A Multi-step Model of Boundary Spanning and Absorptive Capacity: The Differential Impact of Board and Top Management Team Experience on the Development of Sustainability-related Capabilities

by

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A Dissertation Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

Approved April 2018 by the
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May 2018

ABSTRACT

The study explores the differing roles that a top management team (TMT) and a board play in providing a firm the knowledge to improve its absorptive capacity. Building on the distinction between potential and realized absorptive capacity, initially posited by Zahra and George (2002), I argue that a firm's board of directors and its TMT both act to fill the critical role of knowledge gatekeepers identified by Cohen and Levinthal (1990). But, they play different roles in a firm's efforts to acquire, assimilate, transform and exploit novel information. The engagement of board members with environmental planning through personal experiences as well as prior and current ties shapes the ability of the firm to acquire (i.e., identify and obtain) and assimilate (i.e., analyze, understand, and evaluate) valuable external knowledge. However, because they lack the required in-depth knowledge of the firm's internal operations, they are unable to complete the gatekeeping role. The latter stages of that role depend on the abilities of the TMT to transform (i.e., internalize and converse) and exploit (i.e., use and implement) that knowledge, which depends heavily on their engagement with environmental activities through prior experiences. Thus, the board and TMT are only able to fulfill the roles of knowledge gatekeeper collectively. I develop a set of hypotheses from this core proposition, which I test using the participation of U.S. firms in the Carbon Disclosure Project (CDP). Extremely detailed data on 354 firms from 2008 to 2015 allows me to examine multiple sequential processes, including the decision to participate in the CDP performance relative to the core CDP goal, current internal systems, policies as well as plans, and capabilities to breakdown emissions along various production processes to reduce greenhouse gas emissions.

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CHAPTER 1

INTRODUCTION

1.1 Motivation and Research Question

Knowledge is an essential source of competitive advantage for companies, and especially so in dynamic environments (D'Aveni, 1994). To sustain competitive advantage, firms need dynamic capabilities, which refers to "the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (Teece, Pisano, & Shuen, 1997: 516). Put differently, firms should have both capabilities to continually replenish their current knowledge stocks by acquiring new knowledge and capabilities to utilize new knowledge to stay competitive. One such dynamic capabilities of a firm to quickly identify, assimilate, and exploit new external knowledge is called absorptive capacity (absorptive capacity). The concept of absorptive capacity has been widely applied in research settings where knowledge exchange and transfer is crucial such as M&As (Ceccagnoli & Jiang, 2013), strategic alliances (Vasudeva & Anand, 2011), and cross-units learning (Gupta & Govindarajan, 2000; Jansen, Van Den Bosch, & Volberda, 2005; Szulanski, 1996).

Because valuable external information is not always readily available to a company (Argote, 1999; Olivera & Argote, 1999) and also because it is costly for all members to have a direct interaction with the external environment, a group of individuals who can search and channel new external information to the focal company, called boundary spanners, is crucial for absorptive capacity (Allen, 1977; Cohen & Levinthal, 1990; Tushman & Scanlan, 1981a). These boundary spanners, also known as knowledge gatekeepers, have two primary functions of acquiring new external information and

disseminating it to relevant internal units (Aldrich & Herker, 1977; Tushman & Scanlan, 1981a; Tushman & Scanlan, 1981b). While numerous studies have focused on the outcomes of absorptive capacity, however, few studies have examined the role of boundary spanners for absorptive capacity (Eggers & Kaplan, 2013; Volberda, Foss, & Lyles, 2010). The lack of research on the link is surprising, because Cohen and Levinthal (1990: 132) emphasized the importance of boundary spanners by asserting that, "the firm's absorptive capacity depends on the individuals who stand at the interface of either the firm and the external environment or at the interface between subunits within the firm."

Moreover, most empirical studies do not adequately address that absorptive capacity is a sequential process containing multiple dimensions (Volberda, Foss, & Lyles, 2010). Zahra and George (2002) suggested four dimensions that constitute two sets of potential and realized absorptive capacity. Potential absorptive capacity (potential absorptive capacity) includes *acquisition* and *assimilation* of new knowledge and enables continuous knowledge renewal. Realized absorptive capacity consists of *translation* and *exploitation* of obtained new knowledge by integrating it with internal knowledge (Zahra & George, 2002). That is, potential absorptive capacity depends more on the new external knowledge acquisitions, while realized absorptive capacity depends more on leveraging existing knowledge. Taken together, on the one hand, to the degree that potential absorptive capacity relies on continuous inflows of external knowledge, boundary spanners' function of acquiring new external information is more important for potential absorptive capacity. On the other hand, to the degree that realized absorptive capacity depends on leveraging both external and internal knowledge, boundary spanners' function of internally disseminating new knowledge may be more relevant.

In the paper, I extend both boundary spanners and absorptive capacity theories to explain how each function of boundary spanners matters differently for potential and realized absorptive capacity. Because dynamic capabilities are "strategic in nature" (Teece, Pisano, & Shuen, 1997; Zahra & George, 2002: 188), I examine the impacts of top management teams (TMTs) and boards of directors on absorptive capacity. Mainly, I view TMTs and boards of directors as two distinct, yet complementary, groups of boundary spanners. In this way, I can advance our knowledge of the relationship between roles of TMTs and boards as boundary spanners and absorptive capacity by answering this dissertation's central question:

What are the roles that TMTs and boards play in providing a firm the knowledge to improve its absorptive capacity?

Drawing on both boundary spanners' and absorptive capacity perspectives, I argue that TMTs and boards both function as boundary spanners, but their roles in providing the knowledge to affect the processes of absorptive capacity may be different. In explaining the mechanisms that lead to TMTs' and boards' differential impacts, I adopt two critical concepts of transactive memory system—i.e., internal directory knowledge—and not-invented-here bias—i.e., barriers to process external information.

For example, I assert that boards may play the first function of boundary spanners—i.e., acquiring new information—by having access to the external environment (hence having a large pool of information). Because boards have limited knowledge of internal operations and management (e.g., who is doing what internally) and the transactive memory system of the focal firm, they cannot fulfill the role of boundary spanners alone.

On the other hand, TMTs may have a well-developed transactive memory system to perform the second function of disseminating obtained knowledge across. However, TMTs' ability to search and process the new external information may be (increasingly) limited due to their not-invented-here bias against external ideas (e.g., Hambrick & Fukutomi, 1991), and hence, they too may not fulfill the role of boundary spanners either. Put differently, boards have (a) access to the external environmental knowledge (e.g., ties) but are constrained to (b) transfer the knowledge to the internal personnel. On the other hand, TMTs have (a) internal connections but are limited in their ability to (b) acquire and assimilate diverse external knowledge. Therefore, both boards and TMTs' roles in providing the knowledge to improve absorptive capacity may be different yet complementary in that boards are more likely to enhance potential absorptive capacity compared to TMT, while TMTs may influence on realized absorptive capacity more compared to boards.

