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Editorial Note

The May 2020 issue of the *Journal of International Business Disciplines (JIBD)* has been the result of a rigorous process in two stages:

- Stage 1: all papers that were submitted to 2020 IABD conference went through blind reviews, and high quality papers were accepted for presentation at the conference.
- Stage 2: approximately ten percent of the accepted articles and two invited manuscripts were selected for possible publication in *JIBD*. The respective authors were contacted and asked to resubmit their papers for a second round of reviews. These manuscripts went through a blind review process. In the end, four articles were recommended for publication in the May 2020 issue of *JIBD*.

JIBD is committed to maintaining high standards of quality in all of its publications.

Ahmad Tootoonchi, Chief Editor
Journal of International Business Disciplines

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HARDY LEADERSHIP: A MODEL FOR LEADERSHIP DEVELOPMENT IN A GLOBAL SOCIETY

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ABSTRACT

This paper discusses the traditional leadership paradigm and the factors of social change that delimit its effectiveness. The impact these changes have on leadership are described and an argument is made for a transition to a character-centered leadership paradigm that allows leaders to function more effectively in a global, change-oriented society. The relevance of Hardiness training is then discussed as a model for character centered, holistic leadership development.

INTRODUCTION

From 1975 to 1986, Dr. Salvatore Maddi and a group of graduate students conducted a longitudinal study of 450 male and female managers who worked for Illinois Bell Telephone during one of the most devastating organizational upheavals of the 20th century, the deregulation and divestiture of AT&T. This landmark study provided tremendous insights about how people respond to high stress environments. While two-thirds of the managers studied found themselves debilitated by the high stress environment, the remaining one third “not only survived, but actually thrived” (Khoshaba & Maddi, 2003, p. 13). As a result of this study, Maddi and his colleagues were able to identify the characteristics and behaviors that permitted these individuals to perform successfully in such a high stress environment. These characteristics came to be known as Hardiness.

As part of the original study, Maddi and his colleagues were asked to develop a program for training employees to become hardier. As a result, the Hardiness training program for stress management was developed. Since its inception, this program has helped thousands of individuals achieve similar success amidst stress. Additionally, the Hardiness concept and training program have proven their validity through research studies in the military (P. Bartone, Bartone, Kelly, & Matthews, 2013; Johnsen, Eid, Pallesen, Bartone, & Nissestad, 2009; Westman, 1990), education (Maddi, Khoshaba, Jensen, Carter, Lu, & Harvey 2001), and business (Maddi & Kobasa 1984; Steinhardt, Dolbier, Gottlieb, & McCallister 2003). In the last few years, however, Hardiness training has, as a result of major societal changes that took place around the turn of the century, expanded its utility beyond the realm of stress management and become more increasingly relevant as a model for holistic leadership development that transcends the traditional model of leadership. This paper discusses the traditional leadership paradigm and the factors of social change that delimit its effectiveness. The impact these changes have on leadership are described and an argument is made for a transition to a character-centered, holistic leadership development.

TRADITIONAL LEADERSHIP

Traditional leadership within organizations has focused on what the leader does in order to get things done (Lussier & Achua, 2007). This model of leadership argues that effective leadership involves acquiring the skills, whether technical, conceptual, or human (Northouse, 2012), necessary to get one's followers to perform in such a way that the organization's goals and objectives are accomplished. While this model of leadership may use more democratic, enlightened methodologies for accomplishing goals, in reality such methods are generally incorporated as a means to an end, and are often pushed aside when they do not meet the immediate needs of the moment, or when the leader becomes sufficiently stressed. Consequently, the primary tactics of traditional leaders are command and control (Partridge, 2018).

Whatever tactics are used, the focus of traditional leadership remains on the leader's skills. Covey (1989) refers to this paradigm of leadership as the personality ethic, which argues that success is "more a function of personality, of public image, of attitudes and behaviors, skills and techniques, that lubricate the process of human interaction" (p. 19). At its best, this style of leadership accomplishes results. At its worst, however, it is "clearly manipulative, even deceptive, encouraging people to use techniques to get other people to like them" and to follow them (p. 19).

Because of the emphasis the traditional leadership model places on skills, its related development programs tend to focus solely on training leaders to utilize the traditional skills necessary to get things done. As Northouse (2004) explained, "The skills approach [to leadership development] provides a structure that is very consistent with the curricula of most leadership education programs . . . [that] have traditionally taught classes in problem solving, conflict resolution, listening, and team work" as well as other leadership skill sets (p. 51). While all of these skills are important, simply understanding and using them within the construct of the traditional leadership model is becoming less and less effective. Recent societal changes have altered and are altering our world so drastically that old models of leadership, and consequently leadership development, are no longer effective.

OUR CHANGED WORLD

At the end of the 20th century, a number of fundamental changes took place that altered the world of work dramatically and created a context where resilience and hardiness is even more important for leaders than ever before. At the time, Work (1996) described the changing nature of our global environment in the following way:

The world as we have known it is changing at a dizzying pace, fueled by advances in technology and innovation. People are crisscrossing the planet in numbers not imagined even fifty years ago, demands for consumer goods and services and capital goods are soaring worldwide, and corporations, not-for-profit organizations, and other institutions are finding and developing new and significantly profitable markets beyond regional and national borders. At the core of this emerging global economy is a computer-driven information and communications technology that serves to under-gird and link the world's production and consumption capacities and needs. (p. 76)

As Work (1996) also explained, a number of social forces were driving rapid, revolutionary changes that altered both our work and personal lives. These forces included the rise of the global economy (Jarvis, 2000; McNair, 2001; Merricks, 2001), the emergence of the information society (Jarvis; McNair; Merricks), the changing nature of the workplace (Adams, October 1998; Bridges, 1996; Khoshaba & Maddi, 2003; Vanscoy, July 2000), technology (Jarvis; McNair) and shifting demographics (Adams; Bridges; McNair; Vanscoy; Work).

The term global economy refers to “the process whereby world wide economic forces supplant those of nation and locality” (McNair, 2001, p. 16). This process began as a result of increased international competition and expanded as resource scarcity increased (i.e. during the oil crisis). This led major corporations to seek cheaper manufacturing sites internationally (Jarvis, 2000), which further increased global competition. Since then, globalization has accelerated due to communication and transportation technology, global political restructuring, and the apparent dominance of capitalism as an economic philosophy. As a result of its emergence, the global economy has impacted organizations and leaders by increasing competition and diversity (Jarvis, 2000).

An information society is one in which most economic value is “generated by trade in knowledge, rather than in manufactured goods” (McNair, 2001p. 18). Due to the fact that “more and more work is knowledge-based rather than industrial,” the rise of an information society, largely dependent upon knowledge workers, fundamentally altered the workplace (Bridges, 1996). Because knowledge workers tend to be more educated than employees of the past, are more likely to want to participate in the workplace. They are, therefore, less likely to appreciate traditional command and control leadership because they are capable of and expect greater autonomy and involvement. As Vanscoy (July 2000) declared, “they’ll sooner weather the risks of unemployment than knuckle under to outmoded thinking” that restricts their freedom (p. 92). Furthermore, as part of their education, knowledge workers have often been taught the “techniques” of leadership and become resentful when these are used insincerely to “motivate” them.

Closely allied with the changing economy and the rise of the information society was the altered state of the workplace. As Khoshabba and Maddi (2003) explained, “Businesses now favor smaller, more rapidly changing work units over larger sized corporations” (p. 12). These smaller, more flexible organizations offered and continue to offer less security for employees than did the large corporations of the past because they are involved in mergers and acquisitions and

“expand, contract or shift direction more frequently . . . in response to ever-changing customer demands” (Adams, 1998, p. 9). Hence, “we can no longer expect to only work for one employer” (p. 12). In fact, Bridges (1996) went so far as to indicate that in the future organizations will become “de-jobbed” as they constantly alter the composition of their workforce to meet changing demands, a prediction that in some ways had occurred. Thus, as jobs have become and continue to become more transitory and smaller and more responsive organizations become more common, the workplace becomes less stable and more impersonal.

Another significant force for change was the increased rate of technological advancements (Jarvis, 2000; McNair, 2001). The rise of a global economy and a technology-based information society created a need for companies to achieve competitive advantage by staying one step ahead of their competitor’s technology. This need involved increasing investments in research and development. With so much money at stake in a highly competitive environment, anxiety, fear, distrust, and other negative emotions have come to challenge the ability of leaders to act in accordance with the effective leadership skills they have been taught. Furthermore, technological advancements have led to technology disruptions. As (El Namaki, 2017) explained,

Disruption is a radical change in the task or distant environments of an organization or a framework. It is triggered by disruptive forces or breakthroughs that alter current status in a tangible and measurable way. Disruption could be as fast and complete as to destroy existing markets, businesses and technologies and it could be as partial and progressive as to carve out a rapid incremental transformation. Disruptive forces leave a permanent imprint that compels a shift in products, processes and business models to what we may term the “new normal” (p. 74)

Thus, technology has driven change in ways that significantly altered the landscape of business by increasing instability and demanding rapid change.

In addition, “dramatically increasing numbers of women [have been] entering the work force in roles they would have been precluded from playing just a few decades ago” (Work, 1996, p. 77). As they have done so, they have brought with them a different way of leading and being led (Northouse, 2012). The same is true for the ethnic groups currently increasing their involvement in the workplace (Bordas, 2007, 2013; Northouse, 2012). As Work explained, “the ethnic, cultural, and gender characteristics of America’s population and labor force are rapidly changing” (p. 77). New immigration patterns, combined with more traditional ones, are drastically altering the “face” of the work force. In fact, “it is estimated that nonwhite ethnic and cultural groups will exceed one-third of all new entrants to the labor force between now and the turn of the century” (p. 77). Once again, these trends have only continued since then.

These changes in the economy and the workplace have put tremendous pressure on all employees, especially leaders, to engage in ongoing learning, development, and change. McNair (2001) explained that workers, “need more sophisticated technical skills, [which] are rapidly changing, often in unpredictable ways” (p. 21). He further asserted that, “to cope in this world, individuals will need increasing skills in self-management, to be good at anticipating and responding to change, and perhaps above all to be good learners” (p. 23). Consequently, ongoing learning is essential

(Jarvis, 2001; Jupp, 2002; McNair, 2001; Senge, 1990). As Knowles, Holton, and Swanson (1998) further stated,

A person's job security is increasingly dependent on an ability to grow and learn, sometimes in rather radical ways. Adults today are often faced with demands to learn and relearn their jobs multiple times in a career. Those who do not have strong learning skills usually face layoffs. (p. 169)

Jarvis and Tosey (2001) argued that employees and leaders would need the following skills in the changing economy "learning to learn, communication and collaboration, creative thinking and problem solving, technological literacy, global business literacy, leadership, career self-management" (p. 154). Current efforts to develop badging initiatives in higher education (Fain, 2016).

These changes and demands have also significantly increased individual stress levels, particularly in the case of leaders who are already burdened by high stress. As numerous authors have explained, leadership roles have always existed within a high stress context (Fassel, 1998; Lambert, Lambert, & Yamase 2003; Quinn, 1996; Sturnick, 1998). This is true both in the business arena as well as in health care, public service, politics, and education (Stieglitz, 1998; Wilde, Ebbers, Shelley, & Gmelch 2003). As a result, burnout, health problems, and emotional turmoil appear common among leaders (Lambert et al.; Stieglitz; Sturnick).

Sources of this turmoil include lack of supervisory support (Steinhardt et al., 2003), role ambiguity (Khoshaba & Maddi, 2003), constant scrutiny (Goleman, Boyatzis, & McKee, 2002), and information overload combined with mental fatigue (Restak, 2001; Smith, Winter 2002). Unfortunately, however, the abundance of information leaders receive does not necessarily make it easier for them to access the right information, which can also be stressful (Goleman, Boyatzis, & McKee 2002). Finally, Clark and Cooper (2000) delineated all of the following factors as contributors to occupational stress for leaders: "role in the organization; relationships at work; career development; . . . home/work interface; [and] . . . the structure and climate of the organization (such as the management style, level of consultation, communication and politics)" (p. 174).

All of these stressors have a strong negative impact on leadership and personal effectiveness in a variety of ways. These negative effects include, but are not limited to, diminished job satisfaction (Steinhardt et al., 2003), illness (Goleman, 1995; Khoshaba & Maddi, 2003), cultural contamination through emotional contagion (Goleman et al., 2002; Lansisalmi, Peiro, & Kivimaki, 2000), hampered learning capacity and memory (Howard, 2000; Jensen, 1998; LeDoux, 1996; Restak, 2001), psychological disorders such as panic attacks and depression (Goleman; Restak), and performance (Westman, 1990). As Khoshabba and Maddi (2003) explained, "as daily stress rises, we tend to perform poorly, mentally burn out, get ill more frequently, and in the extreme, behave more aggressively" (p. 12). These symptoms of leadership burnout are merely augmented by the dramatic social changes previously delineated.

As forces for change accelerate and workplace stress increases, it becomes harder and harder to simply use "techniques" of leadership, which may have worked in the past, to accomplish

organizational goals. Quinn (1996) explained, “There are people who know how to lead, . . . yet they cannot bring themselves to initiate the process. There is no energy left. They are victims of burnout” (p. 20). In such situations, leaders cannot depend solely on their skills to succeed. They must achieve a higher level of leadership capacity that incorporates not only what the leader does, but who the leader is. Quinn argued, “To turn this situation around, for the healing process to begin, people must engage in deep personal change” (p. 21). Given this need, skill-based leadership development programs are no longer sufficient. What is needed is a leadership program that provides a process for supporting and engaging in deep, holistic personal change while also providing training in character-based leadership skills.

CHARACTER CENTERED LEADERSHIP

Hardiness as a training program is based on the idea that personal effectiveness is dependent on nourishing and developing the whole self. This philosophy of development is closely aligned with Covey’s (1989) “Character Ethic” paradigm. He explained, “The Character Ethic [teaches] that there are basic principles of effective living, and that people can only experience true success and enduring happiness as they learn to integrate these principles into their basic character” (p. 18). The essence of this type of leadership is fundamentally different than that of the paradigm of traditional leadership. Quinn (2004) explained,

becoming a leader is not a matter of becoming adept at a certain set of ‘behaviors’ or learning a particular set of leadership ‘principles’ or ‘tools.’ Behaviors, principles, and tools all have their place, but they will not make transformational leaders of us without a process of deep inner change. (p. 195)

Leadership education, therefore, must not only provide skill enhancement, but also identity development. Instead of focusing on teaching leaders to use whatever technique is necessary to get the results he or she desires, leadership development training programs must focus on fostering integrity by “creating a seamless link between [a leader’s] espoused values, actions, and behaviors” (Luthans & Avolio, 2003, p. 242). Such alignment is essential because, as Zenger and Folkman (2002) declared, “Personal character is the core of all leadership effectiveness. . . . ethical standards, integrity, and authenticity are extremely important” (p. 13). Where these are lacking, leaders lose much of their credibility and influence with those they lead.

Unfortunately, however, this kind of leadership requires tremendous energy, which is typically in short supply when individuals are facing the high stress levels of today’s workplace. As a result, it is imperative that leadership development programs also engage and educate leaders in a process of holistic personal growth that will allow them to function effectively within the context of today’s global, change-oriented society.

HARDY LEADERSHIP

The Hardiness training program facilitates this process of character-centered leadership education by assisting leaders to develop internal qualities as well as behavioral skills integrated into the identity of the leader. As a result, leaders not only alter their behaviors, but also their identity, thereby ensuring that they can thrive in high-stress environments.

