliar knowledge with existing knowledge elements.

TABLE 2. SUMMARY OF ORGANIZATIONAL CAPITAL DEFINITIONS & CONCEPTUALIZATIONS

Author	Concept	Definition
Edvinsson & Malone (1997)	Structural Capital	Structural capital includes intangible assets such as business partnerships or customer loyalty
Youndt, Subramaniam, & Snell (2004)	Organizational Capital	Organizational capital represents institutionalized knowledge and codified experience stored in databases, routines, patents, manuals, structures, and the like (Hall, 1992; Itami, 1987; Walsh and Ungson, 1991). Contexualized knowledge-knowledge embedded within an organizations'' processes, routines, and social contexts – is particularly difficult to replicate and thereby even more important to competitive advantage (Badarracco, 1991).
Bontis (1996)	Structural Capital (overarching intellectual capital includes relational and human capital)	Structural capital is the firm's organizational capabilities to meet market requirements. It involves the organization's routines and structures that support employees' quests for optimum intellectual performance and, therefore, overall business performance. An individual can have a high level of intellect, but if the organization has poor systems and procedures by which to track his or her actions, the overall intellectual capital will not reach its fullest potential.
Gulati (1995)	Organizational Capital Resources	Scholars within the resource-based perspective have also highlighted the role of organizational capital resources that has among its elements the network of contacts a firm may have with its external environment (Tomer, 1987).
Lev (2001)	Intangible Assets (subset)	R&D, patents, trademarks, copyrights, brand names
Stewart (1999)	Structural Capital	Structural capital belongs to the organization as a whole. It can be reproduced and shared. Some of the categories of structural capital is entitled to legal rights of ownership: technologies, inventions, data, publications, and processes can be patented, copy-righted, or shielded by trade-secrets. But also include the elements of strategy and culture, structures and systems, organizational routines and procedures.
Levinthal & March (1993)	Organizations Recorded Histories	Organizations record the lessons of histories in the modification of rules and the elaboration of stories, but neither is perfect instrument. Problems of memory, conflict, turnover, and decentralization make it difficult to extract lesions from experience and to retain them (March, Sproull, and Tamuz, 1991).

TABLE 2 (CONTINUED)

Author	Concept	Definition
Combs & Hall (1998)	Path Dependency	Path dependency is located in three forms: ▪ Technology-as-hardware: Comprises the specific technical artifacts such as products, machinery, equipment, software, etc. ▪ Knowledge base: Consists of the shared mental framework of fundamental design concepts. Include corporate culture. ▪ Routines: Routines which deploy the existing knowledge base of the firm in order to make sense of particular problems in the area of product and processes development. Includes "conceptual structuring and archiving of a technical document; or selecting external sources of knowledge to access and disseminate internally".
Hass & Hansen (2005)	Codified Knowledge	Codified knowledge is recorded in documents and obtained through the firm's electronic database system, it is often simplified and generalized during its conversation to document form to make it more widely applicable.
Hansen (1999)	Codified Knowledge	Level of codification is the degree to which the knowledge is fully documented or expressed in writing at the time of transfer between different individuals or units.

TABLE 3. DESCRIPTIVE STATISTICS OF SCALES

Variable	n	ά	Min. Value	Max. Value	Mean	Std. Deviation	Variance	Skew-ness	Kurtosis
1. radical innovation	61	0.76	1.75	3.58	2.55	0.35	0.12	0.40	1.02
2. incremental innovation	61	0.87	2.95	4.36	3.77	0.27	0.07	-0.61	1.08
3. exploratory search	61	0.91	3.63	6.33	4.87	0.52	0.28	0.37	0.50
4. intra-relational social capital	61		0.31	0.92	0.64	0.13	0.02	-0.17	-0.10
5. inter-inform. social capital 1	61		0.02	0.56	0.17	0.09	0.01	2.15	6.06
6. inter-inform. social capital 2	61		4.40	25.44	15.01	5.33	28.37	-0.10	-0.72
7. inter-inform. social capital 3	61		0.00	3.22	0.71	0.71	0.50	1.70	3.36
8. business unit experience-level	61		0.75	1.56	1.03	0.14	0.02	1.51	3.83
9. organizational experience-level	61		0.45	2.53	1.47	0.50	0.25	0.07	-0.56
10. educational-level	61		1.50	4.86	3.38	0.64	0.41	-0.40	0.50
11. functional experience-level	61		1.17	3.50	2.03	0.49	0.24	0.70	0.87
12. industry experience-level	61		0.75	2.75	1.67	0.41	0.17	0.13	-0.15
13. business unit experience--heterogeneity	61		0.09	0.20	0.13	0.02	0.00	1.52	3.81
14. organization experience--heterogeneity	61		0.17	0.84	0.65	0.14	0.02	-1.29	1.81
15. educational--heterogeneity	61		0.00	0.95	0.76	0.15	0.02	-2.27	9.27
16. functional experience-heterogeneity	61		0.13	0.39	0.22	0.05	0.00	0.71	0.87
17. industry experience-heterogeneity	61		0.06	0.23	0.14	0.03	0.00	0.14	-0.13
18. human capital-heterogeneity composite	61		0.97	2.32	1.91	0.24	0.06	-1.32	3.25
18. codified capital	61	0.71	3.44	5.78	4.87	0.51	0.26	-0.66	0.35
19. team size	61		4.00	59.00	14.49	10.57	111.75	1.66	3.98
20. size of network	61		3.00	1020.00	141.08	179.72	32299.71	2.58	8.98
21. project interdependence	61	0.76	3.75	6.06	5.11	0.46	0.21	-0.64	0.92
22. type of project	61		1.50	6.86	3.55	0.95	0.91	0.68	1.59
23. gender-diversity	61		0.00	0.48	0.14	0.14	0.02	0.57	-0.72
24. ethnic-diversity	61		0.00	0.54	0.13	0.16	0.03	0.85	-0.67