Specifically, I examine how TMTs and boards' knowledge stocks, reflected in their aggregate prior external experiences, affect the firm's processes of potential absorptive capacity and realized absorptive capacity for new knowledge. The boundary spanners' perspective suggests that TMTs and boards with more of cross-boundary experiences among the members are more likely to be able to replenish their knowledge base through expertise and external connections. I systematically separate experiences of TMTs and boards across two boundaries—the focal organization and its country because these experiences may provide not only social capitals such as ties but also human capital such as diverse managerial practices and policies (Finkelstein, Hambrick, & Cannella, 2009;

Grant, 1996). In particular, I capture the members' aggregate prior external experiences (1) in other companies and (2) in companies incorporated in other countries.

1.2. Research Context

I test the research model by examining firm's effort to reduce their carbon emissions, a critical pro-environmental management task. Carbon emission reduction is a good setting to study the influence of TMTs and boards as boundary spanners on absorptive capacity. Because environmental management often requires significant investments as well as a sustained commitment to systematically change extensive organizational processes (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013; Smith, 2003), the boundary spanning role of both top executives and directors is critical: e.g., gaining environmentally related information from the government, rivals, as well as third-parties, and establishing new policies, practices, and processes for the organization (Chin, Hambrick, & Trevino, 2013; Delmas & Toffel, 2008; Lewis, Walls, & Dowell, 2014).

Environmental management knowledge is highly tacit as well as path-dependent, and hence requires expertise to assimilate new knowledge (Darnall & Edwards, 2006; Hart, 1995). Also, most environmental management knowledge exists external to organizations, and internally applying such knowledge requires a broad and systematic change (Berrone et al., 2013; Smith, 2003). For instance, firms need a breakthrough to create new ways to use sustainable materials (let alone identifying which materials are sustainable), substitute (a part of or whole) value chain with alternative approaches and cooperate with suppliers (so that the suppliers can change their operations sustainably).

Compared to other types of strategically sensitive managerial knowledge, pro-environmental knowledge may have fewer barriers for strategic leaders to transfer

knowledge. Put differently, strategic leaders might not have reasons to hold back environmental knowledge, so external experiences of them may capture related knowledge better.

1.3. Contributions

The study contributes to the literature on absorptive capacity, environmental management, and strategic leadership. First, I add to the conceptual and limited empirical research on the role of strategic leaders—i.e., a collective term for TMTs and boards (Finkelstein, Hambrick, & Cannella, 2009)—as a source of absorptive capacity in an environmental context. Drawing on the boundary spanners' and absorptive capacity perspectives, I identify and examine how the capabilities of leaders as knowledge gatekeepers affect dimensions of organizational absorptive capacity for environmental knowledge. In their seminal paper, Cohen and Levinthal (1990) have conceptually recognized the importance of the gatekeepers' own individual absorptive capacity (e.g., cognition, capabilities) in developing organizational absorptive capacity. However, as Eggars and Kaplan (2013: 295) stated in their review paper, "research on managerial cognition and organizational capabilities has essentially developed in two parallel tracks. … (However, organizational) routines and capabilities are based on the (managers') understanding of how things should be done". Although several recent studies have started to recognize the importance of the role of managers' abilities in developing organizational capabilities (Benner & Tripsas, 2012; Eggers & Kaplan, 2013; Helfat & Martin, 2015), we still know little as to how the leaders' certain abilities (e.g., boundary spanning ability) may influence related organizational capabilities (see Volberda, Foss, & Lyles, 2010; Eggars & Kaplan 2012; Helfat & Martin, 2015 for reviews). Also, even when individuals' role is considered as

antecedents, such studies have focused mostly on the role of managers, leaving out the role of boards of directors in affecting organizational capabilities. The boundary spanners and absorptive capacity perspectives advance our understanding of how characteristics of a group of knowledge gatekeepers could address their impacts on the processes of organizational absorptive capacity.

A key managerial implication is that successfully incorporating new strategic knowledge requires the presence of qualified gatekeepers in both the board and TMT. Particularly in the face of new challenges such as enhanced emphasis on socially and environmentally responsible management, the study offers a detailed picture of the relationship between leaders' knowledge and organizational capabilities. Obtaining this kind of fine-grained picture is critical for understanding how the antecedents exert their influence and, therefore, why organizations may differ in their learning and their eventual outcomes such as performance and innovation.

Second, I contribute to the strategic leadership literature by extending the research domain to organizational capabilities. Little systematic research has considered the roles that boards and TMTs play in influencing absorptive capacity. By relating the structural differences of TMTs and boards as being internal and mostly extremal members to their functional roles of boundary spanners, I offer systematic evidence that boards and TMTs could complement each other in building potential and realized absorptive capacity.

Lastly, I contribute to the environmental management literature. While prior studies on the environmental performance have provided valuable insights as to what factors might influence pollution reductions, much less is known as to the process to improve environmental performance (Ben-Oz & Greve, 2015). That is, we still know little about

how environmental routines and capabilities to enhance pro-environmental performance develop over time. Moreover, existing studies on the link between strategic leaders and environmental outcomes (e.g., pollution reduction) have an implicit assumption that firms can improve environmental performance when the strategic leaders view it is advantageous to do so (e.g., Chin et al., 2013). The current study suggests that environmental expertise may not be so easily obtained, and firms should make an effort to build capabilities at both strategic leader- and organizational (operational) levels to improve environmental performance (effectively).

CHAPTER 2

LITERATURE REVIEW

I first present my core proposition and then introduce central concepts of my theoretical model. After clarifying each concept, I provide the theoretical approaches for the proposition. Lastly, I develop the overarching theoretical model.

2.1 Core Proposition

The experiences of the board are more relevant to potential absorptive capacity, while the experiences of the TMT are more relevant to realized absorptive capacity.

2.2. Central Concepts

Absorptive capacity

Absorptive capacity refers to "a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce dynamic organizational capability" (Zahra & George, 2002: 186). Specifically, acquisition refers to "the firm's capability to identify and acquire externally generated knowledge," while assimilation refers to "the firm's routines and processes that allow it to analyze, process, interpret, and understand the information obtained from external sources" (Zahra & George, 2002; 189). On the other hand, transformation reflects the firm's capability to integrate existing and new knowledge, and exploitation denotes the firm's ability to "harvest and incorporate knowledge into its operations" (Zahra & George, 2002; 190).

Building on these definitions, Zahra and George (2002) introduced two distinct sets of potential and realized absorptive capacity to explain why some firms are better at creating value out of their knowledge stock. Specifically, potential absorptive capacity includes the *acquisition* and *assimilation* of new knowledge and realized absorptive

capacity consists of a firm's routines and processes to *transform* and *exploit* new knowledge. So, potential absorptive capacity "provides firms strategic flexibility and the degrees of freedom to adapt and evolve in high-velocity environments" (185), while realized absorptive capacity reflects "the firm's capability to leverage the knowledge that has been absorbed." Both are critical, because potential absorptive capacity in the absence of realized absorptive capacity may not help the firm reap the benefits of new knowledge and realized absorptive capacity in the absence of potential absorptive capacity might lead the firm fall into a competence trap over time (Ahuja & Lampert, 2001). That is, potential and realized absorptive capacity are distinct yet complementary to become dynamic capability.