The internal principles upon which Hardiness is founded, and which must be integrated into one's basic character to overcome stress and increase leadership effectiveness, are commitment, control, and challenge. Maddi (2004) recently defined these characteristics in the following terms,

If you are strong in commitment, you want to stay involved with the people and events going on around you, as that seems the best way to find what is experientially interesting and meaningful. It seems wasteful to you to sink into isolation and alienation. If you are strong in control, you want to struggle to have an influence on the outcomes going on around you, even if this may seem difficult in certain circumstances. It seems wasteful to you to sink into powerlessness and passivity. Furthermore, if you are strong in challenge, you find the process of continuing to learn from your experiences. (p. 286)

Each of these characteristics represents an essential attribute leaders must possess to operate effectively in high stress environments.

Commitment

Leaders who are high in commitment view their “work as important and worthwhile enough to warrant [their] full attention, imagination and effort” (Maddi & Khoshaba 2005, p. 18). As a result, they “stay involved with the events and people around [them] even when the going gets rough” (p. 18). This is typically because they have a strong sense of purpose and vision, and are passionately engaged in what they are doing. In terms of leadership, a hardy leader would be one who “is actively engaged in the work as well as the people doing the work.” (P. T. Bartone, Eid, Johnsen, Laberg, & Snook, 2006, p. 502). It is not surprising, therefore, that numerous leadership experts have documented the value of commitment and its underlying variables of visionary leadership, passionate engagement, and purpose-centered behavior (Batten, 1998; Covey, 1989; Goleman et al., 2002; Northouse, 2004; Quinn, 1996, 2004; Wheatley, 1999). In addition, connections have been made to the role of commitment in achieving flow, intrinsic motivation, and heroic and courageous leadership (Lloyd & Atella, 2000).

Control

Maddi and Khoshaba (2005) described leaders who possess a strong sense of control as “trying to positively influence the outcomes of the changes going on around [them]” (p. 18) because they

believe in their capacity to act within their sphere of influence in order to bring about positive change in their environment, they are able to face difficult challenges as they arise. Covey (1989) described this as operating within one's circle of influence in order to address one's circle of concern. This proactive response to life is an essential element of leadership that is based upon a leader's locus of control, confidence and self-efficacy, and personal mastery—all of which have been identified as critical elements of leadership and resilience (Benard, 2004; Goleman et al., 2002; Lloyd & Atella, 2000; Luthans & Avolio, 2003; Northouse, 2004; Quinn, 2004; Senge, 1990; Sutcliffe & Vogus, 2003). In addition, Lloyd and Atella (2000) discuss how control can be contrasted with over-control, which could likely explain differences in autocratic vs. empowering approaches to leadership. They also address the connection between control and leader responsibility. Thus, leaders who demonstrate a control orientation would be "confident and planful in pursuing tasks and goals" (P. T. Bartone et al., 2006, p. 502).

Challenge

The concept of challenge refers to the attitude a leader possesses that leads him or her to "face up to stressful changes, try to understand them, and solve them" (Maddi & Khoshaba 2005, p. 18). Such individuals are not afraid to face difficult challenges or to take risks because they humbly recognize and accept that "the social systems necessary to solve modern problems are inherently complex. . . . [and] it is impossible to anticipate all possible events and effects, so failure or accident is inevitable" (Stone, 2002, p. 195). As leaders, these individuals would not be "deterred by obstacles and setbacks, but instead interpret these as challenges to overcome and to learn from" (P. T. Bartone et al., 2006, p. 502). Because they know that failure is simply a mechanism that facilitates their learning and growth, they would view "novel situations that test one's abilities" as "fun" (P. T. Bartone et al., 2006, p. 502). Lloyd and Atella (2000) suggest a connection between this and a leader's ability to demonstrate authenticity and courage and the practice of activist social support.

These three character traits: commitment, control, and challenge, under-gird the Hardiness training program, and make it possible for individuals to engage in the deep personal change that can "only occur when people take active control of their lives," in spite of the challenges they face (Quinn, 1996, p. 21).

Regarding the interplay of these three traits, Maddi (2004) stated, "Conceptually, not one of the 3 Cs by itself is enough to provide the needed courage and motivation to turn stressful changes to advantage. What is needed is all three of the Cs operating together" (p. 287). When combined, these attitudinal elements facilitate the reframing of challenges in positive ways so as to better deal with them. This allows leaders to see themselves, others, and their environment in a more positive, involved, caring way that fosters greater spiritual, mental, and emotional health. These characteristics and behaviors likely contribute to the ability to respond to the needs of followers outlined by Rath and Conchie (2008): trust, hope, security, and compassion. In addition, commitment, control, and challenge also impact one's ability to engage in the relational and behavioral aspects of hardiness: social support and healthful living. Both of these areas of personal effectiveness are critical components of effective leadership.

Social Support

Social support encompasses the fostering of and use of positive social relationships to assist individuals in overcoming challenges. It also deals with conflict resolution (Khoshaba & Maddi, 2003). Grounded in the principles of commitment, control, and challenge, these social support processes are founded on the idea that oneself and those with whom he or she relates are worthwhile and capable of growth and change. As leaders interrelate with others based on these principles and act in service to their relationships, they become more effective at managing conflict, communicating whole messages, monitoring and managing their learned ideas and emotional triggers, and giving and receiving both assistance and encouragement, while avoiding overprotection and subtle competition (Khoshaba & Maddi). These principles and skills are taught as part of the Hardiness training program and represent essential components of emotionally intelligent leadership (Goleman et al., 2002). In fact, virtually all leadership experts identify relational skills (conflict resolution, effective communication, etc.) or relationships in general as critically essential elements of effective leadership (Covey, 1989; Goleman et al., 2002; Greenleaf, 1998; Luthans & Avolio, 2003; Northouse, 2004; Palmer, 1998; Quinn, 2004; Spears, 1998; Wheatley, 1999; Zenger & Folkman, 2002). Furthermore, the development of relational skills and the existence of strong supportive relationships are particularly important when leaders are striving to function in high stress environments (Benard, 2004; Higgins, 1994; Maddi2004; Maddi & Khoshaba2005; Reivich & Shatte, 2002).

In spite of the emphasis Hardiness places on skill development, it is important to reiterate that simple possession of interpersonal skills is not what makes an effective leader; because it is not simply what the leader does, or how he or she does it, that nurtures strong relationships, but rather “how the person is regarding us when doing these things” (Institute, 2000, p. 24). Thus while skills are necessary to develop and maintain strong supportive relationships, character is essential for leaders who hope to sustain the supportive relationships necessary to insure success amid stress.

Healthful Living

Healthful living practices, which Maddi (2004) refers to as “self-care,” include “relaxation, nutrition, and physical activity” and represent a critical element of Hardiness training (p. 294). Maddi explained,

The aim of this self-care regimen is to provide and maintain optimal arousal for doing the work of effective coping and social support interaction regardless of whatever stressful circumstances are going on. This . . . is a way of keeping the anxiety associated with change within tolerable limits. (p. 294)

Although little research and writing has addressed the role of physical health practices in relation to leadership development, anecdotal discussion of its importance is not uncommon (Covey, 1989, p. 289-292; Murrell, 2003, p. 107). At the same time, significant research has demonstrated that a

healthy, relaxed body is more energetic and alert and less debilitated by fatigue, moodiness, attention difficulties, and mental, physical, learning, and psychological disabilities and illnesses (Khoshaba & Maddi, 2003). These negative effects, once exaggerated by high stress environments, could significantly delimit leadership effectiveness. Thus while in the past many leaders have performed successfully in spite of a failure to live healthfully, these individuals could not and will not be able to achieve their full potential as leaders while continuing to neglect their physical health in the increasingly fast-paced, change oriented, globally competitive society of the future. Fortunately, Hardiness training provides a model for addressing this component of leadership effectiveness as part of its holistic approach to individual and leadership development.

HARDINESS AND LEADERSHIP

Clearly, the Hardiness model has a lot to contribute to the development of individuals as leaders. However, this assertion is more than just theoretical. Indeed, some important research has been done to examine and apply the principles of hardiness to the practices of leadership and leadership development.

The connection between leadership and hardiness goes back to the original research study upon which the concept was built (Maddi & Kobasa, 1984). Indeed, the original study was focused on studying what allowed mid-level managers and executives to achieve success in their work, including their leadership, in spite of stressful challenges. As Lloyd and Atella attest, “A vision of leadership, with broadened horizons for a new millennium, can become better defined through visionary thinking. This stream of thought . . . flows back to the research on the hardy executive”(p. 156). Indeed, they suggest that, with its emphasis on resiliency, the original hardiness research represents an early effort to study positive leadership. Given the foundation of hardiness in existential philosophy and its emphasis on meaning, the connection with visionary leadership is significant.

Since then some additional studies have been conducted to more directly explore the connection between hardiness and leadership. Building upon the work of McClellan (2013), which identified both theoretical similarities and a statistical relationship between servant leadership and psychological hardiness, Popa (2012) applied the concepts of hardiness and servant leadership to the design of a engaged learning course that placed students in the role.

In their study of leadership among military cadets at West Point, P. T. Bartone et al. (2006) sought to determine the extent to which personality factors predicted leader performance in academic and field experiences. In their study, they found that hardiness was the “strongest predictor of leader performance, and the only personality factor predicting leader performance across the two different contexts” (p. 512). In a similar study with naval Cadets, Eid et al. (2009) examined the impact of hardiness on leadership styles. Their results suggested that “personality hardiness—especially hardiness challenge—as a personality dimension that may be an important developmental precursor for positive leadership styles. Another similar study found that Hardiness predicted adaptability among graduates of West Point once they graduated (P. Bartone et al., 2013). Finally, P. T. Bartone (2006) identified ways in which leaders might promote the hardiness of followers using a case study approach.

CONCLUSION

Our society has changed dramatically. The economy, the market place, the workforce, our communities, and our work environment and tools all evolved dramatically at the turn of the century as a result of the forces of globalization. If leaders are going to remain effective in this altered society, they must engage in co-evolutionary processes. Traditional leadership models and techniques will no longer bring about the success they did in the past. Even if effective methods are used within the paradigm of traditional leadership, the high stress context of today's global society and workplace makes it difficult, if not impossible, for leaders to act appropriately when they are not grounded to solid principles. The Hardiness model not only provides such principles, commitment, control, and challenges, it also offers a methodology for developing and internalizing them. Additionally, it advocates for a holistic strategy of personal development that helps leaders to improve their physical, emotional, mental, spiritual, and social well-being and effectiveness. In so doing, leaders develop greater resistance to stress and improve their leadership capacity, not to mention learning new leadership skills. Hence, the emerging concept of Hardy leadership development, because of its relevance in a global, change-oriented society, may well prove to be the greatest outgrowth of the original Hardiness studies thus far.

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ALTERNATIVE MULTI-MODE INTERNATIONAL LEARNING: A MODEL ESTABLISHING COLLABORATION

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ABSTRACT

International engagement enriches a student's college experience, broadens thinking, enhances cultural intelligence and makes students attractive to employers. Concurrently, higher education institutions have been under significant pressure to internationalize their business and management curricula in response to the needs of both industry and accrediting organizations. Fittingly, American universities that create and offer students international experiences are becoming the norm. However, still too few college students are in a position to participate in an international experience because of costs, time commitment, or personal concerns. In response, many business schools have implemented a variety of tactics to internationalize.

The authors developed multiple innovative international learning projects. The evolving effort encourages students, faculty, and industry professionals from Spain, the Netherlands, and the United States to meet in multiple modes, network, and learn together. This paper describes the history of the innovative projects, report how it has worked and evolved, and its benefits.

INTRODUCTION

The need for developing individuals who can work and lead with a global mindset has become more important than ever. Technological advancements have facilitated the integration of seamless supply chain systems satisfying the diverse needs of consumers around the world. This rapid pace of globalization has to be accompanied with the education of individuals to thrive in a multicultural environment (Javidan, Steers & Hitt, 2007). Similarly, higher education experts around the world agree that international engagement enriches a student's college experience, broadens thinking, and makes students more attractive to future employers, facilitating the development of global managers. Two trends are notable in the pursuit of providing a business education that is globally relevant. First, American universities' providing their students international experiences is becoming the norm. In fact, Harvard Business School sends its entire class to study abroad (Sood, 2012). Global, international and intercultural competencies enable expansion of leadership skills essential to navigate in a complex and diverse global environment (Earnest, 2003). However, despite acknowledging that cross-cultural

competencies provide advantages, still too few college students are in a position to participate in an international experience because of costs, time commitment, or personal concerns. Second, virtual teams involving distributed, multinational team members are becoming a regular feature of the

workplace environment (Jenster & Steiler, 2011). A recent survey indicates that less than one-third of the white-collar employees in the United States were prepared to deal with the complexities of such team environments. Differences in culture, communication styles, accents and time zone challenges have been noted as the biggest hurdles (Solomon, 2012; Jimenez et al., 2017). Thus, study abroad programs are not sufficient to address the emerging needs of the global workplace. Higher education institutions need to have a repertoire of options to equip students with the essential skills and training approaches to enter the workforce.

In response, many business schools have implemented a variety of tactics to internationalize their programs (Orahood, Kruze & Pearson, 2004). By offering a variety of impactful options, we argue that students are served more fully since they can select from a “menu” of global options that range along a continuum in terms of time, cost, and personal commitment. Creating an assortment of globalization options that vary in regards to time and financial investment is posited to allow more students a “global” experience.

This paper presents two innovative experiential activities developed for a School of Business to efficiently amplify opportunities to ‘globalize’ students where they are exposed to and immersed in shorter term international learning environments, networked with global industry experts, and connected with fellow students and international citizens. University students and faculty from Spain, the Netherlands, and the United States collaborated to develop the projects to meet, network, and learn together. We start with a historical background of globalizing efforts and universities and then discuss the two global learning options.

BACKGROUND ON INTERNATIONAL STUDIES

Active globalizing efforts by universities have a long history. The University of Delaware established the first study abroad program in 1923 following the horrific Great War (Burness, 2009). From these modest beginnings, now over 3.7 million students receive international study exposure annually and that number is growing by 12% each year (Sood, 2012). Studies show that it enhances the quality of learning for nearly every type of student (Redden, 2010), not just elite students. Not surprisingly, international experiences better prepare students by improving critical thinking and relationship-building skills (Imam, 2014), learning leadership skills, broadening their worldview (MBA.com), experiencing new cultures (TopUniversities.com, 2014), and even advancing their career. Ninety-two percent of firms desire college graduates with skills learned with international experiences (Matthews, 2015). Employers will seek out students with international experiences (Orahood, Kruze, & Pearson, 2004). According to the Huffington Post, a University of California study that found 97 percent of students who studied abroad found a job within 12 months after graduation, while just 49% of graduates who did not study abroad were employed within the same time period (Matthews, 2015). Cross-cultural exposure is no longer an “add-on” to college experience but is necessary to complete today’s student. Maybe not surprisingly, the Lincoln Commission, a government-appointed panel of education experts, set a participation goal in 2005 of one million students studying abroad annually by 2015 (Lincoln

Commission Report on Global Competence and National Needs). Bhandari and Blumenthal (2011, p. 2) note that most countries now consider international academic mobility and educational exchanges as “critical components for sharing knowledge, building intellectual capital, and remaining competitive in a globalizing world.” A significant body of research speaks to the benefits of study abroad programs

such as recognition of global issues and growth in intercultural awareness and intercultural communication skills (Douglas & Jones-Rikkers, 2001; Langley & Breese, 2005; Soria & Troisi, 2014).