TABLE 4. FACTOR ANALYSIS

Items	Factor Loadings				
	1	2	3	4	5
Tries new approaches when solving problems	**0.88**				0.11
Tries new methods or techniques to solve problems	**0.87**				
Searches for fresh, new ways to look at problems	**0.87**				
Utilizes creativity when solving problems	**0.84**	0.11			
Strives for experimentation when solving problems	**0.76**				0.10
Varies how problem solving is approached	**0.69**				
Reinforces our prevailing product lines	0.11	**0.89**			0.11
Reinforces our existing expertise in prevailing product lines	0.16	**0.89**			
Reinforces how we currently compete in this product market	0.18	**0.84**			
Other Company ABC facilities depend on our facility for information or materials needed to perform their objectives			**0.84**		
The objectives of our facility are related to other facilities	0.15	0.10	**0.80**		
Our Company ABC facility can not accomplish its objectives without information or materials from other Company ABC facilities			**0.80**		
Makes our existing expertise in prevailing products obsolete		-0.10		**0.82**	
Makes prevailing product lines obsolete				**0.82**	
Fundamentally changes our prevailing products	0.15			**0.80**	
Much of our team's work is captured in drawings	0.12		-0.10		**0.82**
Much of our team's work is captured in technical specs.	0.19				**0.78**
Much of our team's work is accessed through shared drives	0.19		0.12		**0.70**

N=1,320; Principle Components Analysis with Quartimax Rotation.
Loadings are bolded if the item's cross loadings are less than .30.
Factor 1=Exploratory Search; Factor 2=Incremental Innovation; Factor 3=Work Team Interdependence; Factor 4=Radical Innovation; Factor 5=Codified Capital

TABLE 5. CORRELATIONS

Scale	1	2	3	4	5	6	7	8	9
1. radical innovation	1.00								
2. incremental innovation	-0.01	1.00							
3. exploratory search	0.19	0.41**	1.00						
4. intra-relational social capital	0.25	0.11	0.10	1.00					
5. inter-inform. social capital 1	-0.19	-0.05	0.11	0.02	1.00				
6. inter-inform. social capital 2	0.02	0.10	-0.05	-0.11	0.19	1.00			
7. inter-inform. social capital 3	-0.22	0.20	0.11	-0.26	0.24	0.41**	1.00		
8. cross business unit-level	-0.05	-0.13	0.08	-0.20	0.15	0.33**	0.43**	1.00	
9. cross organization-level	0.27*	0.11	0.26*	-0.16	-0.10	-0.20	-0.08	-0.11	1.00
10. education-level	-0.18	0.11	0.05	-0.36**	0.32*	0.27*	0.46**	0.21	0.35**
11. functional experience-level	-0.17	0.01	0.29*	-0.06	0.41**	-0.02	0.36**	0.08	0.14
12. industry experience-level	-0.09	0.15	0.06	-0.03	0.23	0.07	0.14	0.00	0.20
13. cross business unit-diversity	-0.06	-0.13	0.08	-0.20	0.15	0.33**	0.43**	1.00	-0.11
14. cross organization-diversity	0.10	0.07	0.07	-0.37**	-0.08	-0.07	0.02	-0.05	0.57**
15. education-diversity	0.00	-0.13	-0.29*	-0.13	0.04	0.08	-0.02	-0.02	-0.16
16. functional experience-diversity	-0.17	0.01	0.29*	-0.06	0.41**	-0.02	0.36	0.08	0.14
17. industry experience-diversity	-0.09	0.15	0.06	-0.03	0.24	0.06	0.14	0.00	0.20
18. human capital composite	.007	-0.03	-0.06	-0.33**	0.12	0.04	0.13	0.05	0.29*
19. codified capital	0.09	0.24	0.38**	0.10	0.07	-0.01	-0.16	-0.03	-0.02
20. team size	0.01	0.01	-0.19	-0.65**	-0.11	0.31*	0.05	0.03	0.16
21. size of network	0.05	0.02	-0.20	-0.54**	-0.13	0.24	-0.02	-0.09	0.16
22. project interdependence	0.31*	0.18	0.22	0.09	0.10	0.08	0.12	0.06	0.18
23. type of project	0.16	0.38**	0.31*	-0.03	-0.08	0.36**	0.31*	0.06	0.08
24. gender-diversity	-0.03	-0.06	0.21	-0.15	0.30*	-0.10	-0.03	-0.03	0.22
25. ethnic-diversity	0.19	0.28*	0.19	-0.02	0.02	-0.10	0.05	-0.10	0.39

* $p < 0.05$
** $p < 0.01$

TABLE 5 (CONTINUED)

Scale	10	11	12	13	14	15	16	17	18	19
1. radical innovation										
2. incremental innovation										
3. exploratory search										
4. intra-relational social capital										
5. inter-inform. social capital 1										
6. inter-inform. social capital 2										
7. inter-inform. social capital 3										
8. cross business unit-level										
9. cross organization-level										
10. education-level	1.00									
11. functional experience-level	0.47**	1.00								
12. industry experience-level	0.29*	0.42**	1.00							
13. cross business unit-diversity	0.22	0.08	-0.01	1.00						
14. cross organization-diversity	0.32*	0.06	0.25	-0.05	1.00					
15. education-diversity	-0.38**	-0.32**	-0.05	-0.03	0.22	1.00				
16. functional experience-diversity	0.47**	1.00	0.42**	0.08	0.06	-0.33**	1.00			
17. industry experience-diversity	0.29*	0.42**	1.00	-0.01	0.25*	-0.05	0.42**	1.00		
18. human capital composite	0.11	0.12	0.36**	0.05	0.78**	0.69**	0.12	0.36**	1.00	
19. codified capital	0.00	-0.01	-0.08	-0.03	-0.19	-0.31*	-0.01	-0.08	-0.33**	1.00
20. team size	0.17	-0.19	0.02	0.02	0.42**	0.24	-0.20	0.01	0.36**	-0.03
21. size of network	0.09	-0.20	0.01	-0.10	0.37**	0.23	-0.20	0.00	0.32*	-0.05
22. project interdependence	0.18	-0.12	-0.24	0.06	0.12	-0.08	-0.12	-0.24*	-0.4	0.23
23. type of project	0.16	0.15	0.10	0.06	0.20	0.04	0.15	0.10	0.20	0.14
24. gender-diversity	0.09	0.11	0.13	-0.04	0.07	-0.02	0.10	0.13	0.07	-0.10
25. ethnic-diversity	0.41**	0.27*	0.17	-0.10	0.33**	-0.21	0.27*	0.17	0.14	0.15