Boundary spanners' functions

The literature on boundary spanners largely suggests two main functions of boundary spanners: connecting (1) the external and (2) the internal environments (Tushman, 1977; Aldrich & Herker, 1978; Tushman & Scanlan, 1981). The former allows the boundary spanners to gather and channel valuable external information to the focal firm, while the latter enables them to identify what kinds of external knowledge has value for the firm and who among the internal members can best utilize it. Put differently, boundary spanners' two functions are also distinct yet complementary to fulfill the role of knowledge gatekeepers, because while external connections expose the boundary spanners to various external information, internal connections are also necessary to see the value of new external knowledge and disseminate it across relevant internal units.

However, while internal and external connections are indispensable, the connections themselves may not necessarily lead to the effective functioning of boundary

spanners for mostly two reasons. First, to successfully perform the role of boundary spanners, individuals should recognize and identify valuable external knowledge, yet this is not easy if they are biased against external knowledge. Because knowledge is mostly transferred and absorbed on the level of individuals, boundary spanners' bias could constrain their information processing. Second, to effectively transfer and disseminate newly acquired knowledge, boundary spanners require inside directory knowledge of who does what. That is, even if one has gained valuable knowledge, it may be difficult to put it to use without knowing the internal members required to integrate the new and existing knowledge. Therefore, below I introduce two essential concepts of the transactive memory system and not-invented-here bias to explain these mechanisms that affect the two functions of boundary spanners.

Transactive memory system

A transactive memory system refers to "a shared system that individuals in groups and organizations develop to collectively encode, store, and retrieve knowledge in different domains" (Argote & Ren, 2012: 1376; see also Wegner, 1987). Research suggests that a transactive memory system affects dynamic organizational capability via primarily two ways. First, a transactive memory system facilitates members' ability to identify and transfer valuable external knowledge. Specifically, a transactive memory system allows the team members to develop specialized skills and knowledge further, which in turn expand the total knowledge pool of the team (Hollingshead, 2000). When team members are well aware of each other's area of expertise, they can rely on one another for particular knowledge. Hence, a transactive memory system enables the team members to free their intellectual capacity to search and learn external knowledge in their distinct areas (Lewis

& Herndon, 2011). For instance, in an IT company, one member might be good at JAVA programming while others might have expertise in C+ and SQL. Knowing the spectrum of available knowledge in the group and who does what, the member with JAVA expertise can spend more time on tracking recent knowledge about JAVA, rather than spending energy and time on C+ or SQL. Therefore, members can bring in diverse more up-to-date knowledge without much redundancy. In doing so, a well-developed transactive memory system helps collectively assimilate valuable external information (Teece, 2007) and connect the members with those who have complementary expertise.

Second, a transactive memory system contributes to the second role of boundary spanners to connect the internal members by distributing new knowledge to the right people, and also by helping the problem-solving to accomplish team tasks through efficient and effective knowledge sharing and coordination among the members (Heavey & Simsek, 2015). A transactive memory system is more than the knowledge repository, and it provides members "a system of generating, distributing, and integrating knowledge" via "efficient encoding, distributing, and retrieving knowledge in the group" (Heavey & Simsek, 2015).

Not-invented-here bias

Not-invented-here bias refers to "a negative attitude toward external knowledge," and often leads individuals to reject externally driven knowledge even when the knowledge has value for the organization (Antons & Piller, 2015). Research on not-invented-here bias suggests that individuals tend to develop a negative attitude toward knowledge, ideas and technologies derived from the external environment of their social groups (e.g., companies), and that not-invented-here bias may occur not only consciously, but also unconsciously. Studies have also identified that organizational and country boundaries are

important determinants of whether knowledge is perceived to be external to individuals. Put differently, these studies indicate that individuals may develop not-invented-here bias when they belong to a social group (e.g., organizations, countries), and such bias may occur almost automatically hindering knowledge exchange with the external environment.

Although not-invented-here bias occurs for any individuals in social groups, research suggests two conditions where individuals are more likely to suffer from the bias. First, in organizational contexts, not-invented-here bias is more likely to arise when one's social identities are strongly related to their organizations, because strong social identities such may lead to rejections of external knowledge (Antons & Piller, 2015; Baer & Brown, 2012; Gupta & Govindarajan, 2000). Second, individuals in situations characterized by high complexity and ambiguity are more likely to have a not-invented-here bias because it simplifies information processing (Antons & Piller 2015). In such contexts, not-invented-here bias selectively filters familiar (internal) information and maintains cognitive consistency (c.f., Ajzen, 2001; Bohner & Wanke, 2002). In fact, numerous studies report incidents where new and better ideas were rejected because they were different than previously dominant familiar ideas (Nickerson, 1998; Biyalogorksy, Boulding, & Staelin, 2006).

2.3. Theoretical Approaches

Absorptive Capacity Theory

Absorptive capacity is a dynamic capability that affects the "firm's ability to create and deploy the knowledge necessary to build other organizational capabilities." The central premise of absorptive capacity is that a firm requires existing related knowledge to learn and exploit new knowledge, obtained from its environment. Put differently, merely

exposing the firm to different external knowledge is not enough to learn, and the firm's own effort to acquire and exploit external knowledge is necessary (Cohen & Levinthal, 1989; 1990). Building on the premise, scholars have examined various organizational factors that may enhance absorptive capacities such as decentralization, corporate culture, and practices (e.g., Schleimer & Pedersen, 2013; Jasen, Bosch & Volberda, 2005).

This study addresses three significant lacunae in the extensive literature on absorptive capacity. First, relatively few studies have examined the influence of individuals on absorptive capacity. A few scholars have focused on people factors and found significant roles that individuals play in improving absorptive capacity (e.g., Lenox & King, 2004; Minbaeva, Pedersen, Björkman, Fey, & Park, 2003; Tan, 2015). For instance, Lenox and King (2004) found that the number of managers in charge of pollution prevention at HQ positively affects the extent of adoption of an EMS (environmental management systems) practice at the facility. In another study, Van Den Bosch and Van Wijk (2001) theoretically asserted that managerial knowledge and capabilities are parts of absorptive capacity. Minbaeva et al. (2003), on the other hand, viewed employees' ability and motivation as parts of absorptive capacity and found such absorptive capacity positively affects knowledge transfer to the subsidiary. However, little research has systematically examined how individuals may affect absorptive capacity.

Second, only handful studies have captured the multi-dimensional aspect of absorptive capacity introduced by Zahra and George—i.e., potential and realized absorptive capacity (e.g., Jansen et al., 2005). The limited understanding of the process of acquiring and applying external knowledge is a significant gap in the literature. Specifically, we know the outcomes of the process (e.g., financial performance or innovation), but not

so much about the activities and efforts that build such process (Volberda, Foss & Lyles, 2010; Lane et al., 2006 for review). Moreover, we still know little as to whether each set of potential and realized absorptive capacity is equally easy (or difficult) to manage for firms.

Lastly, little empirical studies of absorptive capacity have examined the role top managers and directors in affecting absorptive capacity. Existing studies have focused mainly on discrete events (e.g., strategic alliances) related to functional knowledge such as R&D (e.g., Tortoriello, 2015), and we know little as to the full applicability of the absorptive capacity perspective. However, absorptive capacity may be vital for other types of knowledge such as managerial knowledge. Reflecting this gap, Volberda, Foss, and Lyles (2010: 940) call for "more research on the relative effect of (the) management skills and capability on absorptive capacity." Also, in their review papers, Helfat and Martin (2015) emphasized the critical roles of managers for strategic changes as well as performance, indicating that managers are an important source of organizational learning capability.