However, gaining international experience isn't yet perfected. There is evidence of student learning not meeting expectations of what a global experience should be for multiple reasons. The benefits of intercultural development tend to be short-term rather than long lasting (Rexeisen, Anderson, Lawton, & Hubbard, 2008). In addition, in spite of the recognition of the significance of developing a global perspective, students are not embracing the study abroad option in growing numbers (Bandopadhyay & Bandopadhyay, 2015). In fact, fewer than 10% of all US undergraduate college students study abroad (Klebnikov, 2015). Moreover, there is a lack of diversification within the students who do study abroad. Those students who are studying abroad are "the same type of students who always studied abroad," (Salisbury, 2012). The existing model of study abroad is not serving new markets of young students. The familiar international study 'product' is not appealing to additional segments of university students. Research notes that most study abroad programs in the United States do not adequately represent the broader student population. For instance, students of color do not participate in comparable numbers as white students owing to financial constraints or fear of encountering racism abroad (Dessoff, 2006; Van Der Meid, 2003). Similarly, students opting for such programs have been identified as predominantly females (Institute of International Education, 2008; Redden, 2008). Further, cost continues to be a major hurdle for students that lack the resources to pursue study abroad options (Shafteel, Shafteel, & Ahluwalia, 2007).

A NEED FOR MULTI-MODE GLOBAL LEARNING EXPERIENCES

The premier body for accreditation of business schools, the Association to Advance Collegiate Schools of Business (AACSB) notes that it is imperative for business schools to adapt to the changing dynamics of higher education fostered by new learning environments and changing student demographics and aspirations. It is desirable for business schools to form connections with other business schools and become co-creators of knowledge. Thus, institutions enable development of global leadership skills as multinational, diverse, global teams work together (Iannarelli, 2016).

"International experience" includes more than extended travel abroad. Research calls for teaching pedagogies that require students to deeply engage their cognitive abilities with cross-border and cross-cultural interactions (Aggarwal & Zhan, 2018). It also considers domestic interactions with representatives from other cultures, networking with international peers and working with a cross-cultural team (Douglas & Jones-Rikkers, 2001). Networking and collaboration opportunities aid the development of a global mindset as well as behaviors and skills to lead globally. For instance, students attending the university hosting international students or faculty benefit from the transactions they have with the international guests. These non-traditional options have proven to efficiently change student thinking, broaden understanding of international business practices, and increase interpersonal skills.

Moreover, technology has enabled schools to offer impactful interactions with peer international institutions and their students. Students are now in a position to easily and commonly interact globally with their international partner school peers in a directed classroom setting via myriad internet options. It could be expected that those previously unavailable experiences have the potential to add more global experiences, prepare students better for their face-to-face interactions when they occur, and generally engage the students earlier in the globalizing process. If live experiences (delivered either face-to-face

or via internet conversations) are the driving force of engaging students in globalization, then it makes sense to understand how educators can further deliver these experiences via available internet technologies. Research has recognized the limitations of technology mediated communications in the richness of information conveyed. Recent research in the realm of Global Virtual Teams calls for examining the role of collaboration platforms and more advanced tools for virtual communication (Jimenez et al., 2017)

RESEARCH GOALS

Scholars and practitioners alike emphasize the need for students to have a global mindset (Govindarajan & Gupta, 2001; Levy, Beechler, Taylor & Boyacigiller, 2007). In light of the constraints associated with study abroad programs, the authors collaborated with instructors from two other universities in Europe to develop unique projects that attempt to address the limitations of extent study abroad programs, is in line with recent pedagogical innovations in the realm of global education and provides a cost effective alternative to long duration study abroad programs. In the subsequent section, we detail the approach undertaken and the nature of the planned projects.

The Globalizing Menu

Based on the research, the authors collaborated with two other schools: a partnering Spanish university to develop an intensive (4-day), international sport business conference-like event and a Dutch university to create a shared inter-university case study. The goal was to collaboratively design the global experiential events to involve active learning incorporating inter university projects and faculty from the United States and Spain and from the US and Netherlands. The two projects are intended to fill the void between “No International Experience” and the resource-heavy “Semester-long Study Abroad,” which should offer more students multiple modes of global experiences. See figure 1.

No International Experience	Inter-University Shared Project	Short Inter-University Experience	Semester-long Study Abroad
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FIGURE 1

Project1: Multicultural Sports Networking Conference

The purpose of the first collaboration project is to support an annual international-focused, experience-rich event (hosted alternating years by the two partnering universities) to provide students from both universities with career-relevant, industry-delivered experiences where business industry knowledge obtained from classroom theory is delivered, integrated and magnified with close interactions with

students from both universities and business professionals from the US and Spain. Students participating in the program are invited to engage over the two-year cycle. Spanish university students would visit the United States and attend this U.S.-based class on alternating years (e.g. 2019, 2021, and 2023). A similar format, occurring on alternating years (e.g. 2020, 2024) is planned for the Spanish University. Students from the American university could attend the conference with the Spanish students to get a remarkable immersive international experience, affordably, right on the American University's campus.

Students from the Spanish and American universities would attend panel presentations in the morning on the American University's campus. Afternoons include group case work integrating teams mixed with American and European students. Here, students engage in interactive discussion to further incorporate learned concepts. Following this, the attending students visit host city sport venues and meet additional sport managers that expand the day's learning.

A draft of the 4-day schedule can be found in Table 1.

Presentations in this example deal with topics such as the international fan behavior, international sport sponsorship, international brand iconography, and more. Industry experts and faculty from the aforementioned universities who specialize in the topic deliver the sessions. The noted faculty and industry speakers confirmed willingness to participate in the summer event six months prior to the event for planning purposes.

Project2: Multicultural Virtual Teaming Project centered on a case

The purpose of the second project is to expose students to the elements of working in multicultural, geographically dispersed team, such as interacting with individuals from different cultures and thus may speak different languages, hold different perspectives regarding work expectations and decision making (Janssens & Brett, 2006), and rely on technology for getting the work done. It is an inter-University project that brings together via audio-video technology a class from a U.S. university and a class from a Dutch university. The two classes would each study an international case that deals with a global issue but students from each university would be randomly assigned to join a mixed-nationality team (half American, half Dutch). Using high quality audio-video technology resources, students at both institutions could collaborate on shared projects. This virtual teamwork, crossing international and university boundaries, exposes students to live global problem-solving situations. Students from the two universities collaborate to resolve decisions to a case ("Which Way for Huawei?", Griffin, Pustay, 2020) over a short duration. The time period is chosen to allow enough time for students to acquaint themselves with their counterparts in the other university and develop a team culture to work on the small project. A small sample of students from both universities will be considered. The exercise will expose students to the challenges of working and communicating in distributed virtual teams, providing opportunities for learning essential skills and knowledge in teamwork. Appendix 1 provides the set of activities around the case. The case is chosen because it requires students to deliberate on different political, economic, technological, legal and cultural issues in a global context involving the Chinese Multinational Corporation, Huawei.

Students from the American and the Dutch universities will be randomly and equally distributed in five to six teams of about six students each (actual number of teams depends on class size). Each team will

be assigned to complete the tasks as detailed in the Appendix on specific dates during the semester. Students work virtually on the tasks. The faculty involved in the creation of this project met virtually to identify the main case and then discuss the student activities around the case.

TABLE 1 - PROPOSED INTERNATIONAL SPORT MARKETING COLLABORATION

	Day 1 National Brands and International Fandom	Day 2 Minor League and Amateur athletics in America	Day 3 Managing Brands	Day 4 Sport Revenue and Economics	Day 5 Free Day, Tour Philadelphia
9:00-10:15	Speaker 1 – Philadelphia Eagles Speaker 2 – Uvic (Spain)	Speaker 3 – Wilmington Bluerocks U.S. Archery Olympic coach	Speaker 4- Blanquerna University (Spain) Speaker 5 Philadelphia Union	Speaker 6 – Philadelphia Phillies Speaker 7 - Schiller University (Germany)	Meet at Widener, go to train station. Tour city with Widener students.
10:15-10:30	Coffee break	Coffee break	Coffee break	Coffee break	
10:30-11:45	Speaker 8 – International Star Wars fan group organizer (501 st Legion)	Speaker 9 - Widener U. Speaker 10 – Widener U.	Speaker 11 – Widener U. (discuss International Sport Broadcasting) Freedom Hall	Speaker 12 – Montclair St. (International Sport Sponsorship)	
11:45-1:00	Lunch	Lunch	Lunch	Lunch at Xfinity live	Lunch
1:00-2:15	Attend screening with commentary of <i>Sons of Ben</i> movie - Freedom Hall	Network with Widener coaches	Case study or interactive discussion	CBP planner	
2:15-5:00	Sons of Ben Fan Group panel Q&A	Quick Stadium and Widener facilities tour	Tour PPL soccer park. Compare it to European stadiums.	Speaker 13 – Philadelphia Phillies CBP tour	
Evening	Tour Lincoln Financial Field	Tour Frawley Stadium (MiLB)	Banquet dinner, Widener U.	Tour Citizens Bank Park	

The faculty from Netherlands also visited the American university, met with the American students face to face and finalized aspects of the virtual project, such as scheduling deliverables. Students are required to also provide comparative viewpoints based on non-U.S. and non-Dutch policy-making.

The geographically-dispersed students have a range of technology options to facilitate group collaboration. Both institutions have subscriptions to Microsoft Office. Teams is a versatile virtual communications and collaboration platform available to Office 365 subscribers. Teams facilitates a one-stop solution for almost all of the needs of virtual collaboration to include video and voice class, instant polling, file sharing, separation of tasks by groups/teams by means of the *channel* capability,

and live chatting, among others. Office Teams helps virtual teams overcome some of the challenges of asynchronous VC tools by facilitating dynamic or live file sharing and communication. Importantly, the ability to segregate by teams allows the instructors significant leverage over controlling the structure and monitoring communication norms of different teams. Nonetheless, students are not restricted to communicate using Teams alone, but can use Skype, Google Hangouts etc. for communication. However, they are strongly encouraged to use Office Teams to maintain visibility and transparency. Thus, we believe that by directing communication and collaboration over a common platform, we can control for several aspects of effective virtual collaboration.

RESEARCH CONTRIBUTIONS

The high impact international projects outlined in this paper enable students to gain international experience with an option of immersion possibilities. These options not only expose a new group of students to global experiences, but also do it relatively inexpensively. They can interact with international students on a range of engaging projects. They learn from faculty from multiple European universities, network with both groups, and study international business topics – all without leaving their campus. Research says they will better understand international topics, deepen their interpersonal skills, and be more attractive as employees. Steps would be taken to ensure that there is sufficient interaction, both in-class and informal, between the American university students and the international students. Moreover, such projects will help the American university to not only market to global-minded students and parents, but also develop students who are globally-minded. Students without any prior exposure to international experiences gain valuable cross-cultural know-how and become better able at making cross-institutional decisions. Both projects have been developed in cooperation with the respective international partner university and will be launched in the upcoming semester(s). Each project includes a socialization class where students from participating schools get familiar with one another.

CONCLUSIONS

There is no doubt that universities are seeking to supply students with international exposure. On the demand side, consumers such as university students are expecting more experiences in their valued purchases (Pine, Gilmore, 1998). Most articles involving international experiences have involved extended student stays. Our study outlined the collaborative use and effect of two “mid-range”

globalizations efforts that serve to add to the menu of international study options available to universities and students: a shorter, immersive biannual course supplemented with teleconferencing efforts, and an inter-university case project. The globalizing effort is replicable and seems to promise positive results for a modest and sustainable investment by all those involved. It seems the model would be welcome as a pedagogical alternative. Importantly, these projects facilitate development of a global mindset. Importantly, the projects will help develop valuable transferrable skills sought after in the global workplace.

LIMITATIONS AND FURTHER RESEARCH

Our study proposes a set of projects to overcome the limitations of study abroad programs. It is however, not without limitations. The study will be generalizable only after implementation and repetition with multiple sections and over semesters. However, this will be the next step in the process of developing and improving the menu of options for students to develop inter-cultural competences. Researchers should replicate the study and conduct a study that incorporates multiple collaborations from different fields (i.e., different international university partners from Anthropology, Chemistry, Environmental Sciences, etc.).

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APPENDIX: Multinational, virtual team project involving students from two universities

I. Project Intended Learning Objectives

By participating in this project, students will learn and develop/enhance the following knowledge and skills:

1. Communicating virtually across geographical boundaries
2. Collaborating with multicultural teams
3. Jointly solving a problem with global considerations and perspectives (political, legal, cultural and economic)
4. Identify a systematic framework or process to evaluate and propose a strategy involving multiple stakeholders

II. Team assignments

Since the primary aim of this project is to provide a multinational experience, student teams will be composed of an equal number of Widener and Windesheim students. The instructors of both Universities will make the team assignments.

Assignment Categories

A. Get to know your colleagues from USA/Windesheim

- Live virtual meeting
- Share a Vlog or a blog or a brief introduction in your respective team channel

B. Stakeholder Analysis and Interest Map

The subsequent assignments rely on the case “Which Way for Huawei (pages 250-251) from *International Business: A Managerial Perspective*, Griffin RW and Pustay MW, 9e. Pearson.

Step 1: Review the case and formulate your initial thoughts on the case. To more thoroughly assess the decisions of each government, conduct a stakeholder analysis and prepare an interest map as outlined below.

Start by visualizing the environment. Then map all parties you (the government) are in contact with and are part of that environment (US, EU, Canada etc.)

Step 2: Who are the most relevant stakeholders from the viewpoint of (American, European, Canadian, other) policy makers and why are they important?

- Assume the position of your home government (Widener students in a team would consider themselves in the position of the U.S. government and Windesheim students would assume the position of the EU).
- Identify all relevant stakeholders in the context of the Huawei case, either influenced by Huawei and/or your government’s policies towards it. Consider those entities that are relevant to making your strategy decision. Then specify the *importance* and *quality* of these stakeholders for you (as

the government). In determining *importance*, consider the role of each stakeholder in terms of political, social and economic considerations or contributions. Current *Quality* reflects the nature of the relationship with the government.

- Score the above attributes for each stakeholder (*importance* and *quality*) on a suitable scale: - - / - / + - / + / + + (*hardly/not important, slightly important, moderately important, important, very important*) and (*very poor/problematic, poor, acceptable, good, very good*)

Step 3: Use the above information to create a Stakeholder Analysis Map:

- Draw a coordinate grid: The *horizontal axis* may indicate the *importance* of the relationship, and the vertical axis the *quality* of the relationship (the coordinates ranging from: - - / - / + - / + / + +).
- Put your own country/block (e.g. US government) in the center of the cross of axes
- Based on your analysis from Step 2, score the *importance* and *quality* of each relevant stakeholder vis-à-vis your government.

C. Case Responses

- Discuss your stakeholder analysis with your team members and review the responses in light of your analysis for the different governments. Respond to the questions at the end of the case after deliberating with your team members. Each team will submit a US, EU, Canadian government policy assessment on Huawei.
- Alternative Scenarios

Consider policy decisions by other nations such as Latin American nations (Mexico, Brazil, Argentina, Chile) Asian nations (Singapore, Japan, India) and/or African nations (identify the specific nations you considered) and assess their approach in terms of different criteria relevant to international business.

- *Your* strategy assessment

Now that you have analyzed the positions taken by different governments, discuss what position you would take. Explain the basis for your stand.

D. Collaboration Strategy

Once you have developed a good understanding of your team members, work on creating suitable

- Norms and roles of team members (ground rules for acceptable and non-acceptable behavior, modes and frequency of communication, individual responsibilities)
- Dealing with challenges and strategies (conflicts, deadlocks, other obstacles)
- Learning strategies
- Communication tools (Teams Chat, Zoom, Google Hangouts, Whatsapp, etc). MS Office Teams facilitates communicating via chats, audio and video. However each team is free to experiment with tools for communication.

Provide a brief write up of your collaboration strategy, identifying key elements stated above. Which communication tools did you use, how and which worked best?

E. Cultural Intelligence

What did you learn about your colleagues' culture? How do they communicate and collaborate? What are some unique customs and traditions? Did you encounter language obstacles? How has the experience changed (in a positive or negative way) your confidence, understanding and ability to work with people from other cultures and countries?