* $p < 0.05$
** $p < 0.01$

TABLE 5 (CONTINUED)

Scale	20	21	22	23	24	25
1. radical innovation						
2. incremental innovation						
3. exploratory search						
4. intra-relational social capital						
5. inter-inform. social capital 1						
6. inter-inform. social capital 2						
7. inter-inform. social capital 3						
8. cross business unit-level						
9. cross organization-level						
10. education-level						
11. functional experience-level						
12. industry experience-level						
13. cross business unit-diversity						
14. cross organization-diversity						
15. education-diversity						
16. functional experience-diversity						
17. industry experience-diversity						
18. human capital composite						
19. codified capital						
20. team size	1.00					
21. size of network	0.96**	1.00				
22. project interdependence	0.03	0.03	1.00			
23. type of project	0.07	0.04	0.28*	1.00		
24. gender-diversity	0.10	0.10	-0.12	-0.32**	1.00	
25. ethnic-diversity	0.08	0.05	0.05	0.07	0.18	1.00

* $p < 0.05$
** $p < 0.01$

TABLE 6. AGGREGATION STATISTICS

Scale	Number of Items	ICC1	ICC2	ANOVA	Rwg Median[10]	Rwg Mean[11]	Mean Team Size
Radical Innovation	3	0.05634297	0.3700491	$F(129, 1278) = 1.59$, $p > .001$	0.828	0.7996	7
Incremental Innovation	3	0.03071553	0.2388027	$F(129, 1286) = 1.31$, $p > .01$	0.8789	0.8406	7
Exploratory Search	6	0.08006255	0.461502	$F(130, 1159) = 1.86$, $p > .001$	0.6557	0.5709	7
Codified Capital	3	0.06537287	0.4095351	$F(130, 1298) = 1.69$, $p > .001$	0.2251	0.3024	7
Work Group Interdependence	3	0.03552227	0.2678152	$F(130, 1300) = 1.37$, $p > .01$	0.2758	0.3142	7

[10] Rwg Median for the 60 teams included in the final sample did vary from the information above (Radical Innovation=0.74; Incremental Innovation=0.87; Exploratory Search=0.75; Codified Capital=0.60; Work Group Interdependence=0.64).

[11] Rwg Mean for the 60 teams included in the final sample did vary from the information above (Radical Innovation=0.70; Incremental Innovation=0.86; Exploratory Search=0.70; Codified Capital=0.57; Work Group Interdependence=0.52).

TABLE 7. RADICAL & INCREMENTAL INNOVATION REGRESSED ON EXPLORATORY SEARCH

	Radical Innovation				Incremental Innovation			
Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**	
Constant	1.323*	.500	1.099	.593	3.160	.366	2.639	.416
Size of Location	.000	.004	.000	.004	-.001	.003	.001	.003
Interdependence	.216*	.098	.204*	.100	.044	.072	.016	.070
Type of Task	.024	.050	.008	.055	.097*	.037	.062	.039
Gender Diversity	-.002	.335	-.097	.362	.040	.245	-.181	.254
Ethnic Diversity	.361	.272	.336	.275	.409*	.199	.351†	.193
Exploratory Search			.071	.099			.164*	.070
Adjusted R^2	.054		.046		.143		.209	
F for Adjusted R^2	1.69		1.48		3.00*		3.64**	
ΔR^2			.008				.073	
F for ΔR^2			.504				5.56*	
N	60		60		60		60	

Unstandardized regression coefficients (*b*) and standard error (s.e.) are reported for the respective controls and predictor variables.
n = 60.
†*p* < .1 (2-tailed test)
**p* < .05 (2-tailed test)
***p* < .01 (2-tailed test)
****p* < .001 (2-tailed test)

TABLE 8. EXPLORATORY SEARCH REGRESSED ON HUMAN CAPITAL (LEVEL & HETEROGENEITY)

	Human Capital - Level				Human Capital - Heterogeneity			
Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**	
	b	s.e.	b	s.e.	b	s.e.	b	s.e.
Constant	3.173***	.681	2.55**	.872	3.36***	.999	3.549***	.857
Size of Location	-.013*	.006	-.009	.006	-.01	.006	-.012	.006
Interdependence	.172	.134	.204	.145	.136	.143	.162†	.135
Type of Task	.217**	.069	.192**	.070	.208**	.072	.228**	.071
Gender Diversity	1.341**	.456	1.121*	.459	1.319**	.462	1.367**	.460
Ethnic Diversity	.351	.370	.328	.412	.056	.414	.378	.374
Business Unit Experience			.528	.432				
Organizational Experience			.227	.137				
Level of Education			-.242†	.124				
Functional Experience			.308†	.156				
Industry Experience			-.077	.164				
Business Unit Heterogeneity					1.993	3.384		
Organizational Heterogeneity					.426	.532		
Educational Heterogeneity					-.749	.445		
Functional Heterogeneity					1.087	1.361		
Industry Heterogeneity					-1.176	2.041		
HC-Heterogeneity Composite							-.204	.280
Adjusted R^2	.237		.275		.240		.230	
F for Adjusted R^2	4.72**		3.28**		2.90		3.99**	
ΔR^2			.096		.067		.007	
F for ΔR^2			1.59		1.05		.530	
N	60		60		60		60	

Unstandardized regression coefficients (*b*) and standard error (s.e.) are reported for the respective controls and predictor variables.
n = 60.
$^{\dagger}p < .1$
*$p < .05$
**$p < .01$
***$p < .001$