In sum, considering that knowledge primarily resides in individuals (Cohen & Levinthal, 1990; Felin & Hesterly, 2007; Reiche, 2011), it is crucial to unfold how individuals, particularly leaders, influence the absorptive capacity process of potential absorptive capacity and realized absorptive capacity.

Boundary Spanners Theory

In their original paper, Cohen and Levinthal (1990: 132) stated, "an organization's absorptive capacity depends on the absorptive capacity of the individuals who stand at the interface of … the firm and the external environment," emphasizing the importance of

boundary spanners for absorptive capacity. The boundary spanner perspective originates in the open systems view of firms in organization theory to clearly define interactions between organizations and the environment (Aldrich & Herker, 1977; Leifer & Delbecq, 1978; March & Simon, 1958; Thompson, 1967). Organizations should continuously gain information from their external environment to stay flexible and competitive, yet it is often very costly for them because continuous interactions with the external environment can distract them from the primary business (e.g., Wang & Bansal, 2012). One solution is to create a unique role for people who can mediate between the organization and its environment (Monteiro & Birkinshaw, 2017).

Pointing this, classic boundary spanner literature has focused on individual boundary spanners, and particularly on their functions to successfully perform the boundary spanning role (Aldrich & Herker, 1977; Tushman & Scanlan, 1981). To fulfill their purpose, boundary spanners require both internal and external connections (Tushman, 1977; Aldrich & Herker, 1978; Tushman & Scanlan, 1981). However, although both types of connections are crucial to fulfilling the role of boundary spanner, the same group or individual does not necessarily take both functions. For instance, using samples of bargaining teams, Friedman and Podolny (1992) empirically found that different individuals can assume two functions within a group, which indicates that different individuals or different units can be responsible for each function. Also, in a recent study, Monterio and Birkinshaw (2017) found that the importance of boundary spanning functions could shift over time. In a qualitative study using scouting units, the authors found that the significance of each role of channeling, translating, matchmaking, and transforming changed (U shape) along the years (from year 1 to year 3): the scouts gradually emphasized

more value-added tasks such as transforming than channeling over the three years. Taken together, the boundary spanner literature suggests that the two functions can be assumed by separate, yet complementary groups or individuals.

Overall, the boundary spanner perspective is consistent with absorptive capacity perspective in that both perspectives recognize that firms should interact with its environment to gain new knowledge and that existing knowledge is also essential to learn external knowledge. However, the absorptive capacity literature has yet to explain how individual experiences obtained internally and externally (e.g., cross organizational boundaries) could affect absorptive capacity processes. On the other hand, boundary spanner perspective categorizes individuals' experiences based on their originating sources—i.e., external and internal—and suggest that both experiences together shape expertise, which in turn affects group performance. However, the literature neglects to distinguish potentially different influences of external and internal connections on building organizational capabilities.

2.4. Boundary Spanners and Absorptive Capacity: An Extension

I build on the following studies in the boundary spanner literature: Studies that found that (1) both internal and external connections are important for boundary spanners (Tushman & Scanlan, 1981), (2) different boundary spanners could fulfill each function separately (Friedman & Podolny, 1992), and (3) the importance of each function could change as a project develops (Monterio & Birkinshaw, 2017). I further argue that internal and external knowledge of boundary spanners may affect potential and realized absorptive capacity differently. More specifically, to the degree that potential absorptive capacity relies more on continuous inflows of external knowledge than on internal knowledge, the

impact of boundary spanners' external experiences on potential absorptive capacity is stronger than that of internal experiences. On the other hand, to the degree that realized absorptive capacity needs deep internal knowledge (e.g., Zahra & George, 2002), the impact of boundary spanners' internal knowledge on realized absorptive capacity may be stronger than that of external knowledge.

To elaborate the theory, I focus on two groups of boundary spanners who possess different proportions of internal and external experiences (and hence knowledge)—namely, top management teams (TMTs) and boards of directors. TMTs and boards are important boundary spanners who sit at the intersections of the internal and external environments. However, unlike other boundary spanners such as lower level technical units within an organization, TMTs and boards may not necessarily work as a team in interacting with external entities (Finkelstein, Hambrick, & Cannella, 2009). Instead, their information searching and gathering may involve uncoordinated activities such as informal meetings and conferences, suggesting that all members' aggregate experiences may be an important indicator of the groups' knowledge.

Mainly, I examine the impacts TMTs' and boards' the aggregate external experiences in related knowledge domain on potential and realized absorptive capacity. While strategic leadership literature has provided largely two ways that leaders gain knowledge—i.e., via (1) diversity of experiences (Kilduff, Angelmar, & Mehra, 2000; Haynes & Hillman, 2010), and (2) experiences in a specific area such as functional (Bermiss & Murmann, 2015) and industrial experiences (Kor & Misangyi, 2008; Bailey & Helfat, 2003), I follow the latter approach for the purpose of this dissertation. The absorptive capacity theory posits that learning is cumulative and path-dependent for both

individuals and organizations and that both individuals and organizations learn by association (Cohen & Levinthal, 1990). More fundamentally, Cohen and Levinthal (1990: 129) suggested that accumulated prior knowledge helps not only the ability to encode new knowledge into memory but also the ability to retrieve and utilize it, because memory development is "self-reinforcing" in a way that once more knowledge is stored in memory, the knowledge is more readily available to retrieve and utilize. Put differently, the past knowledge of TMTs and boards may not only help them acquire new related knowledge better but also lead them to more efficiently and effectively use it in a new setting—i.e., the focal organization. That is, when the members' knowledge overlaps to a certain degree, the group's absorptive capacity for the related knowledge is higher. TMTs and boards can quickly recognize valuable new knowledge and learn faster when the new knowledge is related to their aggregate accumulated knowledge. Therefore, TMTs' and boards' aggregate external experiences in related knowledge domain may reflect the group's ability to gather and transfer new external knowledge in the particular domain.

Furthermore, because of the structural differences of TMTs and boards as being mostly composed of internal and external members, I also draw on the two concepts of the transactive memory system and not-invented-here bias to explain why the impacts of TMTs and boards on potential and realized absorptive capacity might differ. Specifically, while TMTs are all internal members of the focal organizations, most boards of directors, particularly in North America, are composed primarily of outside directors (Boivie, Bednar, Aguilera, & Andrus, 2016; Finkelstein, Hambrick, & Cannella, 2009). In fact, CEO is the only inside director on board in many large firms in the North America (Adams, Hermalin, & Weisbach, 2010). And these differences could lead to the differential impacts of TMTs

and boards on absorptive capacity. I chose the two concepts of the transactive memory system and not-invented-here bias for the following reasons. First, not-invented-here bias is the most widely used individual-level attitude to explain barriers to learn external knowledge (Antons & Piller, 2015). To successfully perform the roles of boundary spanners, strategic leaders need to identify and recognize valuable external knowledge, yet this is not easy if they are biased against external knowledge. Therefore, the not-invented-here bias of TMTs and boards may be particularly detrimental to potential absorptive capacity. Second, a transactive memory system—i.e., a group's directory knowledge of 'who does what'—is essential to efficiently disseminate acquired knowledge, indicating its importance for realized absorptive capacity.