F. Presentation

Each team will make a presentation showcasing their approach to solving the problem, the stakeholder map and solutions proposed, fun facts learned about each others' culture, challenges and approaches to working in multicultural, virtual teams.

III. Communication and Collaboration Tools

Microsoft Office Teams

An environment where we can do all things for the project – sharing files, dynamically communicating (via messages and voice calls), threaded conversations, creating channels for teams and instructors and much more. Teams is integrated with Office 365 apps including Word, Excel, PowerPoint and OneNote.

Office Teams provides you with the features to chat one-on-one, in groups and also make calls (up to 50 people can be on the same chat and call). Check the Chat tab to the left to learn more and use it!

Instructor Channel: Used by the faculty for delivering key announcements (Welcome, project syllabus)

Team Members Channel: Students introduce themselves here – You may upload a picture, a small vlog, etc., blog to orient your colleagues to your interests, ideas, and strengths

Protocols for communication

With Instructors: You can also seek feedback from the individual instructors by addressing them separately or in your group from your own channels.

All team assignments will be submitted as files and addressed to all three instructors only.

With your teammates

- To maintain transparency in your work, students are encouraged to communicate in their respective team channels rather than one-on-one chats or groups. This also ensures you maintain a trail of your work and everyone is always on the same page in your team.

Collaboration guidelines

- Student teams should video call at least once a week. US students have Zoom accounts, which they are encouraged to take use of in initiating chats; or use the Teams environment.

Note: Google Tools require a gmail account

- Google Docs (free, require a gmail account)
- Google Chats
- Skype, Zoom, Google Hangouts (text, audio and video calls – Android OS), Google Duo (works as a mobile app as well for quick video calling)

A DIMENSION LEVEL EXPLORATORY STUDY OF SUPPLY CHAIN RESPONSIVENESS AND SCM PRACTICES

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ABSTRACT

This study builds on Thatte, et al.'s (2013) research model, which found positive relationships between supply chain management (SCM) practices and supply chain responsiveness (SCR). Employing regression analyses, this paper analyzes the effects of specific SCM practices (SCMP) that impact SCR and its dimensions. The study finds that customer relationship (CR) and strategic supplier partnerships (SSP) are found to positively influence operations system responsiveness (OSR), while SSP and information sharing (IS) are found to improve supplier network responsiveness (SNR). IS, SSP, and CR between supply chain trading partners were found to increase SCR. The study did not find any support between SCMP dimensions and logistics process responsiveness (LPR).

INTRODUCTION

Leading global firms across industries have gained competitive advantages over competitors through collaboration with their supply chain members (Lee, 2004). Firms both large and small have benefitted from such partnerships and open information sharing with trading partners (Simchi-Levi et al., 2008). Supply chains seek to improve their responsiveness with respect to their customers (Hines, 2004; Melnyk et al., 2010) in order to excel. It would be useful for firms to identify the practices that can boost their SCR in one or more ways.

Thatte et al. (2013) dealt with large-scale instrument validation and hypotheses testing between SCR, SCM practices, and competitive advantage (CA) using structural equation modeling, and established a positive relationship between SCM practices and SCR, SCR and CA, and SCM practices and CA. This study extends the study of Thatte et al. (2013) by examining the dimension level relationships between SCM practices and SCR in order to understand how SCR can be improved through different SCM practices. Existing literature lacks such dimension level analyses involving SCM practice and SCR. This study aims at filling this gap by providing insight into these relationships, so meaningful practical implications for improving SCR and its three dimensions OSR, LPR, and SNR, via specific

components of supply chain practices, may be drawn. The relationships between the constructs are tested using regression analyses using data from 294 survey respondents.

CONSTRUCTS AND RESEARCH FRAMEWORK

Figure 1 presents the framework for this research. It has been adopted from Thatte et al.'s (2013) study, which developed the SCR construct and a valid and reliable measurement instrument for SCR through rigorous statistical methodologies, including pre-testing, pilot testing, confirmatory factor analysis, unidimensionality, reliability, validity, and second-order construct validation.

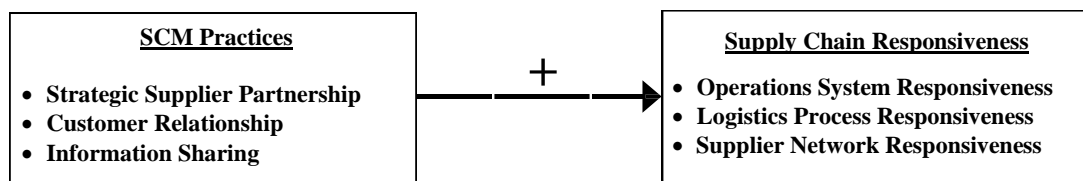


FIGURE 1. RESEARCH FRAMEWORK

SCM Practices

‘SCM practices’ is defined as “the set of activities undertaken by an organization to promote effective management of its supply chain” (Li et al., 2006, p. 109). Li et al. (2005, 2006) proposed ‘SCM practices’ as a multi-dimensional construct comprising upstream and downstream supply chain sides. This study adopts strategic supplier partnership, customer relationship, and information sharing as the three sub-constructs for SCMP as identified by Li et al. (2005, 2006). Li et al. (2005) developed a valid and reliable SCMP measuring instrument. This instrument is adopted in this study. SCMP has been shown to positively impact SCR (Thatte et al., 2013).

SSP is defined as “the long term relationship between the organization and its suppliers. It is designed to leverage the strategic and operational capabilities of individual participating organizations to help them achieve significant ongoing benefits” (Li et al., 2006, p. 109). Croxton et al. (2001) consider SSP as a key SCM practice. Gunasekaran et al. (2001) claim that a strategic partnership emphasizes long-term partnerships and promotes mutual planning and problem-solving efforts. Organizational strategic partnerships promote shared benefits and ongoing collaboration in key strategic areas such as technology, products and markets (Yoshino and Rangan, 1995). Strategic partnerships with suppliers make it easier for organizations to work closely and effectively with a few suppliers rather than multiple suppliers selected on the basis of costs alone (Kalwani and Narayandas, 1995). Cost-effective design alternatives, help in selecting better components and technologies, and assist in design evaluation are some of the benefits of including suppliers early in the product design process

(Tan et al., 2002; Fulconis and Paché, 2005). Porter (1980) suggested that cooperation could enable partners to come together in a stronger position than they alone could. Mentzer et al. (2001) suggest that having closer ties with suppliers is the key to effective management in the global environment. Effective SCM requires cooperation between the supply chain members (Boddy et al., 2000). The past three decades have seen an increasing trend in long term, collaborative relationships by organizations with a few trusted suppliers. Vonderembse & Tracey (1999) argue that in North American supply chains, the level of supplier involvement in continuous improvement and product development efforts is low. They claim that increased involvement of the company / supplier could have a significant impact on the performance of the supply chain. Long-term relationship refers not to any specific time period, but rather to the intention that the arrangement will not be temporary (Chen and Paulraj, 2004). Through close ties, supply chain partners are willing to share risks and reward and to maintain long-term relationships (Cooper and Ellram, 1993; Stuart, 1993). The literature widely discusses the Japanese supplier partnership system (Webster, et al., 2000; Nishiguchi, 1994), where Japanese companies in various industries started to engage their suppliers in collaborative design (Nishiguchi and Brookfield, 1997).

CR is defined as “the entire array of practices that are employed for the purpose of managing customer complaints, building long-term relationships with customers, and improving customer satisfaction” (Li et al., 2006, p. 109). CR is regarded as a key SCM practice in literature (Noble, 1997; Tan et al., 1998; Croxton et al., 2001). The CR practices of an organization can affect both their success in SCM efforts and their performance (Scott and Westbrook, 1991; Ellram, 1991; Turner, 1993). Successful SCM involves downstream customer integration and upstream supplier integration (Tan et al., 1999). Personalized customer care and better customer relationship management are of paramount importance for organizational success (Wines, 1996). Good relationships with trading partners, including clients, are key to organizations' successful SCM efforts (Moberg et al., 2002). Close customer relationships enable product differentiation from competitors, support customer loyalty, and increase customer value (Magretta, 1998). In developing effective SCM strategies, customer relationship activities have played a crucial role (Wisner, 2003).

IS refers to “the extent to which critical and proprietary information is communicated to one’s supply chain partner” (Li et al., 2006, p. 110). Mentzer et al. (2000) mention that shared information may vary in nature from strategic to tactical, and could be related to logistics, customer orders, forecasts, schedules, markets, or other. The sharing of information refers to the access to private data between trading partners, enabling them to monitor the progress of products and orders through different supply chain processes (Simatupang and Sridharan, 2002). Simatupang and Sridharan (2005) provide some of the components of IS, including data acquisition, processing, storage, presentation, recovery and transmission of demand and forecast data, inventory status and locations, order status, cost-related data and performance status. They add that the IS for key performance metrics and process data improves the visibility of the supply chain, thereby enabling effective decision-making. They also state that shared information in a supply chain is only useful if relevant, accurate, timely and reliable (Simatupang and Sridharan, 2005). IS with trading partners allows organizations to make better decisions, take action on a more visible basis (Davenport et al., 2001), and is a critical element of a positive supply chain relationship (Lalonde, 1998). The demand information flows upstream from the point of sale through information sharing, while information about product availability flows downstream (Lee and Whang, 2001; Yu et al., 2001). In addition, information sharing ensures

that the right information is available at the right place and at the right time for the right trading partner (Liu and Kumar, 2003), and aids in reducing the bullwhip effect (Lee et al., 1997; Yu et al., 2001). According to Lummus and Vokurka (1999), a first step is to gain a clear understanding of supply chain concepts and be willing to share information openly with supply chain partners in order to make the supply chain competitive. Lau and Lee (2000) maintain that creating a controlled sharing environment for business data and processes improves the effectiveness of IS among trading partners. However, organizations in supply chains are reluctant to share information with each other (Vokurka & Lummus, 2000) because of the fear of providing competitive and sensitive information, such as stock levels or production schedules (Lancioni et al., 2000; Ballou et al., 2000; Croom et al., 2000).

Supply Chain Responsiveness (SCR)

SCR is defined as the capability of promptness and the degree to which a supply chain can address changes in customer demand (Holweg, 2005; Prater et al., 2001; Lummus et al., 2003; Duclos et al., 2003). SCR is aggregate of three first-order constructs operations system responsiveness (OSR), logistics process responsiveness (LPR), and supplier network responsiveness (SNR). OSR, LPR, and SNR were conceptualized and operationalized as the three sub-constructs of SCR in Thatte et al. (2013).

OSR is defined as the ability of a firm's manufacturing system to address changes in customer demand (Thatte et al., 2013). While OSR includes manufacturing and service operations, this study is limited to firms within the manufacturing industry. OSR at each supply chain entity is an essential constituent of SCR, as each entity is required to provide timely and reliable provisioning of products and services, to satisfy customer demand (Lummus et al., 2003; Duclos et al., 2003; Meehan and Dawson, 2002). OSR items measure the responsiveness of a specific node or firm in a supply chain (Lummus et al., 2003; Duclos et al., 2003). The items used to operationalize the OSR construct are presented in Appendix A.

LPR is defined as the ability of a firm's outbound transportation, distribution, and warehousing system (including 3PL/4PL) to address changes in customer demand (Thatte et al., 2013). These activities include packing and shipping, warehousing, transportation planning and management (Lummus et al., 2003; Duclos et al., 2003; Ricker and Kalakota, 1999), order tracking and delivery, inventory management, and reverse logistics. This study is limited to the outbound logistics of the focal firm. The LPR components include aspects such as adjusting warehouse capacity to address demand changes, accommodating and responding to volatile demand, varying transportation carriers, handling wide variety of products, the ability to pack product-in-transit to meet customer requirements, and the ability to customize products close to the customer, in order to achieve CA. It is vital that firms have easy access to various modes of transportation and are able to utilize them for improving logistics flexibility and responsive (Prater et al., 2001). Firms' logistics should be able to adjust the logistics resources speedily to satisfy market needs (Hise, 1995). Lummus et al. (2003) present logistics process flexibility facets of a supply chain, which have been adapted for LPR measures (see Appendix A).

SNR is defined as the ability of a firm's major suppliers to address changes in the firm's demand (Thatte et al., 2013). Firms' ability to be responsive to customer demand is also dependent on suppliers' ability to make volume changes. The presence of flexible and responsive partners downstream and upstream of a firm is essential for responsiveness (Christopher and Peck, 2004). Supply chains must be able to adapt swiftly to supply disruptions (Walker, 2005) as well. CA, from a responsive supply chain, can be gained through speedily meeting changing customer demands. This could be in the form of promptly supplying new products or satisfying the product volume, mix, variations, or new product introduction needs of the markets. Satisfying these requirements necessitates a responsive supply chain from raw materials to finished products and extending to distribution and delivery. Selecting suppliers who can quickly add new products, and having suppliers make desired changes is detrimental to a firm's responsiveness. Selecting suppliers based on their capabilities, such as in product development, volume flexibility, and rapid deployment, positively impacts delivery time of new products (Choi and Hartley, 1996). A firm's ability to be responsive is weakened due to the lack of supplier flexibility (Holweg, 2005). The measures of SNR used in this study are presented in Appendix A.

RESEARCH METHODOLOGY

This study adopts the SCR instrument developed by Thatte et al. (2013) and the SCM practices instrument from Li et al. (2005) and Li et al. (2006). The items for these instruments are listed in Appendix A. The unit of analysis in this study is a firm since SCMP and SCR rely on the individual operating companies within a supply chain. A similar unit of analysis has been used in previous studies (ex: Swafford et al., 2006). A study that involves the entire supply chain, from raw materials to end customer, would be complex, time consuming, and costly.

Large-scale data collection was carried out using a web-based survey based on the methods of Dillman (2000). E-mail lists were purchased from The Council of Supply Chain Management (CSCMP), Rsateleservices.com, and Lead411.com. Seven SIC codes were covered in the study: 22 *Textile Mill Products*, 23 *Apparel and other Textile Products*, 25 *Furniture and Fixtures*, 34 *Fabricated Metal Products*, 35 *Industrial Machinery and Equipment*, 36 *Electrical and Electronic Equipment*, and 37 *Transportation Equipment*. The lists were limited to organizations with more than 100 employees, as they were most likely to participate in SCM initiatives. Since the focus of this study is SCM, the target respondents were the operations / manufacturing / purchasing / logistics / materials / supply chain – vice presidents, directors, and managers, as these personnel were deemed to have the best knowledge of the supply chain area. When answering the questionnaire, respondents were asked to refer to their major suppliers or customers. The final version of the questionnaire was given to 5498 target respondents by e-mail. The survey was sent by e-mail in three waves to ensure a reasonable response rate.

The response rate was calculated based on the number of clicks generated by the email and the total number converted to a completed survey. A total of 714 click-throughs were generated after three waves of emailing and 294 completes were obtained to provide a good response rate of 41.18%. Response rate based on click-throughs may be a better measure for email surveys since large amounts of emails sent in this way are treated as spam by the email program of respondent organizations and

are unable to be retrieved or viewed by the target respondent. Since it is difficult to track this information accurately, a more appropriate measure would be to base the analysis on the number of

people who visited the site and had the opportunity to review this study's request and purpose, and then decline to complete the survey on any number of grounds. As shown by the characteristics of the population (Appendix B), 11% of the respondents are CEO/President, 45% are Vice Presidents, 25% are Directors, and 19% are Managers. Thus 81 percent of the respondents (CEOs, VPs and Directors) are high-level executives, implying a high level of reliability of the responses received, as these executives have a wider domain (job responsibility) and administrative knowledge. This is in line with previous survey-based SCM studies (ex: Frohlich and Westbrook, 2002). The areas of expertise included 11% executives (CEOs/Presidents), 12% purchasing, 22% SCM, 18% distribution/transportation/logistics, 20% manufacturing/production, 10% materials and 7% other categories, such as sales. Thus, the domains of the respondents cover all key functions throughout the supply chain, from purchasing, manufacturing, sales, and distribution. Since 33% of respondents have been with the organization for more than 10 years and 21% have been with their organization for 6-10 years, the majority of respondents have a comprehensive view of the supply chain program of their company.