TABLE 9. EXPLORATORY SEARCH REGRESSED ON SOCIAL CAPITAL (INTER-INFORMATIONAL & INTRA-RELATIONAL) AND CODIFIED CAPITAL

	Exploratory Search					
Variables	**Model 1**		**Model 2**		**Model 3**	
	b	s.e.	b	s.e.	b	s.e.
Constant	3.271***	.710	3.361***	.69	1.93	.76
Size of Location	-.012	.006	-.018	.01	-.013	.01
Interdependence	.166	.139	.211	.14	.10	.13
Type of Task	.235**	.077	.226**	.07	.210**	.06
Gender Diversity	1.321**	.493	1.323**	.45	1.45**	.43
Ethnic Diversity	.296	.385	.311	.37	.18	.35
Intra-Relational Social Capital			-.625	.45		
Inter-Inform. Social Capital 1	.083	.746				
Inter-Inform. Social Capital 2	-.009	.012				
Inter-Inform. Social Capital 3	.017	.098				
Codified Capital					0.34**	0.11
Adjusted R^2	.202		.237		.237	
F for Adjusted R^2	2.90**		4.717***		4.717***	
ΔR^2	.008		.024		.10	
F for ΔR^2	.210		1.96		9.07**	
N	60		60		60	

Unstandardized regression coefficients (*b*) and standard error (s.e.) are reported for the respective controls and predictor variables.
$n = 60$.
$^{\dagger}p < .1$
$*p < .05$
$**p < .01$
$***p < .001$

TABLE 10. EXPLORATORY SEARCH REGRESSED ON INTERACTIONS

	Exploratory Search			
Variables	**Model 1**		**Model 2**	
	b	s.e.	b	s.e.
Constant	2.032*	.798	2.330**	.792
Size of Location	-.012*	.005	-.013*	.005
Interdependence	.105	.130	.066	.129
Type of Task	.212**	.065	.210**	.063
Gender Diversity	1.46***	.431	1.305**	.428
Ethnic Diversity	.246	.384	.027	.391
Educational-Level	-.042	.099	-.078	.099
Codified Capital	.334**	.114	.280*	.115
Education-Level X Codified Capital			.050†	.026
Adjusted R^2	.324		.358	
F for Adjusted R^2	5.106***		5.177***	
ΔR^2	.103		.041	
F for ΔR^2	4.56*		3.79†	
N	60		60	

Unstandardized regression coefficients (*b*) and standard error (s.e.) are reported for the respective controls and predictor variables.
n = 60.
†*p* < .1
**p* < .05
***p* < .01
****p* < .001

APPENDIX A

Original and Modified Survey Items

Construct	Proposed Measure	Source(s) of Original Measure
Team Human Capital (Level and Heterogeneity)		
Dominant Functional Background	Check all functions you have had experience working in. ▪ Engineering ▪ Finance or accounting ▪ Human resources ▪ Information technology ▪ Operations management ▪ Program management ▪ Sales, marketing, or business development ▪ Supply chain ▪ Strategic pricing	Bunderson & Sutcliffe (2002) ▪ Team members were asked to indicate their years of pervious work experience in each of nine functional areas.
Tenure in Organization	How many years have you worked at Company ABC organization? _____ years ___months	Simons, Pelled, & Smith (1999) ▪ Unmodified from original
Tenure in Industry	Check all industries you have had experience working in. ▪ Banking/finance ▪ Computers/office equipment ▪ Diversified manufacturing ▪ Construction ▪ Consumer products ▪ Business services ▪ Aerospace ▪ Insurance ▪ Pharmaceutical/medical ▪ Retail ▪ Utilities ▪ Transportation	
Education - Level	What is the highest degree you completed? ▪ High school graduate or less ▪ College undergraduate, no degree ▪ Two-year college degree ▪ Four-year college degree ▪ Master's degree ▪ Doctoral degree	Simons, Pelled, & Smith (1999) ▪ Unmodified from original

Construct	Proposed Measure	Source(s) of Original Measure
Team Human Capital (Level and Heterogeneity)		
Education – Degree	Please check the box that indicates the educational background that most closely represents your undergraduate degree/major. ▪ Engineering (listed 14 different types of engineering) ▪ Business/Management ▪ Social Sciences ▪ Science/Technology/Mathematics ▪ Other	Bantel & Jackson (1989)
Team Codified Capital		
Team Codified Capital	To what extent do you agree with the following items describe how your project team stores knowledge and information for access, communication, or transfer? (1 = strongly disagree; 7 = strongly agree) ▪ Our team uses shared drives, knowledge management systems, team websites, etc. as a way to store knowledge. ▪ Much of our team's knowledge is contained in manuals, databases, documents, etc. ▪ Much of our team's work is captured in images, diagrams, charts, spreadsheets, etc. ▪ Much of our team's work is accessed through documents	Subramaniam & Youndt (2005) ▪ Our organization uses patents and licenses as a way to store knowledge ▪ Much of our organization's knowledge is contained in manuals, databases, etc. ▪ Our organization's culture (stories, rituals) contains valuable ideas, ways of doing business, etc. ▪ Our organization embeds much of its knowledge and information in structures, systems, and processes Schulz (2001) ▪ Collections of numbers or specification codes, e.g., when know how and information is embodied in part numbers, bar codes, or mathematical formulas ▪ Word or text documents, e.g., when know how and information is embodied in policy statements, sales reports, or memos ▪ Pictures or images, e.g., when know-how and information is captured organization charts, blue prints, or flow charts.