Taken together, building on these logics, I present the overarching theoretical model in the following section. Particularly, I explicate how the impacts of TMTs and boards on potential and realized absorptive capacity may differ.

2.5. Theoretical Model

Different impact of TMTs and boards on potential and realized the absorptive capacity

Organizational absorptive capacity largely depends on the abilities of strategic leaders to obtain and assimilate valuable external knowledge and disseminate it across internal units (see also Lane, Koka, & Pathak, 2006). To fulfill their roles to enhance the absorptive capacity, these boundary spanners require two critical functions—i.e., being well connected both internally and externally (Tushman & Scanlan, 1981). Both boards and TMTs may have large amounts of external ties including interlocks to gain new information (c.f., Finkelstein, Hambrick, & Cannella, 2009). However, TMTs and boards have key differences related to the two functions leading to their differential impacts on

potential and realized absorptive capacity. Specifically, the degrees to which TMTs and boards are connected to the internal and external environments differ, because the two groups are structurally different as TMTs are all inner members, while boards are mostly outer members from different organizations. These differences lead the leader groups to be distinctive yet complementary in affecting the sets of potential and realized absorptive capacity.

First, while both leader groups positively affect potential absorptive capacity, the impact of boards of directors' aggregate experiences on potential absorptive capacity may be stronger than that of TMTs. Both boards and TMTs' jobs often involve extensive interactions with external stakeholders, which provide access to the external environment. However, regardless of their external connections and encounters, TMT members might be more biased against external ideas due to not-invented-here bias, which filters out external information more than internal information. Not-invented-here bias is likely to arise when the leaders' social identities are strongly tied to the focal social group (Ajzen, 2001; Bohner & Wanke, 2002). And TMTs are more likely to identify with the focal organizations than boards of directors because TMTs are directly involved in managing the daily activities of the organizations and often regarded as the faces of the organizations. Also, numerous studies suggest that executives quickly develop their habits of largely relying on limited internal sources for information in strategic decision-making (see Finkelstein, Hambrick, & Cannella, 2009). In contrary, even if boards have not-invented-here bias, such bias might not be in favor of the internal knowledge of the focal organization, but rather favor their organizations. In sum, boards' aggregate external

experiences may help facilitate acquiring and assimilating new knowledge—i.e., potential absorptive capacity—more than TMTs' aggregate experiences.

Second, although both TMTs and boards may positively influence realized absorptive capacity, the impacts of TMTs' aggregate experiences on realized absorptive capacity is stronger than those of boards. To translate knowledge of the external origin and transfer it to the right internal members, the leaders require a well-developed transactive memory system. However, the transactive memory system of the focal company may not be available for boards of directors, even if there are insiders on the boards. Researchers suggest that a TMS develops as a result of complex patterns of interactions among members sharing their unique knowledge and cognitions (Heavey & Simsek, 2015; Wegner, 1987). That is, the iterative cycles of knowledge exchanges and learning processes create an idiosyncratic "directory" system that facilitates information processing and knowledge exploitation for the group members. Moreover, prior studies suggest that hiring an individual for specific knowledge may not lead to better knowledge acquisition and unitization without "complementary skills and the necessary conditions for effective coordination are in place as well" (Heavey & Simsek, 2017; Wezel et al. 2006). Indeed, Huckman and Pisano (2006) found that surgeons performing the same operation showed significantly lower performance in different hospitals. Together, these studies support that a transactive memory system may not be readily available to boards of directors, and hence TMTs' aggregate experiences may have more influence on transforming and exploiting acquired knowledge—i.e., realized absorptive capacity—than boards' experiences.

CHAPTER 3

HYPOTHESES DEVELOPMENT

3.1. Research Setting

Given my research setting, I focus on the strategic leaders' prior experiences related to pro-environmental, or sustainable, management. This focus fits my theoretical goals well for two reasons. First, much of the pro-environmental knowledge exists external to organizations. Hence, it requires both TMTs' and boards' role as boundary spanners to acquire, assimilate, transform, and exploit environmental knowledge. Second, because pro-environmental managerial knowledge is still relatively new as well as complex to most firms, the strategic leaders' prolonged commitment and experiences are essential to enhance the organizational and realized absorptive capacity for such knowledge.

Below I first develop the baseline hypotheses of the impacts of leader groups' external experiences at environmentally capable companies, and in countries with stringent environmental laws on potential and realized absorptive capacity. Next, I develop the hypotheses for the differential impacts of TMT and board on potential and realized absorptive capacity.

3.2. Hypotheses Development

3.2.1. The impact of TMT and Board external experience at environmentally capable organizations on potential absorptive capacity

Boards and TMT's aggregate external experiences at organizations with high environmental capabilities may allow them to identify and transfer new environmentally related knowledge expanding the focal firm's knowledge pools for sustainable practices and policies. For instance, TMTs and boards with greater aggregate experiences at

organizations with high environmental capabilities may be well aware of the other firm's best practices. The members may bring together various information, and translate it to shared language, values, and knowledge via interactions, and eventually facilitate replenishing pro-environmental knowledge stocks. Also, TMTs' and boards' experiences at external organizations well known for sustainability provide valuable social ties to the focal company, through which they can continuously gain new pro-environmental knowledge.

Taken together, TMTs and boards with more experiences at organizations with high environmental management capability are more likely to gain new environmental information and disseminate it across various functional units within the organization to build organizational capabilities to acquire and assimilate such knowledge.

H1a: The aggregate experience of a firm's TMT members at companies with high environmental capabilities positively affects the firm's potential absorptive capacity.

H1b: The aggregate experience of a firm's board members at companies with high environmental capabilities positively affects the firm's potential absorptive capacity.

3.2.2 The impact of TMT and Board external experience at environmentally capable organizations on realized absorptive capacity

Boards and TMTs with greater aggregate environmentally-related experience in other organizations can better translate and synthesize new knowledge for internal members, enhancing the focal organization's processes to transform and exploit new environmental knowledge. More fundamentally, Cohen and Levinthal (1990: 129) suggested that

accumulated knowledge helps not only the ability to encode new knowledge into memory but also the ability to retrieve and utilize it. It is because memory development is "self-reinforcing" in a way that once knowledge is stored in memory, it is more readily available to retrieve and utilize. Put differently, aggregate environmental knowledge of TMTs and boards may not only help them acquire new related knowledge better but also lead them to more efficiently and effectively use it in a new setting—i.e., the focal organization.

In fact, successfully applying an externally-sourced practice to the focal organization requires a thorough understanding of both explicit and tacit knowledge (Athanassiou & Nigh, 2000). Prior experiences at the source companies allow the leaders to learn tacit knowledge enabling the leaders to implement new environmental practices better. Moreover, once a leader group has recognized the value of new environmental knowledge, the leader group may promote less polluting operational processes to exploit relevant opportunities (e.g., helping organizational members to pursue environmentally friendly products/services, which will facilitate installing methods that combine new and existing knowledge).