This research did not directly investigate non-response bias, as the email lists only had individual names and email addresses without the organizational details. This research compares those subjects who responded to the first e-mail wave and those who responded to the second/third wave. The succeeding waves of the survey were considered representative of non-respondents (Lambert & Harrington, 1990; Armstrong & Overton, 1977). In previous SCM empirical research, similar methodology was also used (Li et al., 2005; Chen & Paulraj, 2004; Handfield & Bechtel, 2002). The comparisons were made using Chi-square tests (χ^2 statistic). There was no significant difference between these two groups in the type of industry (based on SIC), the employment size, and the job title of the respondent (i.e. $p > 0.1$, when testing the null hypotheses: there is no significant difference in the distribution of responses across SIC codes/employment size/job title between groups). In addition, Chi-square independence tests were also carried out to determine whether the distribution of responses across SIC codes, employment size, and job title of the respondent is independent of the three waves when independently considered. No significant difference was found in industry type (based on SIC), employment size, or respondent's job title between the three groups / waves.

RESULTS

Thatte et al. (2013) found SCM practices to have a direct positive impact on the SCR of a firm and confirmed the assertion in literature that organizations engaged in collaborative practices with their supply partners can better respond to customer demand. In order to explore the specific dimensions of SCM practices that lead to higher levels of SCR in terms of OSR, LPR, and SNR, a dimension-level statistical analysis was performed by employing stepwise regression analysis. The stepwise multiple regression analysis is frequently used in exploratory studies (Aron and Aron, 1999). The individual dimensions of SCMP are predictors and the study seeks to understand which of these dimensions contribute significantly to the overall SCR prediction. A stepwise regression analysis is performed to determine which dimensions of SCM practices (viz. SSP, CR, and IS) are significant predictors of SCR (composite score). Table 1 presents the stepwise regression

results of SCMP (dimension level) as the independent variable (IV_{adj}) and SCR (composite score) as the dependent variable (DV). Results indicate an overall model of the three dimensions of SCMP that reasonably predict SCR, $R^2 = 0.194$, $R^2 = 0.186$, $F(3,290) = 23.271$, $p < 0.001$. The model accounted for 18.6% (R^2_{adj}) of the variance in SCR. A summary of regression coefficients is presented in Table 2 and indicates the three dimensions of SCMP in the order IS ($\beta = 0.223$), SSP ($\beta = 0.203$), and CR ($\beta = 0.128$) that significantly predict SCR.

TABLE 1. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on SCR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. IS	0.373	0.139	0.136	0.139	47.157	< 0.001	1	292
2. SSP	0.426	0.182	0.176	0.043	15.147	< 0.001	1	291
3. CR	0.440	0.194	0.186	0.012	4.457	< 0.05	1	290

TABLE 2. COEFFICIENTS FOR SCMP DIMENSIONS (IS, SSP, AND CR) ON SCR

	<i>B</i>	β	<i>t</i>	<i>p</i>
IS	0.185	0.223	3.551	0.000
SSP	0.167	0.203	3.365	0.001
CR	0.104	0.128	2.111	0.036

By using stepwise regression analyses between SCMP dimensions IS, SSP, and CR as IVs and SCR dimensions OSR, LPR, and SNR as DVs, the study further examines which dimensions of SCMP significantly predict one or more dimensions of SCR. The results are presented in Tables 3-8.

TABLE 3. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on OSR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. CR	0.295	0.087	0.084	0.087	27.841	< 0.001	1	292
2. SSP	0.339	0.115	0.109	0.028	9.119	< 0.01	1	291

TABLE 4. COEFFICIENTS FOR SCMP DIMENSIONS (CR AND SSP) ON OSR

	<i>B</i>	β	<i>t</i>	<i>p</i>
CR	0.251	0.227	3.817	0.000
SSP	0.201	0.180	3.020	0.003

Tables 3 and 4 indicate that only two dimensions of SCMP, in the order CR ($\beta = 0.227$) and SSP ($\beta = 0.180$), significantly predict OSR. Results suggest that IS does not contribute significantly to the prediction of OSR.

TABLE 5. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on LPR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. IS	0.285	0.082	0.078	0.082	25.911	< 0.001	1	292
2. CR	0.310	0.096	0.090	0.015	4.693	< 0.05	1	291

As observed in Table 5 the results are not significant ($R^2_{adj} = 0.090$) to draw conclusions with regards to LPR. It is desired that R^2_{adj} be at least 0.10 to indicate that the given IV explains at least 10% of the variance in DV, so as to draw any substantial inferences (Mertler & Vannatta, 2002). The results indicate that none of the SCMP dimensions predict the LPR dimension of SCR when considered individually.

TABLE 6. DIMENSION LEVEL STEPWISE REGRESSION RESULTS

Model Summary for SCMP Dimensions on SNR

Step	<i>R</i>	<i>R</i> ²	<i>R</i> ² _{adj}	ΔR^2	<i>F</i> _{chg}	<i>p</i>	<i>df</i> ₁	<i>df</i> ₂
1. SSP	0.339	0.115	0.112	0.115	37.870	< 0.001	1	292
2. IS	0.390	0.152	0.146	0.037	12.849	< 0.001	1	291

TABLE 7. COEFFICIENTS FOR SCMP DIMENSIONS (SSP AND IS) ON SNR

	<i>B</i>	β	<i>t</i>	<i>p</i>
SSP	0.233	0.242	4.004	0.000
IS	0.210	0.216	3.585	0.000

Tables 6 and 7 show that only two dimensions of SCMP in the order SSP ($\beta = 0.242$) and IS ($\beta = 0.216$), significantly predict SNR. As observed, CR does not contribute significantly to the prediction of SNR.

Table 8 summarizes the regression analyses results. Construct-level regression analysis results found direct and positive impact of SCMP on SCR, and support the structural equation modeling results between SCMP and SCR found by Thatte et al. (2013). The dimension-level regression analyses results suggest that IS, SSP, and CR, in that order, can improve SCR. Results suggest that CR and SSP, in that order, can contribute in improving OSR, while SSP and IS can improve SNR. The study did not find support for the impact of SCMP dimensions on LPR. This could be attributed partly, to the distribution of the variance explained by the IV on the DV when dimension level analyses are performed, thus leading to the reduced significance of these dimension level analyses. These findings are discussed in the following section.

TABLE 8. SUMMARY OF REGRESSION ANALYSES RESULTS FOR SCR AND ITS DIMENSIONS

Predictor	Outcome	R ² _{adj}	Sig. (p)
Construct - Level Regression Analysis			
1. SCM Practices (SCMP)	Supply Chain Responsiveness (SCR)	0.278	0.000
Dimension - Level Regression Analyses			
SCMP: 1. Information Sharing (IS) Strategic Supplier Partnership (SSP) Customer Relationship (CR)	Supply Chain Responsiveness (SCR)	0.186	0.000
SCMP: 1. Customer Relationship (CR) 2. Strategic Supplier Partnership (SSP)	Operations System Responsiveness (OSR)	0.109	0.000
SCMP: Practically NS*	Logistics Process Responsiveness (LPR)	0.090	0.000
SCMP: 1. Strategic Supplier Partnership (SSP) 2. Information Sharing (IS)	Supplier Network Responsiveness (SNR)	0.146	0.000

RESEARCH FINDINGS AND IMPLICATIONS

This study provides researchers insight about the specific SCM practice dimensions that positively impact SCR of a firm. SCMP was found to reasonably predict SCR of a firm, supporting the findings of Thatte et al. (2013). The study found that information sharing and effective relationships with

customers and suppliers can directly lead to higher levels of SCR. This finding supports prior literature (ex: Qrunfleh & Tarafdar, 2013; Frohlich & Westbrook, 2001; Clinton & Closs, 1997; Gunasekaran & Yusuf, 2002; Van Hoek et al., 2001; Handfield & Nichols, 2002). In addition, effective relationships with customers and suppliers will positively influence a firm's ability to be operationally responsive to demand changes by customers. This finding is consistent with Magretta's (1998) case study analyses of Dell Corp. Also, effective relations with suppliers, and quality and timely information sharing, as found by Lambert and Cooper (2000) in their case study research, with supply chain trading partners were found to directly and positively lead to increased supplier responsiveness. This result suggests that organizations must select suppliers based on the potential for close long-term relationships, which is in accordance with Choi and Hartley's (1996) findings. The study did not find IS to improve OSR. The study also did not find CR to improve SNR. Furthermore, the study found that none of the dimensions of SCMP significantly predict LPR.

For managers and organizations, the findings imply that organizations that are involved in IS practices are instrumental in achieving a SCR. These practices include: informing trading partners in advance of changing needs two-way sharing of proprietary information between trading partners, keeping one another informed about issues that affect business, two-way sharing of business knowledge and processes, exchanging information that helps to establish business planning, and keeping one another informed about events or changes that may affect the other partners.

Organizations that are engaged in SSP initiatives can achieve higher levels of SCR wherein organizations set goals and targets, as well as plan and solve problems jointly with suppliers to meet such targets, select suppliers based on quality, include suppliers in continuous improvement programs, and involve key suppliers in new product development initiatives.

Additionally, firms that frequently interact with customers to set reliability, responsiveness, and other standards, regularly measure and evaluate customer satisfaction and determine future customer expectations, facilitate customers' ability to seek assistance from them, and periodically evaluate the importance of the relationship with their customers, can achieve higher levels of SCR.

The results found CR and SSP to predict OSR. This implies that having close customer and supplier relations develops a better understanding between trading partners, and is instrumental in increasing a firm's ability to respond rapidly to demand changes by customer. The study finds that through CR and SSP *mentioned* practices, organizations can be more operationally responsive in terms of being able to respond rapidly to changes in product volume demanded by customers, effectively expedite emergency customer orders, rapidly reconfigure equipment to address demand changes, rapidly reallocate people to address demand changes, and rapidly adjust capacity to address demand changes.

Finally, the study also found that firms' suppliers can be more responsive, in terms of being able to change product mix in a short time, consistently accommodate the focal firm's requests, provide quick inbound logistics to the focal firm, and effectively expedite the focal firm's emergency orders, by engaging in the *mentioned* IS practices and SSP with the focal firm. Thus, SSP is the predominant SCMP dimension that is instrumental in the improvement of SCR as well as two of its dimensions - OSR and SNR. This study thus supports the findings of Qrunfleh and Tarafdar (2013), which found that close relationships with suppliers form the pathway through which supply chains

can be responsive to customer demands. Further, a plausible explanation for the lack of support between the dimensions of SCMP and LPR could be that 59.86% respondents in this study indicated that they outsourced outbound logistics to a moderate to high extent. This outsourcing transfers the LPR capabilities to the 3PL companies and outside the purview of the focal firm; thus the focal firms do not have direct control over LPR capability. The 3PL companies maintain and often exceed customer expectations. There is thus little scope for in-house improvement of LPR by firms. This finding also gives future researchers food for thought.

As today's competition is moving from between firms to between supply chains, more and more organizations are increasingly adopting SCM practices in the pursuit of competitive advantage. The findings of this research assure practitioners that SCM is an effective way of competing, and the implementation of SCM practices does have a strong impact on SCR. This study provides predominant SCM practices that directly impact SCR on an aggregate basis, as well as on one or more of its dimensions.

The findings imply that organizations may be able to improve their overall SCR through IS, SSP, and CR. Organizations can be operationally more responsive through collaborative, inclusive, and win-win relationship practices with upstream and downstream supply chain trading partners, in terms of the five measures of CR and the six measures of SSP (see Appendix A). Also, firms' suppliers can be more responsive through strategic partnership practices in terms of the six measures of SSP, and two-way information sharing in terms of the six measures of IS (see Appendix A), with the focal firm downstream. The findings may encourage practitioners and firms to emphasize on these SCM practices to boost SCR, OSR, and SNR. It could be in the best interest of firms to improve their SCR, OSR, and SNR as these abilities have been found to improve firm competitive advantage (Thatte & Agrawal, 2017; Thatte et al., 2018). The study also provides a research framework that identifies positive and significant relationships between SCMP and SCR. It provides an insight for future research in the area of SCR and SCMP.

LIMITATIONS AND FUTURE RESEARCH

Building on theoretical and empirical studies, this research has extended *past research* in several ways. While this research has contributions from both theoretical and practical perspectives, it also has some limitations that can be addressed in future research as described below.

In this research, the revalidation of constructs was not performed due to the limited number of observations (294). In future research, this may be addressed. To improve the response rate, new mailing lists and research methods can be used. Individual respondents (high-level administrators from procurement, operations, materials, and logistics functions) in an organization were asked to respond to complex SCM issues involving all supply chain participants, including upstream suppliers and downstream customers. No person in an organization, however, is responsible for the entire supply chain. Therefore, some measurement inaccuracy may be generated by using a single respondent. In order to enhance generalizability, future research may extend or replicate the study for other types of industry. Future research may also apply multiple methods of obtaining data. The

use of single respondent to represent intra or inter-organization wide variables may generate some inaccuracy (Koufteros, 1995). Future research may seek to use multiple respondents from each participating organization to improve the reliability of the research findings. Future research may test the relationships in different countries identifying country-specific SCM issues. Because the study found no support for the impact of SCMP dimensions on LPR, future studies can further investigate this aspect.

In future studies, the effects of additional SCMP dimensions on SCR not studied in this research can be studied. Future research may study SCMP and SCR at the supply chain level. To find out how SCM practices differ by industry in improving SCR, investigating the different SCMP and SCR components across supply chains operating in different industries may be interesting. Future studies may perform item-level data analyses to identify which individual SCM practices boost different dimensions of SCR. Such studies would be useful in drawing additional practical and theoretical implications.

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Appendix A. Instrument for Supply Chain Responsiveness and SCM Practices

The instrument used in this study is presented below. It has been adopted from Thatte et al. (2013) and has been included herein for clarity.

SCM Practices (SCMP)*

Please circle the number that accurately reflects the extent of your firm's current level of SCM practices.

Strategic supplier partnership (SSP)

- SSP1 We consider quality as our number one criterion in selecting suppliers
- SSP2 We regularly solve problems jointly with our suppliers
- SSP3 We have helped our suppliers to improve their product quality
- SSP4 We have continuous improvement programs that include our key suppliers
- SSP5 We include our key suppliers in our planning and goal- setting activities
- SSP6 We actively involve our key suppliers in new product development processes

Customer relationship (CR)

- CR1 We frequently interact with customers to set reliability, responsiveness, and other standards for us
- CR2 We frequently measure and evaluate customer satisfaction
- CR3 We frequently determine future customer expectations
- CR4 We facilitate customers' ability to seek assistance from us
- CR5 We periodically evaluate the importance of our relationship with our customers

Information sharing (IS)

- IS1 We inform trading partners in advance of changing needs
- IS2 Our trading partners share proprietary information with us
- IS3 Our trading partners keep us fully informed about issues that affect our business
- IS4 Our trading partners share business knowledge of core business processes with us
- IS5 We and our trading partners exchange information that helps establishment of business planning
- IS6 We and our trading partners keep each other informed about events or changes that may affect the other partners

Supply Chain Responsiveness (SCR)*

Please circle the number that accurately reflects the extent of your supply chain's current level of responsiveness.