Construct	Proposed Measure	Source(s) of Original Measure
Social Capital		
Social Capital	Place a check mark next to the engineers within the Business Unit 123 you got to or interact with in order to solve work problems. [engineers names listed] Please list the first and last names of other Company's ABC's engineers or other technically trained employees outside of Business Unit 123 whom you interact with in order to solve work problems.	Wasserman & Faust (2004) ▪ Unmodified
Exploratory Search		
Exploratory Search	To what extent do you agree with the following items describing your project team (1, "strongly disagree," to 7, "strongly agree")? Our Team… ▪ Ties new methods or techniques to solve problems ▪ Searches for fresh, new ways to look at problems ▪ Strives for experimentation when solving problems ▪ Utilizes creativity when solving problems ▪ Varies how problem solving is approached ▪ Tries new approaches when solving problems	Please see Table 2

Construct	Proposed Measure	Source(s) of Original Measure
Team Innovation		
Radical Innovation	Compared to the average of other teams in your company, how would you rate this team's performance on each of the following items? ▪ Our team's work makes prevailing product/service lines obsolete ▪ Our team's work fundamentally changes our prevailing products/services ▪ Our team's work makes our existing expertise in prevailing products/services obsolete	Gatignon, Tushman, Smith, & Anderson (2002) ▪ Innovation is a minor improvement over the pervious technology (reverse coded) ▪ Innovation was based on a revolutionary change in technology ▪ Innovation was a breakthrough innovation ▪ Innovation led to products that were difficult to replace with substitute using older technology ▪ Innovation represents a major technological advance in subsystem
Incremental Innovation	Compared to the average of other teams in your company, how would you rate this team's performance on each of the following items? ▪ Our team's work reinforces our prevailing product/service lines ▪ Out team's work reinforces our existing expertise in prevailing product/service lines ▪ Our team's work reinforces how we currently compete in this product/service market	Subramaniam & Youndt (2005) ▪ Innovations that reinforce your prevailing product/service lines ▪ Innovations that reinforce your existing expertise in prevailing products/services ▪ Innovations that reinforce how you currently compete ▪ Innovations that make your prevailing product/service lines obsolete ▪ Innovations that fundamentally change your prevailing products/services ▪ Innovations that make your existing expertise in prevailing products/services obsolete

Construct	Proposed Measure	Source(s) of Measure
Control Variables		
Team Size	How many employees are on this project team? _____	
Size of the Teams Network	This is calculated as the sum of the total number of ties for each group. By controlling for the size of the network, it is possible to address the possibility that results are do to the "extensivity" of the network	Burt (2000) ▪ Unmodified from original
Type of Engineering Project	▪ Percentage of time engineering team modified existing products or developed new products.	Katz (1982) & Van de Ven & Yun-han (1989) ▪ Modified from original
Gender	Gender: _____	
Project Inter-dependence	▪ Our Company ABC facility can not accomplish its objectives without information or materials from other Company ABC facilities ▪ Other Company ABC facilities depend on our facility for information or materials needed to perform their objectives ▪ The objectives of our facility are related to other facilities	Campion, Medsker, & Higgs (1993) ▪ Unmodified from original
Age	Age: _____ years	
Ethnicity/ Nationality	Ethnicity/nationality: ▪ White/Caucasian ▪ Black/African American ▪ American Indian/Alaskan Native ▪ Hispanic ▪ Asian ▪ Other race/ethnicity, please specify_____	

APPENDIX B
Survey Instrument

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

Employee Survey

You are invited to participate in a research study being conducted by Erika Harden, a doctoral candidate in the School of Management and Labor Relations at Rutgers University. The purpose of this research is to understand how teams can be configured to enhance team innovation. In particular, we are interested in exploring how team members' educational backgrounds, use of knowledge management systems, and relationships with team members can support team innovation.

Approximately 1,500 subjects (18 years old or older) will participate in the study, and each individual's participation will last approximately 5-10 minutes. The study procedure is to:

- Read and sign this informed consent form
- Complete the enclosed survey, which will take approximately 5-10 minutes

There are no foreseeable risks to participation in this study. Your responses are very valuable to the ultimate success of this important study. By participating in the study you are helping to advance the management of teams in today's organizations.

- Participation in this study is VOLUNTARY. You may choose not to participate, and are FREE TO WITHDRAW at any time during the survey without penalty to you. In addition, you may choose not to answer any questions with which you are not comfortable.
- The KAI Inventory, included in the envelope, is being sponsored by Parker Hannifin to help engineers understand their different styles of decision making. This is not part of the study mentioned above, but **all responses will be kept confidential**, only the primary researcher and the scoring company will see raw data. If a report is presented or published, only group results will be stated.

This research is **confidential**. The records of this study will be kept private. Research records will be kept in a locked file and on a secure computer; only researchers will have access to the records. The primary researcher and the Institutional Review Board at Rutgers University are the only parties that will be allowed to see the raw data, except as may be required by law. If a report of this study is presented or published, only group results will be stated.

If you have any questions about the study procedures, you may contact Erika Harden at (732) 690-1073. If you have any questions about your rights as a research subject, contact the Sponsored Programs Administrator at Rutgers University at:

Rutgers University Institutional Review Board
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
Tel: 732-932-0150 ext. 2104
Email: humansubjects@orse.rutgers.edu

A copy of this form is attached; you may keep it for your records. Thank you for participating.

E Harden

Erika Harden

If you agree to participate in the survey please sign below:

_____

575051

APPROVED
Date: 2/27/07

EXPIRES
FEB 2 6 2008

About Your Parker Facility

1 Problem Solving

When faced with a PROBLEM TO SOLVE, to what extent do the following items describe YOUR ENGINEERING WORK TEAM at this facility?

Problem Solving: Using new approaches...	Strongly Disagree						Strongly Agree
Tries new methods or techniques to solve problems	1	2	3	4	5	6	7
Searches for fresh, new ways to look at problems	1	2	3	4	5	6	7
Strives for experimentation when solving problems	1	2	3	4	5	6	7
Utilizes creativity when solving problems	1	2	3	4	5	6	7
Varies how problem solving is approached	1	2	3	4	5	6	7
Tries new approaches when solving problems	1	2	3	4	5	6	7

Problem Solving: Using established approaches...	Strongly Disagree						Strongly Agree
Uses existing resources or tools to solve problems	1	2	3	4	5	6	7
Makes use of existing methods or techniques to solve problems	1	2	3	4	5	6	7
Uses existing, established ways to examine problems	1	2	3	4	5	6	7
Relies on established approaches when solving problems	1	2	3	4	5	6	7
Approaches problem solving in a consistent manner	1	2	3	4	5	6	7
Utilizes routines when solving problems	1	2	3	4	5	6	7
Strives for efficiency when solving problems	1	2	3	4	5	6	7

2 Information Storage

To what extent do the following items describe how YOUR ENGINEERING WORK TEAM at this facility stores knowledge and information for access, communication, and transfer?