Although an alternative argument could be made that top executives and directors might not successfully transfer external knowledge to the focal company due to differences between the focal firm and the other organization, still TMTs and boards with more external experiences are more able to integrate diverse internal and external environmental knowledge for the following reasons. Literature suggests that when tasks are complicated (e.g., environmental management), the successful outcome depends on the similarity between the former and current jobs. Put differently, TMTs and boards whose members have experiences of great sustainable routines, systems, and practices are still more likely

to provide tacit knowledge to solve problems in transforming and exploiting new environmental knowledge relative to those with fewer members (or none of them) have such experiences.

H2a: The aggregate experiences of a firm's TMT members at companies with high environmental capabilities positively affect the firm's realized absorptive capacity.

H2b: The aggregate experiences of a firm's board members at companies with high environmental capabilities positively affect the firm's realized absorptive capacity.

3.2.3 The impact of TMT and Board external experience in countries with the stringent environmental law on potential absorptive capacity

Moving onto the country-level experiences, TMT and board members often gain relevant external experience through working in companies that are headquartered in environmentally stringent countries. Country-level strict environmental regulations and laws not only pressure firms to abide by higher standards but also generate tacitly understood rules and customs for appropriate actions in the society (Camerer & Vepsalainen, 1988; Volberda, 1999). Hence, firms surrounded by environmentally conscious stakeholders may endeavor to improve their sustainable practices. Empirical studies also provide supporting evidence. Firms produced more extensive and complete corporate social performance reports when monitored by the government authorities (Marquis & Qian, 2013). Moreover, firms headquartered in countries with more number of environmental NGO disclosed their environmental practices to a higher degree (Marquis, Toffel, & Zhou, 2013). Even if firms in those countries do not make extra sustainable

efforts, strategic leaders' encounters with more environmentally conscious stakeholders may affect them in a way to pay more attention to pro-environmental management. So, TMT and board aggregate experiences in companies headquartered in pro-environmentally demanding countries may bring in human capital (e.g., first-hand experience), social capitals (e.g., diverse networks with foreign individuals) as well as cognitive capital (e.g., paying more attention to sustainability), enhancing the inflows of sustainability-related information. Indeed, leaders with prior experiences in a foreign country where a certain management practice originated and was popularized adopted the management practice (Shin, Seidle, & Okhmatovskiy, 2016). Therefore, the aggregate experiences of TMTs and boards in companies incorporated in countries with stringent environmental laws may bring in diverse environmental management knowledge to the focal firms positively affecting potential absorptive capacity. Thus,

> H3a: The aggregate experiences of a firm's TMT members in countries known for strict environmental regulations positively affect the firm's potential absorptive capacity
>
> H3b: The aggregate experiences of a firm's board members in countries known for strict environmental regulations positively affect the firm's potential absorptive capacity.

3.2.4. The impact of TMT and Board external experience in countries with the stringent environmental law on realized absorptive capacity

TMTs and boards with more experiences in environmentally demanding countries may be better at implementing popular managerial practices and systems in the focal firms. One central challenge in a practice adoption is accessing to relevant information required to

implement it (Shropshire, 2010; Shin, Seidle, & Okhmatovskiy, 2016). Applying an externally-sourced environmental practice requires a thorough understanding of both explicit and tacit knowledge (Athanassiou & Nigh, 2000). The uncertainty related to the effectiveness of a new practice or system hinders integrating the new knowledge with existing knowledge. And the uncertainty is higher when new practices are from other institutions due to differences in not only between the organizations but also between the countries. Put differently, the effectiveness of boundary spanners' role in making actual changes in the focal company is contingent on the degree that relevant information is available to the boundary spanners. Hence, TMTs and boards with greater aggregate first-hand experiences in the source companies help reduce the uncertainty, positively affecting the focal firm's ability to integrate and execute new environmental knowledge. Thus,

H4a: The aggregate experiences of a firm's TMT members in countries known for strict environmental regulations positively affect the firm's realized absorptive capacity.

H4b: The aggregate experiences of a firm's board members in countries known for strict environmental regulations positively affects the firm's realized absorptive capacity.

3.2.5. The differential impact of TMT and Board external experience on potential and realized absorptive capacity

The aggregate pro-environmental experience of boards may have a stronger influence on potential absorptive capacity than those of TMTs. First, boards with greater aggregate experiences with superior environmentally capabilities as well as the higher density of ecologically conscious stakeholders may bring in diverse environmental knowledge

enhancing the focal firms' capabilities to acquire and assimilate pro-environmental knowledge. However, hindered by not-invented-here bias, TMTs' such experience may not effectively introduce valuable sustainable practices to the focal firms. Hence, the impacts of boards' aggregate pro-environmental experiences on potential absorptive capacity is greater than those of TMTs'.

On the other hand, the aggregate pro-environmental experiences of TMTs may have a stronger impact on realized absorptive capacity than those of boards. TMTs with new environmental knowledge such as modified regulatory act, new environmental management systems, and new recycling materials could facilitate installing pro-environmental policies, as well as information provision across diverse units using the transactive memory system of the focal organization. However, boards of directors have neither enough inside directory knowledge nor managerial knowledge to synthesize and execute environmental knowledge at the focal firm. In fact, a related study finds that losing a COO to a rival company was more detrimental than the loss of other (non-operational) executives (Bermiss & Murmann, 2015), indicating inside operational knowledge is crucial to knowledge exploitation. Therefore, I develop the following hypotheses on the complementary yet different impact of boards' and TMTs' aggregate pro-environmental experiences on potential and realized absorptive capacity.

> H5a: The aggregate experiences of a firm's board members at organizations with high environmental capabilities have a greater impact on the firm's potential absorptive capacity compared to those of the TMT members.

H5b: The aggregate experiences of a firm's TMT members at organizations with high environmental capabilities have a greater impact on the firm's realized absorptive capacity compared to those of the board members with such knowledge.

H5c: The aggregate experiences of a firm's board in environmentally demanding countries have a greater impact on the firm's potential absorptive capacity compared to those of the TMT members.

H5d: The aggregate experiences of a firm's TMT members in environmentally demanding countries have a greater impact on the firm's realized absorptive capacity compared to those of the board members.

CHAPTER 4

RESEARCH SETTING AND DESIGN

4.1. Data

I examine the above relationships in the context of climate change. To study this, I generated a unique data set covering S&P 500 US firms from 2008 to 2015, which combines data on relevant experiences and ties of TMTs and boards with data on firms' environmental activities and performance from the Carbon Disclosure Project (CDP). The CDP is a UK-based non-profit organization that has collected carbon emissions data of all Financial Times Global 500 firms (and also of firms in the S&P 500 index since 2006) since 2002. Starting from 2008, CDP expanded the questionnaire, and included various issues such as 'the potential risks and opportunities,' 'the firm's climate change strategy,' 'the firm's greenhouse gas emissions' and 'environmental governance and HR practices.' The questionnaire consists mostly of open-ended items where respondents provide a detailed explanation of each question (or numeric data when the specific number is requested).