Operations system responsiveness (OSR)

- OSR1 Our operations system responds rapidly to changes in product volume demanded by customers
- OSR2 Our operations system effectively expedites emergency customer orders
- OSR3 Our operations system rapidly reconfigures equipment to address demand changes
- OSR4 Our operations system rapidly reallocates people to address demand changes
- OSR5 Our operations system rapidly adjusts capacity to address demand changes

Logistics process responsiveness (LPR)

- LPR1 Our logistics system responds rapidly to unexpected demand change
LPR2 Our logistics system rapidly adjusts warehouse capacity to address demand changes
LPR3 Our logistics system rapidly varies transportation carriers to address demand changes
LPR4 Our logistics system effectively delivers expedited shipments

Supplier network responsiveness (SNR)

- SNR1 Our major suppliers change product mix in a relatively short time
SNR2 Our major suppliers consistently accommodate our requests
SNR3 Our major suppliers provide quick inbound logistics to us
SNR4 Our major suppliers effectively expedite our emergency orders

* All items are measured using a 5-point Likert scale measured from 1-not at all to 5-to a great extent

Appendix B. Characteristics of the Respondents

1.	Job Titles (290)	
	CEO/President	10.69% (31)
	Vice President	44.83% (130)
	Director	25.17% (73)
	Manager	19.31% (56)
2.	Job Functions (291)	
	Corporate Executive	42.27% (123)
	Purchasing	4.47% (13)
	Manufacturing / Production	8.59% (25)
	Distribution / Logistics	13.06% (38)
	SCM	16.84 (49)
	Transportation	1.37% (4)
	Materials	0.69% (2)
	Operations	6.19% (18)
3.	Years worked at the organization (290)	
	Under 2 years	19.31% (56)
	2-5 years	26.55% (77)
	6-10 years	20.69% (60)
	Over 10 years	33.45% (97)

Appendix C. Characteristics of the Surveyed Organizations

1.	Organizations that have embarked upon a program aimed specially at implementing “Supply Chain Management” (294).	
	Yes:	63.27% (186)
	No:	36.73% (108)
	Average length of implementation: 4.15 years	
2.	Primary production system (283)	
	Engineer to Order	10.60% (30)
	Make to Order	35.69% (101)
	Assemble to Order	20.85% (59)
	Make to Stock	32.86% (93)
3.	Industry – SIC (278)	
	Textile mill Products (SIC 22)	0.00% (0)
	Apparel and Other Textile Products (SIC 23)	1.44% (4)
	Furniture and Fixtures (SIC 25)	2.52% (7)
	Fabricated Metal Products (SIC 34)	10.43% (29)
	Industrial Machinery and Equipment (SIC 35)	10.07% (28)
	Electrical and Electronic Equipment (SIC 36)	39.57% (110)
	Transportation Equipment (SIC 37)	9.35% (26)
	Other	26.62% (74)
4.	Number of employees (291)	
	1-50	4.12% (12)
	51-100	6.87% (20)
	101-250	12.03% (35)
	251-500	12.37% (36)
	501-1000	8.59% (25)
	Over 1000	56.01% (163)
5.	Annual sales in millions of \$ (278)	
	Under 5	2.52% (7)
	5 to 10	3.60% (10)
	10 to <25	7.19% (20)
	25 to <50	8.99% (25)
	50 to <100	6.83% (19)
	>100	70.86% (197)

PATENT ATTRIBUTES AND CONTROL RIGHTS: COMBINING SIGNALING THEORY WITH TRANSACTION COST ECONOMICS

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ABSTRACT

This study investigates the empirical relationship between patent attributes and allocation of control rights, and the relationship between patent attributes and up-front payment in R&D alliance contracts. Patent attributes of focal innovations reduce measurement costs for the party with less information. Patent novelty, patent importance, self-citations, and patent generalizability are reliable and cost-effective signals for underlying knowledge embodied in the patent. Drawing on signaling theory, I argue that signals of patent novelty and technological importance reinforce each other such that biotech firms gain higher upfront payment and a large share of control rights. Further, patent novelty and patent generalizability negatively interact with each other such that biotech firms gain lower upfront payment from pharm firms and smaller share of control rights. Hypotheses are tested with a sample of R&D alliance contract between biotechnology firms and pharmaceutical firms in biotechnology industry.

INTRODUCTION

Firms increasingly rely on strategic alliances to conduct joint research and development to share investment risk, access valuable capability, and ultimately gain competitive advantage in the product market (Teece, 1986; Somaya, Kim & Vonortas, 2011). The market for technology has been expanding exponentially. According to the estimate of Arora, Fosfuri, and Gambardella (2001), during the period of 1985-1997, more than 15,000 technology licensing transactions were conducted worldwide, with a total value of over \$320 billion.

Prior research sheds insightful light on strategic alliance phenomenon. One stream of strategy research has investigated the independent effects of contractual governance and prior ties, and whether these two governance mechanisms complement or substitute for each other (e.g. Luo, 2002; Parkhe, 1993; Poppo & Zenger, 2002; Reuer & Arino, 2007; Ryall and Sampson; 2009; Zollo, Reuer, & Singh, 2002). A second stream of strategy research explores particular contractual provisions. These contractual provisions include lump-sum payments and royalty rates in technology licensing (e.g. Bessy, Brousseau, & Saussier, 2008), exclusivity and scope restrictions by product or geography (e.g. Somaya et al, 2011), contract duration in strategic alliances (e.g. Reuer & Arino, 2007).

Relatedly, one set of studies in finance and management literatures investigates how external equity market conditions and the supply and demand for alliance partners impact allocation of control rights (e.g. Lerner & Merges, 1998; Adegbesan & Higgins, 2010). Control rights are an essential subset of contractual provisions associated with intellectual property rights, licensing rights, manufacturing

rights, and marketing rights (Lerner & Merges, 1998). Control rights “confer the ability to make decisions affecting the distribution of an income stream whose magnitude and even existence are uncertain *ex ante*” (Adegbesan & Higgins, 2010). The allocation of control rights, in essence, measures how jointly created value within an alliance is distributed between alliance partners in uncertain and unpredictable market *ex ante* (Adegbesan & Higgins, 2010). Prior empirical research has demonstrated various antecedents of control rights allocation such as equity market conditions, and supply and demand for alliance partners in the strategic factor market (e.g. Adegbesan & Higgins, 2010; Lerner & Merges, 1998). While prior research deepens our understanding of determinants of particular contractual provisions like control rights, and upfront payment, how patent attributes impact the allocation of control rights in R&D alliances still awaits theoretical development. I draw on transaction cost economics and signaling theory to develop hypotheses and test them with a sample of R&D contracts between biotech firms and pharmaceutical firms.

Given that the market for technology is characterized by information asymmetry, the exchange party with less information may encounter greater measurement cost in assessing the value of licensed technology. Considering that the main concern of a R&D alliance is whether the focal patent of one alliance partner, combined with complementary assets of another, can be turned into a new product or service, effectively measuring the value of a focal patent becomes essential for alliance formation and the subsequent allocation of control rights. I propose that patent attributes reduce transaction costs for both parties and allocation of control rights and upfront payment vary with patent attributes. Patent attributes include technological importance, novelty, and generalizability. Patent attributes are measured based on patent citation data. These three patent characteristics represent the pre-certified value of patent quality (Joshi & Nerkar, 2010). Technological importance captures the influence of a focal patent on subsequent knowledge generation. Technological importance is measured as the number of citations received by a focal patent (Hall, Jaffe & Trajtenberg, 2001). A high number of citations received by a focal patent certifies the high impact of the focal patent on subsequent knowledge generation. Knowledge novelty captures the extent to which the focal patent builds on prior knowledge in diverse technology domains (Hall et al, 2001). The more technological classes a focal patent spans, the more knowledge inflow to the focal patent, showing a high likelihood of knowledge novelty and production of high impact products. Generalizability refers to the extent to which subsequent citations to the focal patent are concentrated in different technology classes (Hall et al, 2001). A focal patent with high generalizability has broad scope and is more generalizable if the technology classes of citing patents span many different technological classes.

I contend that patent attributes (novelty, technological importance, and generalizability) reduce the measurement cost incurred to pharma firms and disclosure risk incurred by biotech firms. Further, patent attributes also signal to other parties about the value of that technology, and allows for more bidding of the technology possessing firm's knowledge. Thus, patent attributes reliably signal the underlying quality of the patent for pharma firms and enable biotech firms to capture economic value as reflected by high upfront payments and a large share of control rights. Further, patent novelty, technological importance of patent, and patent generalizability signal differing dimensions of knowledge quality, patent attributes that either complement or substitute for each other, which exert a differential effect on upfront payment and allocation of control rights.

I use sample contracts from biotech-pharma R&D alliances to test my hypotheses. All these contracts include patents owned by biotech firms. Biotech firms provide the patent to capture innovation rent in

the alliance with pharma firms. Pharma firms offer complementary capabilities including development experience, the lengthy and costly process of conducting human tests, and regulatory Food and Drug Administration (FDA) approval, manufacturing and marketing. Patent attributes are measured using patent citation data from the *National Bureau of Economic Research* patent data (Hall, Jaffe & Trajtenberg, 2001). Patent citations have been used to measure patent value in empirical management research (e.g. Hall, Jaffe & Trajtenberg, 2005; Levitas & McFadyen, 2009).

The structure of this paper is as follows. The theory and hypotheses section reviews transaction cost economics and signaling theory in management. The theory of patent attributes is developed as an effective mechanism of measurement cost reduction and signals of patent. Based on this theory, I develop hypotheses linking patent attributes to allocation of up-front payment and control rights. The Method section describes sample selection, measures of variables, and the analysis method. The discussion section concludes with limitations and future avenues for research.

THEORY AND HYPOTHESES

Transaction Cost and Signaling Theory in R&D Alliances

In the market for technological know-how and innovations, effectively measuring the value of focal patents can be problematic due to asymmetric distribution of information between exchange partners. Knowledge tacitness may also prevent effective transfer across organizational boundaries. Among the barriers to effectively govern inter-firm alliances, opportunism concerns are particularly severe (Williamson, 1985). Technology licensors may inflate the value of innovation, attempting to optimize licensing rent (Pisano, 1997). Licensees of focal innovation may act opportunistically by appropriating the knowledge, if technology licensors fully disclose the information (Oxley, 1997). Measurement cost is larger in the R&D alliance context with high information asymmetry, increasing the transaction cost to biotech firms and pharma firms. Measurement cost is defined as the cost incurred to pharma firms for obtaining additional information in order to evaluate the value of focal innovation that biotech firms bring to the alliance.

The Socio-structural perspective posits that a firm's reputation in the social structure, as well as its prior relationships symbols of organizational trust, can mitigate concerns of opportunism and misappropriation, and facilitate inter-firm coordination (e.g. Gulati, 1995; Poppo & Zenger, 2002; Robinson & Stuart, 2007; Ryall & Sampson, 2009). For instance, a focal firm with a high reputation in the social structure affords higher up-front payment in R&D alliances (Robinson & Stuart, 2007). Transaction cost theorists suggest internalizing R&D activities or governing R&D alliances via contractual provisions to align partner interests (Williamson, 1985; Poppo & Zenger, 2002). For instance, particular contractual terms can vary with asset specificity and collaboration duration (e.g. Reuer & Arino, 2007; Somaya, Kim & Vonortas, 2011).

Prior empirical research has ignored how patent attributes including patent novelty, patent importance, self-citations, and patent generalizability in alliance contracts influence payment structure and control rights allocation. After all, reliably gauging the value of licensed patent is the first important step in

alliance formation, contract crafting and implementation. Whether R&D alliance can develop and commercialize new product is to a large extent dependent on the quality of patented knowledge (see Figure 1). The critical theoretical relationship between patent attributes and up-front payment and control rights allocation deserve theoretical consideration and empirical test.

Control rights as an important set of contractual provisions also receive increasingly scholarly attention, as ‘the allocation of control rights is a central issue in the negotiation of alliances’ (Lerner & Merges, 1998: 127). Elfenbein and Lerner (2003) contend that “allocation of control rights are partly determined by efficiency concerns but also by relative bargaining power of the partners”. Adegbesan and Higgins (2010) further distinguish pie-splitting control rights representing the *ex ante* allocation of value within alliance. Allocation of control rights has been found to vary with financial market conditions (Lerner, Shane, & Tsai, 2003), financial resources possessed by biotech firms (Lerner & Merges, 1998), and supply and demand of alliance partners (Adegbesan & Higgins, 2010).

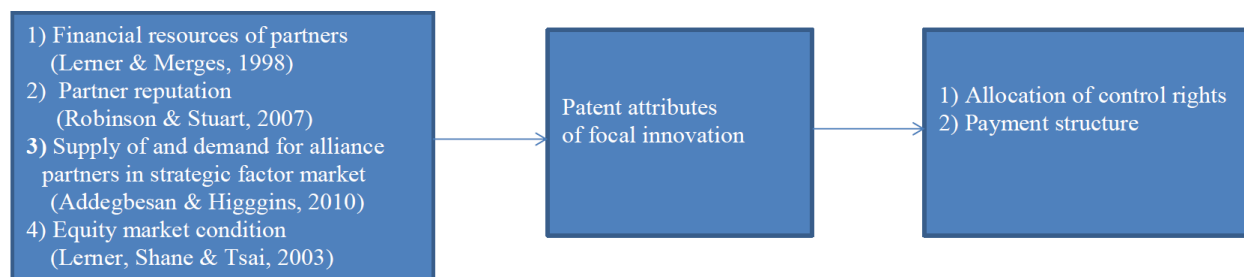


FIGURE 1

Specifically, I examine signaling effects of four patent attributes on allocation of control rights and upfront payment in R&D alliances between a biotech firm and a pharma firm. Patent novelty, patent importance, self-citations, and patent generalizability are measured with patent citation data. In the empirical works of strategic management, patents serve as signals of high quality of internal R&D to reduce information asymmetry between firms and investors, and alliance partners. The signal of possessing patents reduces the need to hold cash (Levitas & McFadyen, 2009) and increases the bargaining power of small firms to capture innovation value in R&D alliances (Adegbesan & Higgins, 2010). Scholars further this line of research and examine the signaling effect of specific patent attributes to stock markets. Hall, Jaffe and Trajtenberg (2005) posit that patent citation is one measure of the importance of a firm’s patents, and empirically find that the stock market values the intangible assets embodied in patents, each additional citation increasing firm value by 3%. In addition, Hall and colleagues (2005) demonstrate that self-citations are more valuable than external citations.

As these signals of patent quality are not the focus of biotech firms, pharma firms have no concern that the signals about these patent attributes would be distorted by biotech firms. Thus these patent attributes serve as a low-cost and effective measurement of underlying quality of patented knowledge. Pharma firms receive these signals and make inferences about patent quality.

Further, the management literature, with the exception of Arthurs, Busenitz, Hoskisson and Johnson (2008) and Agarwal, Ganco, and Ziedonis (2009), examines single or multiple positive signals, intentional or unintentional, in multiple contexts (e.g. Gulati & Higgins, 2003; Reuer, Tong & Wu, 2012) with little emphasis on the fact that signals can be negative in interfirm alliances. While information economics emphasize signals that distinguish high quality firms/individuals from low quality firms/individuals, signals are broadly theorized to reduce information asymmetry to facilitate market exchanges, regardless of being positive or negative. For instance, Agarwal and colleagues (2009) show that firms repeatedly litigate other firms for patent infringement, which sends a negative signal to competing firms, and effectively deters competitors from hiring departing inventors from litigious firms. This study proposes that patent generalizability, among the four patent attributes, is negatively associated with control right allocation and upfront payment to small biotech firms.