	Strongly Disagree						Strongly Agree
Much of our team's work is captured in technical specs.	1	2	3	4	5	6	7
Much of our team's work is captured in drawings	1	2	3	4	5	6	7
Much of our team's work is accessed through shared drives	1	2	3	4	5	6	7

3 Knowledge Sharing

To what extent do you agree the following items describe knowledge sharing within your ENGINEERING WORK TEAM?

	Strongly Disagree						Strongly Agree
Information used to make key decisions is freely shared among engineering team members	1	2	3	4	5	6	7
Engineering team members work hard to keep one another up to date on their activities	1	2	3	4	5	6	7
Engineering team members are kept "in the loop" about key issues affecting the team	1	2	3	4	5	6	7

4 Type of Work

	Sustaining						Developing New
At this facility, what percentage of time is spent on sustaining current products vs. developing new products?	100%	80%	60%	50%	60%	80%	100%
In your position at Parker, what percentage of your time is spent on sustaining current products vs. developing new products?	100%	80%	60%	50%	60%	80%	100%

Select the one best engineering technical area that most closely represents your current position?

- ☐ Applications/Tech. Service
- ☐ Manufact./Process
- ☐ Quality
- ☐ Software
- ☐ Systems
- ☐ Design/Draft/Analytical
- ☐ Materials
- ☐ Developing New Products/R&D
- ☐ Sustaining Current Products/ Product Line
- ☐ Test

About Your Parker Facility (cont.)

5 Interdependence of Work

To what extent do you agree the following items describe interdependence of work?

Interdependence of Your Facility...	Strongly Disagree						Strongly Agree
Our Parker facility can not accomplish its objectives without information or materials from other Parker facilities	1	2	3	4	5	6	7
Other Parker facilities depend on our facility for information or materials needed to perform their objectives	1	2	3	4	5	6	7
The objectives of our facility are related to other facilities	1	2	3	4	5	6	7

Interdependence of Your Work ...	Strongly Disagree						Strongly Agree
I cannot accomplish my tasks without information or materials from other members of my team	1	2	3	4	5	6	7
Other members of my team depend on me for information or materials needed to perform their tasks	1	2	3	4	5	6	7
Within my team, jobs performed by team members are related to one another	1	2	3	4	5	6	7

6 Work Team Performance

How would you rate YOUR ENGINEERING WORK TEAM'S performance on each of the following items?

Developing New Products...	Strongly Disagree				Strongly Agree
Makes prevailing product lines obsolete	1	2	3	4	5
Fundamentally changes our prevailing products	1	2	3	4	5
Makes our existing expertise in prevailing products obsolete	1	2	3	4	5

Improving Current Products...	Strongly Disagree				Strongly Agree
Reinforces our prevailing product lines	1	2	3	4	5
Reinforces our existing expertise in prevailing product lines	1	2	3	4	5
Reinforces how we currently compete in this product market	1	2	3	4	5

How would you rate this team's OVERALL PERFORMANCE on the following items?

	Poor		Good		Excellent
Progress of projects compared with initial expectations	1	2	3	4	5
Projects launched on budget	1	2	3	4	5
Projects launched on schedule	1	2	3	4	5

7 Work Climate

To what extent do you agree that the following items describe YOUR FACILITIE'S WORK CLIMATE?

	Strongly Disagree						Strongly Agree
New ideas are appreciated	1	2	3	4	5	6	7
Time is invested for testing new ideas	1	2	3	4	5	6	7
People receive recognition for innovation	1	2	3	4	5	6	7
New ideas can fail without penalty to the originating person	1	2	3	4	5	6	7

8 Collaboration within the CIC Group

Place a check mark next to the engineers within the CIC Group you go to or interact with in order to solve work problems.

CIC Group

- ☐ Christopher Girard
- ☐ Justin Shaw
- ☐ Roger Palmer

Climate Systems

- ☐ Brad Beerman
- ☐ Bradley Baxter
- ☐ Brandon Rodgers
- ☐ Brent Guerra
- ☐ Brian Oberley
- ☐ Christopher Gorman
- ☐ Dwayne Whitaker
- ☐ Eric Bickford
- ☐ Frederick Pilon
- ☐ James Ary
- ☐ Jay Sunderland
- ☐ Jeffrey Gleckler
- ☐ Judd Girard
- ☐ Justin Knott
- ☐ Justin Miller
- ☐ Kim Ellis
- ☐ Kraig Biberstein
- ☐ Larry Zeigler
- ☐ Mark Schuller
- ☐ Michael Lortie
- ☐ Michael Trumbower
- ☐ Philip Plunk
- ☐ Phyllis Sheffield
- ☐ Randy Bell
- ☐ Shawn Wilson
- ☐ Sherry Kaufman
- ☐ Stephen O'Shaughnessey
- ☐ Steven Schnelle
- ☐ Thomas Trent
- ☐ Timothy Louvar
- ☐ William Reust

Fluid Control

- ☐ Alexander Obst
- ☐ Andrew Brzoska
- ☐ Andrzej Sadowski
- ☐ Anthony Burt
- ☐ Charles Bald
- ☐ David Rougeot Jr
- ☐ Dennis Balazovich
- ☐ Donald Duquette
- ☐ Dwight Matthews
- ☐ Edward Wu
- ☐ Efrain Aguero Jr
- ☐ Gary Pierko
- ☐ George Merrick
- ☐ James Christensen
- ☐ Jared Glass
- ☐ Jason Krajc
- ☐ John Napierski
- ☐ Kevin Wilson
- ☐ Leonard Jaeger
- ☐ Mark Senior

Fluid Control (cont)