I generated the sample by matching data from the Carbon Disclosure Project (CDP) with several other data sources. I focus exclusively on U.S. companies from 2008 to 2015. The total number of S&P 500 listed firms by market cap between 2008 and 2015 was 707, and among them, 444 responded to the CDP (total 2,380 firm-year observations). Additionally, the CDP sent out surveys to the Global (FT) 500 firms listed in the US, and 108 firms (284 firm-year observations) responded during 2008-2015. The final sample consisted of 354 firms and 1,489 firm-year observations. Because the empirical tests are conducted with the firms that responded to CDP surveys, I examined whether there was

any difference between firms that responded and firms using two sample t-test (e.g., firm size; Hoetker & Agarwal, 2007), and the results showed that there was no significant difference between them.

4.2. Measurement

Dependent variables.

I followed the original definitions of Zahra and George (2002), and also adopted the descriptions of the multi-dimensions discussed by Jansen et al. (2005). The potential and realized absorptive capacity were measured using CDP data.

Potential absorptive capacity. Potential absorptive capacity includes acquisition and assimilation of new external knowledge. I used the sum of the following two dimensions to measure potential absorptive capacity.

Acquisition. The acquisition is the count of how many out of seven relevant programs and policies the firm engages. Hence, the variable ranges from 0-7. I first created three items that capture firms' plans and policies that reflect the firms' ability to acquire external information and aggregated the three items to measure acquisition. Specifically, the acquisition should reflect firms' "efforts expended" to obtain external knowledge (Lane, Salk, & Lyles, 2001; Jansen, Van den Bosch, & Volberda, 2005). Having concrete plans is an important indicator that the firm may make an effort to learn because firms with (concrete) plans or targets are more likely to search for and be attuned to external information than those without such plans. To reflect such efforts, I used three items asking whether a firm (1) has greenhouse gas reduction plans in place (concrete plans but have not been initiated or completed), (2) has had external (third party) organizations verify their own direct and/or indirect emissions reporting and (3) has (regular) interactions with

external parties including climate change policy makers, research institutes, trade associations and others (any other external organizations not included in the three major organizations are listed and counted as 1). The item is coded '1' if the firm answered 'yes' and provided detailed information on the plans, and '0' if they responded, "No. We do not have a plan".

Second, I created four binary items related to firm's regular interactions with the external organizations, particularly policymakers, trade associations, research institutes, and external auditors/verifiers (and any others). Even if firms' interactions are to sway the external parties to ease emissions' regulations or rules in their favor, still such interactions would allow the firms to learn more from the external environment compared to firms without such interactions. Also, firms that have their emissions reporting verified and audited by external auditors are more likely to learn from the external environment, because external auditors and verifiers not only monitor the reported practices and performance of firms, but also they share common and recommended industrial practices as well as policies for emissions performance with the firms. The item is coded '1' if firms answered 'yes,' and '0' if they responded, "No. We do not use external verification" or "No. We do not interact with the organization".

Assimilation. Assimilation is the count variable of how many of the total three policies and practices the firm engages. Similar to the acquisition, I created three dummy variables and aggregated them to measure assimilation. Assimilation refers to "the extent to which (the firm) was able to analyze and understand new knowledge (from the external environment)" and has often been measured with firms' understanding of changes in the

environment and recognizing new opportunities in the markets (e.g., Lane, Salk, & Lyles, 2001; Jansen et al., 2005).

Therefore, I measured assimilation using items asking whether the firm (1) has identified any financial opportunities (e.g., revenues) related to climate change, (2) has identified any physical opportunities (e.g., changes in business operations) related to climate change, and (3) has identified any other general opportunities related to climate change. I chose these items because unless firms understand changes in the external environment and see the relevance of the changes to them, they may not be able to view such changes as either financial, physical or general opportunities. Each item is coded 1 if the firm answered "Yes" and provided written explanation/information on the identified opportunities, and 0 if they responded, "No. We have not identified any opportunities".

***Realized absorptive capacity*.** Realized absorptive capacity consists of transformation and exploitation of new knowledge. I first calculated each dimension, and then used the sum of the two dimensions.

Transformation. Transformation is the count of the total 25 practices and processes the firm engages. Transformation refers to the degree to which firms could adjust the routines and practices to facilitate the use of both existing and new knowledge (Zahra & George, 2002). Prior scholars measured it as whether a firm can recognize consequences of externally acquired knowledge (e.g., Jansen, Van den Bosch, & Volberda, 2005). Following the studies, I measured transformation by whether the firm identify, measure and predict separate indirect emissions along their value chain and supply chain activities: (1) employee business travels-e.g., total 5 dummy items measuring different types of employee travels, (2) external distributions and logistics, e.g., total 5 dummy items of

specific processes along it (3) use and disposal of their products and services-e.g., total 7 different items, and (4) supply chain-e.g., total 8 dummy items. The items indicate that firms can apply externally obtained knowledge (e.g., measuring emissions amount), and apply it to capture emissions that happened externally to the firms. Also, these items reflect the firms' ability to see the consequences of external knowledge as the firms can make adjustments by learning the emissions created along the life cycle of their products as well as more broad and comprehensive production processes. Each item is coded '1' if the firm provided detailed information on their process, practices or policies and '0' otherwise.

Exploitation. Exploitation is the count of total three processes that the firm engages. We created three dummy variables and then added them. Exploitation refers to whether the firm can use knowledge to achieve outcomes (Zahra & George, 2002). Because the final goal of learning from the external environment in the climate change context is to reduce actual emissions amount, I measured it using the following items: reductions in the amounts of (1) the direct emissions, (2) the indirect emissions, and (3) electricity consumption. For each item, I divided each year's amount by the year's revenue and subtracted the ratio of the previous year from that of the focal year. When the final value is 0 or positive, I coded it as 0, and if the number is negative, I coded it as 1 (reduction).

Independent variables

TMTs and boards cross-boundary experience. I measured mainly two cross-boundary experiences of the TMTs and boards: the aggregate work experiences (1) at different organizations that have high environmental capabilities/performance and (2) in foreign countries that have strict environmental laws for companies. Using both Boardex and ExecuComp data, I created a list of members of TMTs and boards at firms responded

to CDP in each year during 2008 to 2015. I then tracked other organizations that each executive and director has served since 2000 using Boardex Individual Employment Profile data. The year 2000 was selected because previous scholars suggest that the environmental commitment of companies have significantly increased since the year 2000 (e.g., Flammer, 2013).

First, for the leader groups' experience in companies with high environmental capabilities, I use two different data: Kinder, Lydenberg, Domini (KLD) environmental strength data and Dow Jones Sustainability Index (DJSI) North America. I used KLD data to capture the leader groups' experience in other companies that had better capabilities than the focal company. Also, I used Dow Jones Sustainability Index North America to capture the leader groups' experiences in other companies with high environmental capabilities. Only the Indices from 2005 to 2014 were available, so I could not track the leaders' experience between 2000 and 2004. However, studies suggest that the past three years might be good enough to measure one's accumulated knowledge (Geletkanycz & Hambrick, 1997; Hambrick & Fukutomi, 1999).