In addition to examining the separate signaling effect of each patent attribute, positive or negative, in allocation of control rights and upfront payment to small biotech firms, our study also contends that some patent attributes may interact negatively or positively to impact allocation of control rights and upfront payment to small biotech firms. Arthurs and colleagues (2008) show that signals may substitute for each other. When new firms, going through the initial public offering (IPO), incur high debt that leads to concerns about paying off the interest in a timely manner, management can counteract investor concerns by accepting a longer lockup period in which current shareholders are not allowed to sell their stock shares after the IPO (Arthurs, Busenitz, Hoskisson & Johnson, 2008).

Knowledge Novelty

Knowledge novelty refers to the extent to which knowledge or technologies are new to an organization (Ahuja & Lampert, 2001). Knowledge novelty plays an important role in organizational learning and innovation (Rosenkopf & McGrath, 2011). Innovation research scholars have provided compelling theoretical and empirical arguments that knowledge novelty enhances the impact of resulting innovations (Nerkar, 2003). Knowledge novelty is particularly important to large established firms. Ahuja and Lampert (2001) provide two reasons. First, novel technologies furnish organizations with new perspectives in solving problems. Second, new technologies alter existing cognitive structures within inventors/organizations.

It is imperative that large and established firms forge interfirm alliances with small and innovative biotech firms to overcome local search tendency (Helfat, 1994; Rosenkopf & Almeida, 2003). Jiang, Tan, and Thursby (2010) find that incumbent firms proactively search for new knowledge to invent by forming alliances with different partners in the early stages of technological change. Novel technologies signal high economic value and attract a large number of bidders, increasing the bargaining power of biotech firms.

Increased bargaining power, derived from knowledge novelty, on the part of small biotech firms is also protected by strong appropriability conditions of biopharmaceutical industry. The appropriability conditions affect the extent to which firms can capture rents from innovations (Teece, 1986). Empirical studies have offered evidence that the biopharmaceutical industry is characterized by stringent patent regime. Patent protection accounts for about 30% of new inventions in pharmaceutical and chemical

industries (Mansfield, 1986; cf. Ahuja, Lampert, & Tandon, 2008).

The bargaining power that knowledge novelty affords biotech firms can be reflected in the large amount of up-front payment. Up-front payment is non-contingent and may be subject to misuse (Robinson & Stuart, 2007). As a result, pharma firms would be less willing to make a large up-front payment if pharma firms do not really need novel knowledge from biotech firms. Conversely, the more certain knowledge via patents signaling is, the less risk a biotech firm will be willing to bear.

Hypothesis 1a:

Knowledge novelty of focal patents owned by biotech firms in the alliance contract is positively related to the ratio of up-front payment to total payment specified in alliance contract.

Knowledge novelty can also help biotech firms win more control rights. Control rights refer to “those that confer ownership and control over activities and intermediate outputs that directly affect the allocation of portions of the overall value to be created by an alliance” (Adegbesan and Higgins, 2010: 191). Elfenbein and Lerner (2003) suggest that allocation of control rights are partly determined by relative bargaining power of the partners as well as by efficiency concerns. Adegbesan and Higgins (2010) identify 10 control rights which are decomposed into four categories: intellectual property rights, licensing rights, manufacturing rights, and marketing rights. A patent, with high novel knowledge, signals to the potential technology buyers the high likelihood of producing a high impact product, thereby increasing the number of buyers and enhancing the ability of small firms possessing novel patents to negotiate with other parties for a large share of control rights.

Hypothesis 1b:

The more novel the focal patent owned by biotech firms in the alliance contract, the larger share of control rights biotech firms retain.

Technological Importance

Technological importance captures the influence of a focal patent on subsequent knowledge generation. Technological importance is measured as the number of citations received by a focal patent (Hall, Jaffe & Trajtenberg, 2001). A high number of citations received by a focal patent certifies the high impact of a focal patent on subsequent knowledge generation.

Most patents have relatively low value and only highly-cited patents have high value (Trajtenber, 1990; cf Ahuja & Lampert, 2001). Technologically important patents have higher scientific and technical significance, providing patent owners with strong intellectual property protection (IPP), an effective approvability means (Joshi & Nerkar, 2010).

Technologically important patents are likely to be noticed by competing and potential partners, as granting patents to focal owners concurrently discloses the knowledge elements embedded in the patents. As biopharmaceutical industry has strong patent regime, economically valuable patent as measured by high number of citations send positive signal to pharm firm. At the same time, highly cited focal patent in alliance contract helps small biotech firms to gain greater bargaining power, thus

extracting high percentage of innovation rent reflected by high upfront payment and large share of control rights in contractual alliances.

Hypothesis 2a: Technological importance of a focal patent owned by biotech firms in the alliance contract increases the bargaining power of biotech firms such that the greater the technological importance of the focal patents, the higher the ratio of up-front payment to total payment from pharmaceutical firms.

Hypothesis 2b:

Technological importance of a focal patent owned by biotech firm in the alliance contract increases the bargaining power of biotech firms such that the greater the technological importance of the focal patent, the more control rights that biotech firms retain.

Self-citation

Citations to a focal patent can be made by external patents owned by other firms (external citations). Patents owned by one firm can also cite patents owned by the same firm (self-citations). Self-citations differ from other citations in two respects. First, when one firm cites its own patent on a regular basis, it shows that the focal patent is the foundational technology. A patent with multiple self-citations not only indicates its economic value, but also the strategic stakes—the substantial extent to which a firm builds on its own technology (Somaya, 2003). Firms are less likely to settle a patent infringement lawsuit if either party has strategic stakes on the controversial patent. (Somaya, 2003). Second, the number of self-citations reflects the extent to which existing knowledge is exploited or reused (Katila & Ahuja, 2002). Multiple self-citations indicate that firms acquire a deeper understanding of the underlying knowledge by repeatedly revisiting the focal patent.

A high number of self-citations implies a high ability to appropriate value in a strategic alliance. Firms in the biotech industry, with a strong IP regime, can effectively protect key patents with multiple self-citations in lawsuits, because self-citing the firm's own patent shows to the court the visible knowledge development along the technology trajectory. Constantly revisiting the underlying knowledge elements embodied in a patent not only deepens understanding the association between knowledge elements, but also quickens the speed of research progress. When a biotech firm owns a patent with multiple self-citations, such patent signals potential buyers the high likelihood of launching a new product in an uncertain R&D alliance.

Ahuja, Lampert, and Novelli (2012) distinguish two types of appropriability: primary and generative. Primary appropriability “refers to a firm's effectiveness in exploiting a given invention by translating it into a product or licensable solution for users” (Ahuja et al, 2012:3). Generative appropriability refers to “a firm's effectiveness in capturing the greatest share of future *inventions* spawned by its existing inventions. A patent with multiple self-citations constitutes the foundation of subsequent innovations and spawns future innovations, thus signaling to pharma partners the high ability of creating new innovations. Patents with multiple self-citations increases the generative appropriability of a biotech firm to capture innovation value in a R&D alliance.

Hypothesis 3a: When a focal patent owned by biotech firms has multiple self-citations, the focal patent tends to earn a higher ratio of upfront payment to total payment from the pharma firm.

Hypothesis 3b: When a focal patent owned by biotech firms has multiple self-citations, the focal patent tends to earn a higher share of control rights.

The above hypotheses concerns the effects of positive signals from patent attributes, such as knowledge novelty, technological importance, and self-citations on upfront payment and allocation of control rights. Signals can also be negative (Connelly, Certo, Ireland, & Reutzel, 2011). For example, when new firms—going through an initial public offering (IPO)—incur high debt and have concerns of paying off the interest in a timely manner, the market reacts negatively and IPO firms experience high IPO underpricing. (Arthurs, Busenitz, Hoskisson & Johnson, 2008). In the following hypothesis, I contend that knowledge generalizability, another patent attribute, however, sends out a negative signal to pharma firms, lowering upfront payment and share of control rights to biotech firm in R&D alliance.

Knowledge Generalizability

Generalizability refers to the extent to which subsequent citations to the focal patent are concentrated in different technology classes (Hall et al, 2001). If focal patent is cited by patents from diverse technology classes, the focal patent has high generalizability. A focal patent with high generalizability is broad in scope and more generalizable.

A general patent means that the knowledge of focal patent is spread over a wide range of technology fields. High generality means that a firm may encounter high legal enforcement cost, as large number of firms can cite the high generality patent and suing these firms can be financially expensive. Further, defendants can ally to counter-sue the plaintiff firm owning the high generality patent. Put differently, appropriating return from a high generality patent may be costly (Hall, Jaffe & Trajtenberg, 2005). It can be reasonably argued that a focal patent with high generality does not afford much bargaining power to a biotech firm due to its inability to appropriate value in a cost efficient manner for the biotech firm, leading to the following hypotheses.

Hypothesis 4a:

Technological generalizability of a focal patent in biotech firms decreases the bargaining power of biotech firms such that technological generalizability of a focal patent is negatively associated with the ratio of up-front payment to total payment from pharmaceutical firms.

Hypothesis 4b:

Technological generalizability of a focal patent in biotech firms decreases the bargaining power of biotech firms such that technological generalizability of a focal patent is negatively associated with share of control rights.

The foregoing hypotheses examine the positive and negative effect of each individual signal (e.g. knowledge novelty, patent importance, patent generalizability), on allocation of upfront payment and control rights to biotech firms. Pharm firms will examine the patent attributes as a whole instead of

looking at one individual patent attribute without considering other attributes. As a result, it is theoretically important to examine interaction effects between these patent attributes. Prior IPO context

research has shown signals can substitute for each other (e.g. Arthurs et al, 2009), as signal receivers, like pharma firms in the market for technology, can receive multiple signals for interpretation. Each signal may be positive or negative or the signals can reinforce each other (e.g. Connelly et al, 2011; Levitas & McFaydan, 2009; Tong et al, 2012).

Implicit in the argument of prior empirical research is that different signals from either the focal firm or the focal individual are either complementing or reinforcing the high quality. For instance, Reuer and colleagues (2012) contend that relationships with prestigious venture capitalists (VCs), investment banks and alliance partners complement rather than substitute each other in signaling high quality of target IPO firms. Arthurs, Busenitz, Hoskisson and Johnson's (2009) study— in the context of IPO extend signaling theory— assert that when multiple signals are present, substitution effect can occur. Specifically, a longer lockup period, as a signal of shareholder commitment to IPO firm, can substitute for VC and prestigious underwriter backing. While prior research mainly focuses on how signals act as bonding or commitment mechanism (e.g. Arthurs et al, 2009), our study of patent attributes theorizes signals of patent attributes act as low cost measurement of underlying knowledge codified in patents.

Interaction Effect of Patent Novelty and Self-Citations

In the biopharmaceutical industry, biotech firms are specialized in the upper stream of the value chain: biotech firms conduct activities in research. Pharmaceutical firms have strong capabilities in the downstream: strong capabilities in new product application through the Food and Drug Administration, namely, commercializing and marketing new products (Rothaermel, 2001). The signal that a focal patent is novel and is solidly built on a biotech firm's prior knowledge enhances the prospect of launching a successful product. A large number of self-citations signals that a biotech firm has insights about and has mastered its foundational knowledge. Combined, self-citations and knowledge novelty imply high probability of successful product development, leading to the following hypotheses.

Hypothesis 5a:

The relationship between patent novelty and the ratio of up-front payment to total payment from pharma firms increases in the presence of high self-citations of the focal patent that a biotech firm brings to the alliance contract.

Hypothesis 5b:

The relationship between patent novelty and the share of control rights that a biotech firm wins increases in the presence of high self-citations of the focal patent that a biotech firm brings to the alliance contract.

Interaction Effect of Patent Novelty and Patent Generalizability

As high patent generalizability suggests that the innovation may spill over to many different fields, and increases the enforcement cost in protecting its innovation, high patent generalizability weakens the ability of the patent owner to appropriate innovation rent. While knowledge novelty signals high quality of underlying knowledge, high patent generalizability mitigates the bargaining power of biotech firm and the desirability of the focal patent, which leads to the following hypotheses.

Hypothesis 6a:

The relationship between patent novelty and the ratio of up-front payment to total payment from pharma firms decreases in the presence of high patent generalizability of the focal patent that a biotech firm brings to the alliance contract.

Hypothesis 6b:

The relationship between patent novelty and share of control rights that a biotech firm wins decreases in the presence of high patent generalizability of the focal patent that a biotech firm brings to the alliance contract.

DATA AND METHODS

This study relies on the contract information between biotech firms and pharma firms. The alliance information is obtained from Recombinant Capital (Recap), which is based in California and was acquired by Deloitte. The focus is on the contracts involving a patent license where a biotech firm provides patented knowledge and a pharma firm offers complementary capabilities. The R&D alliance is mainly concerned with the valuation and payment for focal patents of the biotech firm and the allocation of control rights between the biotech firm and the pharma firm. The sample period is from 1991 to 2005. This time period captures a dramatic increase in pharmaceutical-biotechnology alliances (Adebesan & Higgins, 2010). To be consistent with prior research, alliances that fall into the following categories are eliminated (Adebesan & Higgins, 2010; Lerner et al, 2003):

- (1) One party to the alliance is either a government agency, university or nonprofit organization;
- (2) No research component exists in the alliance;
- (3) More than three parties enter into a R&D alliance.

Additionally, since this study investigates the effect of patent attributes on allocation of control rights and upfront payment, the contract must explicitly specify the patent numbers that are licensed out. Since some firms are not publicly listed, many R&D alliance contracts do not disclose the involved patent numbers. When contracts listed patent application numbers, the USPTO website was searched to determine the corresponding patent numbers. Out of 1330 contracts signed between biotech and pharma firms, 104 contracts explicitly list the patents or patent application numbers for license.

Dependent Variables

There are two dependent variables in this study. (1) Upfront payment of client firm to R&D firm. Ideally, this measure is the ratio of upfront payment and total milestones, plus upfront payment and royalties, if applicable. Since some firms choose to not disclose milestone payment in the contracts available from Recap, such missing information makes the ratio measure infeasible. The amount of upfront payment is defined as the net present value of innovation rent of the focal patent. Due to incentive misalignment concerns, a pharma firm tends not to pay a large amount of upfront payment, as cash payment to a biotech firm may be subject to misuse for other research projects within the biotech firm (Elfenbein & Lerner, 2003). This variable captures the valuation from a pharma firm and the bargaining power from a biotech firm in capturing its innovation value. To code upfront payment, the following steps were taken. When there is upfront payment and the amount is disclosed, this amount is logarithmically transformed. When there is no upfront payment, this variable is coded zero. For undisclosed upfront payment, it is coded as a missing value. (2) Control rights. Control rights are used in this research context as proxies for value division between alliance partners. I hypothesize that control rights are a function of patent attributes including patent novelty, technological importance, and patent generalizability. Biotech firms gain or lose control rights depending on the patent attributes while pharma firms evaluate the underlying quality of patent based on the signals from these patent attributes. The allocation of control rights reflects the negotiation between alliance partners. Adegbesan and Higgins (2010: 191) define pie splitting control rights as “those that confer ownership and control over activities and intermediate outputs that directly affect the allocation of portions of the overall value to be created by an alliance”. Adegbesan and Higgins (2010) identify 10 control rights associated with intellectual property rights, licensing rights, manufacturing rights, and marketing rights. To be consistent with prior research, the same coding scheme of Adegbesan and Higgins (2010) is utilized. The control right is coded from the perspective of the pharma firm. The author and a second coder separately coded the control rights and to discern which control right is won by the pharmaceutical firm. When disagreement occurs regarding which control right is won by the pharma firm, the two coders used the coding scheme to engage in a discussion until consensus is reached. The control right is a count variable of how many control rights are won by a pharma firm.