- ☐ Matthew Grabowski
- ☐ Michael Noon
- ☐ Michael Valenches
- ☐ Michael Watson
- ☐ Michael Williams
- ☐ Nicola Costa
- ☐ Peter White
- ☐ Raymond Rund
- ☐ Renata Jablonski
- ☐ Richard Herrera
- ☐ Robert Carlson
- ☐ Robert Ferrando
- ☐ Robert Zeiner
- ☐ Robin Peters
- ☐ Rudolph Jabs
- ☐ Stephen Gordon
- ☐ Stephen Rogers
- ☐ Victor Szestakow
- ☐ Vincent Attianese
- ☐ Vincent Sigiel
- ☐ William Fleischer
- ☐ William Henninger

Nich. Portland

- ☐ Carl Drew
- ☐ Charles Coulthard
- ☐ Dale Thurston
- ☐ Frank Amabile Jr
- ☐ Gary Stewart
- ☐ Glenn Mann
- ☐ James Ambrose
- ☐ Joel Titcomb
- ☐ Judy Ricks
- ☐ Keith Richmond
- ☐ Leigh Duren
- ☐ Lori Edwards
- ☐ Marc Goulet
- ☐ Nicholas Darak
- ☐ Omid Ghayebi
- ☐ Peter Dion
- ☐ Randall Small
- ☐ Robert Cotta
- ☐ Robert Fuehrer
- ☐ Robert Rader
- ☐ Russell Brink
- ☐ Russell Roy
- ☐ Sanford Chesley
- ☐ Stephen Rice
- ☐ Theresa Munch
- ☐ Thomas Roeber

Mobile Climate

- ☐ Brenda Jones
- ☐ Brian Descamp
- ☐ Brian Rosenberger
- ☐ Cary Haramoto
- ☐ Chee Teo
- ☐ Christopher Laethem
- ☐ Dean Davis
- ☐ Demetrius Morris
- ☐ Derrick Court
- ☐ Dwayne Mcmillan
- ☐ Dwight Lemmon
- ☐ Erich Zolinski
- ☐ Eugene Dianetti
- ☐ Gary Propst
- ☐ Gary Riley
- ☐ Gerardo Mahuad
- ☐ Jimmy Rogers II
- ☐ John Maddigan
- ☐ John Nielson
- ☐ John Schove
- ☐ Jose Ruz
- ☐ Joseph Shrenkel
- ☐ Kenneth Gleaton
- ☐ Laurie Wunder
- ☐ Leonard Neal Jr
- ☐ Marcus Jones
- ☐ Michael Cristo
- ☐ Michael Ford
- ☐ Michael Milliman
- ☐ Nikhil Baxi
- ☐ Osvaldo Cuaresma
- ☐ Peter Staples
- ☐ Phil Hamilton
- ☐ Ray Copeland
- ☐ Richard Cobb
- ☐ Robert Patterson
- ☐ Robert Prayne
- ☐ Ronald Loder
- ☐ Rusty Spurlock
- ☐ Shannon Corcoran
- ☐ Stanley Sysak
- ☐ Timothy Curry
- ☐ Victor Rivera
- ☐ William Mosher

Refrig. Spec.

- ☐ Adam Pouillie
- ☐ Albert Manna
- ☐ Charles Zdenovec
- ☐ Dale Bader
- ☐ Gregory Edgar
- ☐ Gregory Erickson
- ☐ Jeffrey Teplan
- ☐ John Rolbiecki
- ☐ Joseph Williams
- ☐ Joy Jones
- ☐ Michael Ramis
- ☐ Paul Szymaszek
- ☐ Roberto Valenzuela
- ☐ Steven Mesner
- ☐ William Pacl

Sporlan

- ☐ Albert Sawyers Jr
- ☐ Anthony Korba
- ☐ Becky Voss
- ☐ Bradley Hanneken
- ☐ Brett Godin
- ☐ Brian Clevlen
- ☐ Bruce Gregory
- ☐ Cary Trentmann
- ☐ Charles Hart
- ☐ Christian Parker
- ☐ Corey Grote
- ☐ Daniel Hoffman
- ☐ Daniel Long
- ☐ Danita Chapman
- ☐ David Derner
- ☐ David Niederholtmeyer
- ☐ David Temme
- ☐ David Wrocklage
- ☐ Dean Willenbrink
- ☐ Deanne Theissen
- ☐ Dennis Allen
- ☐ Dennis Nieder
- ☐ Donald Tillotson
- ☐ Douglas Brinkmann
- ☐ Douglas Gildehaus
- ☐ Duane Kiewitt
- ☐ Dustin Searcy
- ☐ Dwane Arts
- ☐ Elizabeth Dudley
- ☐ Francis Filla
- ☐ Gina Jones
- ☐ Glenn Roehrig
- ☐ Gordon Coates III
- ☐ Harley Van Matre
- ☐ Harry Watson IV
- ☐ Heath Schaefer
- ☐ James Bouril
- ☐ James Herbert
- ☐ Jason Forshee
- ☐ Jean Kleekamp
- ☐ Jeanine Schalman
- ☐ John Schoen
- ☐ Joseph Dudley
- ☐ Joseph Freese
- ☐ Karl Baker
- ☐ Keith Fischer
- ☐ Keith Voss
- ☐ Kevin Freeman
- ☐ Kurt Meyer
- ☐ Lawrence Hammond
- ☐ Linda Mense
- ☐ Marian Maune
- ☐ Mark Holdinghausen
- ☐ Mario Mcclain
- ☐ Matthew Dowil
- ☐ Matthew Spaunhorst
- ☐ Matthew Sutterfield
- ☐ Matthew Wehmeyer
- ☐ Michael Benz
- ☐ Michael Borgerding
- ☐ Michael Hoekel

Sporlan

- ☐ Michael Maddock
- ☐ Michael Schwoeppe
- ☐ Miguel Rivera
- ☐ Patrick Bundy
- ☐ Randall Brinkmann
- ☐ Richard Brown
- ☐ Robert Collins
- ☐ Robert Helton III
- ☐ Robert Jones
- ☐ Robert Schindler
- ☐ Rodney Racherbaumer
- ☐ Ronald Blechle
- ☐ Ryan Kliethermes
- ☐ Stephen Bleckman
- ☐ Stephen Maxson
- ☐ Steven Rigg
- ☐ Sydney Fees
- ☐ Timothy Nash
- ☐ Timothy Plassmeyer
- ☐ Timothy Schweizer
- ☐ William Monroe

Others within CIC Group (not listed)

_____

_____

_____

_____

_____

_____

9 Collaboration outside the CIC Group

Please list the first and last names of other Parker ENGINEERS or other technically trained employees (i.e., chemists, R&D scientists, etc.) OUTSIDE of the CIC Group whom you interact with in order to solve work problems.

First Name	Last Name	First Name	Last Name

About Your Background

1 Work Experience

Besides Parker, how many other organizations have you worked for doing similar work?

❑ Parker only ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6 or more

Check all industries you have had experience working in.

❑ Banking/finance	❑ Construction	❑ Aerospace	❑ Retail
❑ Computers/Office equipment	❑ Consumer products	❑ Insurance	❑ Utilities
❑ Diversified manufacturing	❑ Business services	❑ Pharmaceutical/Medical	❑ Transportation

Check all functions you have had experience working in.

❑ Engineering	❑ Information technology	❑ Sales, marketing, or business development
❑ Finance or accounting	❑ Operations management	❑ Supply chain
❑ Human resources	❑ Program management	❑ Strategic pricing

Check all the groups within Parker you have worked in.

❑ Aerospace ❑ Automation ❑ CIC ❑ Fluid Connector ❑ Filtration ❑ Hydraulics ❑ Instrumentation ❑ Seal

In your current position at Parker, do you have direct reports?

❑ Yes ❑ No

2 Education

What is the highest degree you completed?

❑ High school graduate or less ❑ Two-year college degree ❑ Master's degree ❑ College undergraduate, no degree ❑ Four-year college degree ❑ Doctoral degree

Undergraduate Education

Please indicate the undergraduate college or university you graduated from:

_____

Please place a check in the box the most closely identifies your undergraduate degree/major (choose only one):

Engineering
- ❑ Aerospace
- ❑ Agricultural & Biological
- ❑ Automotive
- ❑ Bio Engineering
- ❑ Chemical
- ❑ Civil
- ❑ Computer
- ❑ Design/Drafting
- ❑ Electrical
- ❑ Industrial

Engineering (cont)
- ❑ Manufacturing
- ❑ Mechanical
- ❑ Metallurgical
- ❑ Nuclear

Outside Engineering
- ❑ Business/Management
- ❑ Social Sciences
- ❑ Science/Technology/Mathematics
- ❑ Other

Graduate Education (Masters or Professional Degree)

Please indicate the undergraduate college or university you graduated from:

_____

Please place a check in the box the most closely identifies your undergraduate degree/major (choose only one):

Engineering
- ❑ Aerospace
- ❑ Agricultural & Biological
- ❑ Automotive
- ❑ Bio Engineering
- ❑ Chemical
- ❑ Civil
- ❑ Computer
- ❑ Design/Drafting
- ❑ Electrical
- ❑ Industrial

Engineering (cont)
- ❑ Manufacturing
- ❑ Mechanical
- ❑ Metallurgical
- ❑ Nuclear

Outside Engineering
- ❑ Business/Management
- ❑ Social Sciences
- ❑ Science/Technology/Mathematics
- ❑ Other

ERIKA E. HARDEN

CURRICULUM VITA

EDUCATION

2003-2009	Rutgers University Doctorate of Philosophy Industrial Relations and Human Resource Management, GPA 3.97	New Brunswick, NJ
2001-2003	University of Colorado at Denver Master of Arts Industrial & Organizational Psychology, GPA 4.00	Denver, CO
1998-2001	West Virginia Wesleyan College Bachelors of Arts Psychology Major & Business Minor, GPA 3.84	Buckhannon, WV

PUBLICATIONS

Harden, E.E., Kruse, D., & Blasi, J. (2008). Who Has a Better Idea? Innovation, Shared Capitalism, and HR Policies. *National Bureau of Economic Research (NBER) Working Paper Series.* Cambridge, MA.

Aguinis, H., & Harden, E.E. (2008). Cautionary note on conveniently dismissing chi-square goodness-of-fit test results: Implications for strategic management research. In D. J. Ketchen & D. A. Bergh, (Eds), *Research Methodology in Strategy and Management,* Vol. 5, San Diego, CA: Elsevier.

Aguinis, H., & Harden, E. E. (2008). Sample size rules of thumb: Evaluating three common practices. In C. E. Lance and R. J. Vandenberg (Eds.), *Statistical and Methodological Myths and Urban Legends: Received Doctrine, Verity, and Fable in the Organizational and Social Sciences*. Mahwah, NJ: Lawrence Erlbaum.

Jackson, S.E., Chuang, C., Harden, E., & Jiang, Y. (2006). Toward developing human resource management systems for knowledge-intensive teamwork. J. Mortocchio (Ed.), *Research in Personnel and Human Resource Management*, Vol. 25, (pp. 27-70). New York, NY. Elsevier.

Lepak, D.P., Liao, H., Chung, Y. & Harden, E.E. (2006). A conceptual review of high involvement HR systems in strategic HRM research. J. Mortocchio (Ed.), *Research in Personnel and Human Resource Management*, Vol. 25, (pp. 217-272). New York, NY. Elsevier.

PUBLICATIONS (CONT.)

Aguinis, H. & Harden, E. (2004). Will Banding Benefit My Organization? An Application of Multi-Attribute Utility Analysis. In H. Aguinis (Eds.), *Test Score Banding: legal, technical, and societal issues.* (pp. 193-216). Westport, CT: Praeger.

PROFESSIONAL EXPERIENCE

Parker Hannifin Corporation, Cleveland, OH
Corporate Talent Manager/Development Process Leader *(07/2007 – Present)*

Rutgers University, New Brunswick, NJ
Research Associate & Doctorial Candidate *(08/2003 – 07/2007)*

FMI Corporation, Denver, CO
Leadership and Organizational Development *(06/2002 – 07/2003)*

Strategic Programs, Inc., Denver, CO
Research Associate *(09/2001 – 03/2002)*