The independent variables of patent attributes are measured based on patent citations. Patented knowledge builds on previous knowledge such as scientific journal publications and previously issued patents. While patent citation is an imperfect measure of knowledge flow, patent citations provide researchers with a tool to measure the extent to which a focal patent builds on previous patented knowledge and its influence on subsequent knowledge generation (e.g. Ahuja & Lampert, 2001; Rosenkopf & Almeida, 2003). This study uses the NBER patent dataset compiled by Hall, Jaffe and Trajtenberg (2001) available via the GOOGLE website. The patent citation data used patent novelty which measures the extent to which cited patents of a focal patent span technological fields. The wider the range of technological fields that cited patents cover, the higher originality score. This measure is based on Hall, Jaffe and Trajtenberg (1997).

Technological importance of the focal patent captures the technological and economic value of patents. This is measured as the total citations made to the focal patent (Hall et al, 2001). Subsequent citations to the focal patent have been shown to have high economic value. Lanjouw and Schankerman (2004) use citations and other measures of patent quality for hypotheses testing and find that patents with high

citations are more likely to be litigated. Empirically, buyers and sellers in market for technology use citations to estimate patent value. In a survey of patent owners, Harhoff et al (1999) find that the estimated patent value that patent owners offer for sale is positively related to subsequent citations (cf. Hall et al, 2005). In assessing the value of a licensed patent, firms very likely use citations as a reliable and efficient measure. Joshi and Nerkar (2010) find that licensing firms are more likely to put patents with technological importance in the patent pool, suggesting that both licensing firms and licensee firms use citations for indicators of patent value.

Self-citation captures the extent to which a firm reuses and exploits its extant knowledge. High self-citations show that the focal patent occupies a foundational place in the firm technological trajectory. In their study of new product development, Katila and Ahuja (2002) propose the construct of search depth and measures it with self-citations. Their empirical finding is that search depth has a curvilinear relationship with new product development. Stated differently, knowledge reuse, as measured by self-citations, helps new product development substantially. Also, a focal patent with high self-citations increases firm's exclusionary ability to appropriate innovation rent due to the consistent knowledge development path. This helps firmsto defend their intellectual property if patent litigation arises.

Generalizability of the focal patent captures the extent of knowledge impact of focal patent on subsequent knowledge generation. The generalizability measures technological classes concentration of citations. If most citations are concentrated in a few technological classes, the concentration score is low. Otherwise, the focal patent has a high generalizability score, meaning that citations to the focal patent span many technological classes. I use the generalizability measure developed by Hall, Jaffe and Trajtenberg (1997).

$$\text{Generality or Generalizability}_i = 1 - \sum_j^i s_{ij}^2$$

“where s_{ij} denotes the percentage of citations received by patent i that belong to patent class j , out of n_i patent classes (note that the sum is the Herfindahl concentration index)” (Hall, Jaffe and Trajtenberg (1997).

I also include a few control variables based on prior contractual research. Patent stock of a R&D firm can increase the bargaining power of R&D firms. This variable is measured as the number of filed patents in the year when the alliance contract is signed. If there are missing values, the prior year's patent count is used. To address the skewness issue, I use the natural logarithm of patent count. Prior alliance with other pharmaceutical firms or biotech firms endorses the quality of a biotech firm's research and management. This can also enhance the bargaining power of R&D firms (Adegbesan & Higgins, 2010). The variable is measured as the number of alliances with other firms in the year in which the contract is signed. As an R&D contract may involve more than one patent, I include the number of licensed patents as a control variable. As this variable is not statistically significant, it is not included in the presented models. Year effect is added to control for market conditions and general economic environment. Finally, the number of backward citations in a licensed patent reflects how extensively the patent knowledge is built on prior patents. It may also influence the valuation made by client firm. As a result, I include backward citations as a control variable.

To test the first set of hypotheses with the dependent variable as upfront payment to the R&D firm, I use ordinary linear regression with robust standard errors. Since the number of control rights (the

dependent variable) is count variable, Poisson regression is used instead of negative binomial to mitigate the overdispersion issue.

RESULTS

The descriptive statistics and correlations are presented in Table 1 and Table 2, respectively. Since some firms choose not to disclose the amount of upfront payment, the number of contracts with complete information decreases from 104 to 98. On average, the number of control rights won by R&D firms is four, while the average amount of upfront payment from a client firm is \$116,746 U.S. dollars (4.76 exponentiated times 1000). There is a positive correlation between the patent stock of a R&D firm and upfront payment received, showing that patent stock increases bargaining power of R&D firms. Prior research empirically demonstrates that the number of patents that are filed or granted at USPTO is positively associated with the pre-money values of R&D firms (Lerner, 1994).

Table 3 presents the results of OLS regression with robust standard errors on upfront payment. Model 1-Model 9 test the effects of patent attributes on upfront payment received by R&D firms. Model 1 is the baseline model which includes only control variables. Model 2-Model 5, respectively, test the hypothesized positive effects of four patent attributes on upfront payment, including patent originality (H1a), technological importance of patent (H2a), self-citations (H3a) and generality (H4a). H1a, H2a, and H4a are not supported due to the insignificant coefficients. While the coefficient for self-citations is significant at .01 level, the sign is negative which is contrary to the hypothesized direction. As a result, H3a is not supported. To test two interaction effects (H5a, H6a), I centered variables of self-citations, patent originality, patent generality. Model 7 tests the interaction effect of self-citations and patent originality, which is not significant. Model 9 tests the interaction effect of generality and novelty. It is not significant. Therefore, H5a and H6a are not supported.

Results of Poisson regression on the number of control rights won by client firm are presented in Table 4. As the main interest in this study is the control rights won by R&D firm, we expect to see negative relationships between patent attributes and the number of control rights won by client firms. Model 1 includes the control variables only. It shows the backward citations of a focal patent increases the number of control rights won by R&D firms. Model 2 tests H1b that patent originality is positively associated with the number of control rights won by R&D firms. The coefficient is significant at .1 level with a positive sign, indicating the patent originality actually negatively impacts the number of control rights won by R&D firms. So H1b is not supported. Model 3-Model 5 test the hypothesized positive effects of technological importance (H2b), self-citation (H3b), and generality (H4b) on the number of control rights won by R&D firms. Since the coefficients are not significant, these hypotheses are not supported. Interaction effects of self-citation and originality, generality and originality are tested in Model 7 and Model 8, respectively. Both hypotheses are not supported due to insignificant coefficients.

TABLE 1: DESCRIPTIVE STATISTICS

Variable	N	Mean	Std Dev	Minimum	Maximum
Control rights	104	4.00	1.11	1	7
Upfront pay	98	4.76	2.81	0	7.90
Self-citation	104	0.63	1.60	0	12.00
Technological importance	103	3.19	1.27	0.69	6.37
Patent novelty	104	0.35	0.36	0	1.00
Generality	104	0.54	0.27	0	1.00
Prior alliances	104	0.67	1.25	0	7.00
Patent stock	104	0.55	0.57	0	2.21
Backward citations	103	1.50	0.95	0	3.69

TABLE 2: CORRELATIONS

	1	2	3	4	5	6	7	8	9
1. Control rights									
2. Upfront pay	0.06								
3. Self-citation	-0.098	-0.16							
4. Technological importance	-0.05	-0.16	0.20**						
5. Patent novelty	0.05	0.02	0.17*	0.34***					
6. Generality	-0.01	-0.02	0.05	0.31***	0.17*				
7. Prior alliances	0.09	0.05	-0.14	0.19*	0.01	-0.01			
8. Patent stock	0.19*	-0.002	0.09	-0.005	0.06	0.03	0.27**		
9. Backward citations	-0.17*	0.13	0.35***	0.20**	0.58***	-0.05	-0.08	0.007	
* p<.05									
** p<.01									
***p<.001									

TABLE 3: OLS REGRESSION ON UPFRONT PAYMENT

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Prior alliances	0.309** (0.149)	0.323** (0.149)	0.339** (0.146)	0.228 (0.155)	0.310** (0.152)
Patent stock	-0.260 (0.458)	-0.243 (0.463)	-0.241 (0.456)	-0.130 (0.482)	-0.260 (0.462)
Backward citation	0.375 (0.285)	0.539 (0.361)	0.479* (0.284)	0.597** (0.290)	0.375 (0.288)
Year	included	included	included	included	included
Originality		-0.736 (1.034)			
Tech importance			-0.342 (0.291)		
Self citation				-0.394*** (0.147)	
Generality					0.0601 (1.244)
Constant	-340.1** 144.8)	-345.7** (146.9)	-240.1 (160.5)	-341.4** (143.6)	-340.2** (145.2)
Observations	97	97	97	97	97
R-squared	0.068	0.074	0.086	0.113	0.068
Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1					

TABLE 3: OLS REGRESSION ON UPFRONT PAYMENT (CONTINUED)

VARIABLES	Model 6	Model 7	Model 8	Model 9
Year	included	included	included	included
Prior alliance	0.0119 (0.0238)	0.0116 (0.0241)	0.0128 (0.0243)	0.0132 (0.0240)
Patent stock	0.0709* (0.0370)	0.0720* (0.0386)	0.0680* (0.0355)	0.0678* (0.0353)
Backward citation	-0.0781** (0.0328)	-0.0796** (0.0326)	-0.0883*** (0.0312)	-0.0902*** (0.0319)
Self citation	-0.0107 (0.0303)	-0.00827 (0.0282)		
Originality	0.138* (0.0802)	0.135 (0.0855)	0.154* (0.0805)	0.155* (0.0798)
Self-citation×Originality		-0.0180 (0.115)		
Generality			-0.0737 (0.0979)	-0.0733 (0.0983)
Generality×Originality				0.0720 (0.261)
Constant	-21.07 (14.82)	-20.67 (14.44)	-20.53 (14.77)	-20.79 (14.69)
Observations	97	97	97	97

TABLE 4: POISSON REGRESSION ON CONTROL RIGHTS

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Year	included	included	included	included	included
Prior alliance	0.0161 (0.0223)	0.0139 (0.0242)	0.0152 (0.0226)	0.0139 (0.0222)	0.0157 (0.0223)
Patent stock	0.0695* (0.0365)	0.0674* (0.0355)	0.0690* (0.0365)	0.0735* (0.0377)	0.0699* (0.0367)
Backward citation	-0.0530** (0.0263)	-0.0845*** (0.0310)	-0.0564** (0.0268)	- 0.0464* (0.0274)	-0.0535** (0.0264)
Originality		0.141* (0.0803)			
Tech importance			0.0108 (0.0255)		
Self citation				-0.0118 (0.0286)	
Generality					-0.0392 (0.100)
Constant	-22.86 (15.08)	-21.20 (15.04)	-25.99 (16.11)	-22.77 (14.86)	-22.63 (14.93)
Observations	103	103	103	103	103

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

TABLE 4: POISSON REGRESSION ON CONTROL RIGHTS (CONTINUED)

VARIABLES	(1) Model 6	(2) Model 7	(3) Model 8	(4) Model 9
Year	included	Included	included	included
Prior alliance	0.0119 (0.0238)	0.0116 (0.0241)	0.0128 (0.0243)	0.0132 (0.0240)
Patent stock	0.0709* (0.0370)	0.0720* (0.0386)	0.0680* (0.0355)	0.0678* (0.0353)
Backward citation	-0.0781** (0.0328)	-0.0796** (0.0326)	-0.0883*** (0.0312)	-0.0902*** (0.0319)
Self citation	-0.0107 (0.0303)	-0.00827 (0.0282)		
Originality	0.138* (0.0802)	0.135 (0.0855)	0.154* (0.0805)	0.155* (0.0798)
Self-citation×Originality		-0.0180 (0.115)		
Generality			-0.0737 (0.0979)	-0.0733 (0.0983)
Generality×Originality				0.0720 (0.261)
Constant	-21.07 (14.82)	-20.67 (14.44)	-20.53 (14.77)	-20.79 (14.69)
Observations	103	103	103	103

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

DISCUSSION

This study investigates the signaling role of patent attributes and how patent novelty, technological importance, and patent generalizability impact the upfront payment and the allocation of control rights to biotech firm. This study is to address the intriguing problem of information asymmetry in R&D alliance. I draw on measurement branch of TCE and contend that patent attributes serve as reliable and cost efficient measurements for both biotech and pharm firms to evaluate the technological and commercial value of underlying knowledge in the imperfect market for technology. Second, these patent attributes signal various level of knowledge quality and influence the bargaining power of both parties in upfront payment and control rights distribution.

This study makes three theoretical contributions to strategic alliance literature. First, this study extends signaling theory by positing that signals can be complementary and substituting in highly information asymmetric R&D alliance context. Prior empirical research in management with the exception of

Arthurs, Busenitz, Hoskisson and Johnson (2008) examine the positive role of various signals in communicating high quality of focal firms or individuals. This comes with an expense that some signals can substitute for other signals. In studying the signaling effect of lockup period, Arthurs and colleagues (2008) demonstrate that a longer lockup period that shareholders agree to hold shares of initial public firms substitute signals of venture capital and prestigious investment bank backup. Drawing on signaling theory, I argue that while patent novelty, technological importance, and patent generalizability signal the quality of underlying knowledge, signals of patent novelty and technological importance reinforce each other. Biotech firms with patents that are novel and technological important gain higher upfront payment and a large share of control rights. Further, patent novelty and patent generalizability negatively interact each other, reducing the upfront payment from pharma firms and the share of control rights for biotech firms.

Second, this study focuses on the measurement branch of Transaction Cost Economics (TCE): patent characteristics reduce information impactedness by providing reliable and accurate indicators of underlying attributes of focal innovation. These characteristics not only help licensees to evaluate independently the value of focal innovations, but also help licensors to capture a large share of innovation rent through high up-front payment and more control rights in the alliance contract. While TCE is criticized for being focused on transaction cost instead of transaction value (Zajac & Olson, 1992), broadly speaking, this study shifts the focus of TCE from transaction cost to transaction value, showing that TCE also explains how transaction value is distributed between transaction partners.

Third, this study investigates licensing from the perspective of licensors at the alliance governance phase and shows how licensors use patent characteristics to capture innovation value from big pharma firms. Prior research on allocation of control rights primarily focuses on bargaining power of one or two transaction parties at the firm level. Pharma firms with abundant financial resources and complementary capabilities are portrayed as dominant players in capturing an unfair amount of control rights (e.g. Adegbesan & Higgins, 2010; Lerner & Merges, 1998; Lerner, Shane & Tsai, 2003). Recent literature on alliance formation shows that small and new firms are active players in partner selection decisions. New biotech ventures possess much discretion in choosing with whom to ally (e.g. Diestre & Rajagopalan, 2012; Katila, Rosenberger, and Eisenhardt, 2008). This study makes a small step in pointing out that at the alliance governance stage biotech firms also play strategically in securing innovation rents.

Managerial Implications

This study also offers practical significance for managers and firms. Managers should pay close attention to patent characteristics when engaged in crafting alliance contract. On the part of small and young firms focusing on the upper stream of the value chain, taking advantage of patents demonstrating high novelty and technological importance helps small firms to gain the negotiation leverage and to capture a large share for their innovation output. In terms of strategizing, licensee firms may avoid patent with high generality, as it could incur high cost of protecting the intellectual property and capturing the economic rent from it. At the same time, firms must make a tradeoff when multiple patent attributes, positive and negative, are present.

Limitations and Future Research

This study has some limitations and offers fertile ground for future research in alliance contracts. I have examined the variance in upfront payment and control rights as a function of patent attributes. Contractual terms may also change due to behavioral uncertainty of alliance partners (Parkhe, 1993). When firms have already shown this opportunistic behavior like suing other firms for patent infringement, how would one alliance partner craft contract to handle this demonstrated opportunism? With respect to alliance formation, how such demonstrated opportunism such as being litigious affect the pool of alliance partners? In my second essay, I will investigate the latter question.

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