Second, to measure the leader groups' experience in other countries with stringent environmental laws, I used the Institute of Management Development (IMD)'s environmental law scores for countries. IMD evaluated the strength of environmental laws for top 47-61 industrialized countries as early as 1989, and these scores provide the level that each country's environmental laws hinder the competitiveness of business. Below, I start with the organizational experience of boards and TMTs and then move on to the country-level experience.

Aggregate experience of a TMT and board at other companies with better environmental capabilities than the focal company. Using KLD environmental strengths, I created two variables to measure the board's and TMT's externally obtained experience, respectively. KLD is the most widely used database for environmental and social ratings of publicly traded companies (Waddock, 2003). KLD environmental strengths provide objective (comparable) dummy items related to environmental practices including recycling, eco-friendly products, and materials. Following previous scholars, I adopted the 7 items of environmental strength dimension of KLD and added all items to measure the total score of each firm. Then, I calculated the differences in the KLD scores between the focal CDP-listed company and other companies that directors/executives of the focal company have served. It was coded 1 if the other firm that a leader was serving had a higher environmental score than or equal to the score of the focal CDP-listed firm in the given year, and 0 otherwise. I counted each leader's such experiences (e.g., if a director/executive was serving three companies that had higher ratings than the focal CDP company in the year 2000, then it was coded as three), then accumulated it over the year (e.g., if the next year the director was serving the same three company that again rated higher than the focal CDP company, then it was six in the year 2001). That is, I created a leader-level variable by counting when the other firm's KLD rating is higher than or equal to the focal CDP firm's KLD rating' during the 2000 and 2015 and aggregated them over the years. Finally, I created TMT and board-level variables by adding the group members' total number of such experiences up to each year.

Aggregate experience of a TMT and board at other companies with high environmental capabilities. I followed the same procedure to create variables using S&P

Dow Jones Sustainability Index for North America (DJSI), which consists of 'the top 10% of companies with the highest sustainability rating within their respective industries' (among the 3,000+ of the world largest public companies) (RobecoSAM). Specifically, DJSI includes companies which "lead their industries and set industry-wide best practices," and base the best practices on pro-environmental policy, performance and reporting (Fowler & Hope, 2007). I matched both CDP-listed and other companies with the list of the DJSI using the company names (or ISIN when provided) during the year 2005 to 2015 and coded 1 if a company is listed in the indices, and 0 otherwise. Then, I followed the same process as KLD in coding.

TMTs and boards' aggregate experience in other countries with stringent environmental laws. I followed similar steps as above to measure TMTs and boards' cross-country experiences. To capture country-level environmental laws, I used 'environmental laws' scores of countries from IMD World Competitiveness Year-book (Institute of Management Development, 2000-2015). The environmental law ratings measure whether the environmental laws hinder the competitiveness of businesses in each country among 47-61 industrialized countries around the world, and the rating ranges from 0 (does not hinder) to 10 (hinders the most). I first created a dummy variable which had a value of 0 if the country had bottom 75 % scores, and 1 if the score is top 25% (Pfarrer, Pollock, & Rindova, 2010; Rao, 1994). Then, I followed the identical procedure as above to generate a TMT and board's total number of cumulative experiences in the top 25% environmentally demanding countries.

Control Variables

To isolate the effects of TMTs and boards' cross-boundary experiences on potential and realized absorptive capacity, I controlled for a number of factors. First, I controlled for governance-related factors. Because strong CEO power is likely to reduce the influences of a board of directors as well as other members of a TMT on the absorptive capacity (Henderson, Miller, & Hambrick, 2006), I controlled for CEO power using two measures: CEO tenure and CEO duality. CEO tenure is measured as the total number of years the incumbent CEO had been in the CEO position within a company (Henderson et al., 2006; Wu, Levitas, & Priem, 2005). The CEO duality is coded as 1 when a CEO also serves as the board chairman and 0 otherwise. Boards' and TMT's network sizes refer to the number of ties that a leader group has and are measured with the total sum of the number of networks that each leader of the respective group has.The number of directors refers to the size of the board and is measured with the total number of directors on board. TMT's functional heterogeneity was measured by following Blau's heterogeneity index (Bermiss & Murmann, 2015), and I used total 16 functional categories following Hambrick, Cho, and Chen (1996). I also controlled for the average tenure of TMT and board.

Second, I controlled for the effects of firm characteristics. Two of the most widely adopted antecedents of a firm's capabilities are the firm size and financial performance. For these, I included market capitalization, total assets, and the number of employees as controls. Since these variables are skewed, I used the log of them (Denis, Denis, & Sarin, 1997). Following previous studies, market capitalization is measured as the market value of outstanding common stock shares (Chung & Pruitt, 1994). I also controlled for leverage. Leverage represented the amount of debt used to finance a firm's assets and operations and

was measured as the ratio of the firm's total liabilities to its total assets (Schlingemann, Stulz, & Walkling, 2002).

4.3. Estimation

Since the data includes repeated observations for each firm, it violates the OLS assumption of independence. Also, the firms in the sample could systematically differ in unobservable ways. I first conducted the Breusch-Pagan Lagrange multiplier test to check the presence of unobserved firm effects. When the null hypothesis that the variance of unobserved firm effects is zero is rejected, then it is suggested that panel data method is more appropriate than the pooled OLS (Breusch & Pagan, 1980). The test results showed that unobserved firm effects existed, indicating that panel models are appropriate (Chi, Breusch-Pagan = 870.05, $p < 0.001$ for potential absorptive capacity; Chi, Breusch-Pagan = 523.01, $p < 0.001$ for realized absorptive capacity). The Hausman tests indicated that fixed-effect regression is more appropriate than random effect regression (Chi-square = 63.97, $p < 0.001$ for potential absorptive capacity; Chi-square = 43.28, $p < 0.001$ for realized absorptive capacity). Additionally, Wooldridge tests for autocorrelation in panel data showed that AR(1) test statistics are significant, indicating that the data may have serial correlations (F-value = 195.48, $p < 0.001$ for potential absorptive capacity; F-value = 3.00, $p < 0.10$ for realized absorptive capacity). So, I used fixed effects with clustered errors to account for serial correlation and heteroscedasticity [1] (White, 1980; Rogers, 1994). I tested the hypotheses on the differential impacts of TMTs and boards (H5a – H5d) using an F-test.

[1] The results of the fixed effect model also indicated that 83% of variance for potential absorptive capacity and 78% of variance for realized absorptive capacity were due to differences across panels (within firms).

CHAPTER 5

RESULTS

Table 1 reports descriptive statistics. Table 2 reports the findings with boards' and TMTs' accumulated prior experiences in organizations (1) with higher pro-environmental capabilities than the focal firm and (2) with the best sustainable practices among top 50% largest market capitalization using fixed effects estimation. Despite some high correlations between some of the variables, the variance inflation factor (VIF) indicated that there was no serious concern for multicollinearity (VIF < 10) (Neter, Wasserman, & Kunter, 1990). Models 1 to 4 have the potential absorptive capacity as the dependent variable and Models 5 to 8 have realized absorptive capacity as the dependent variable. Starting with the potential absorptive capacity as the dependent variable, Model 1 includes only the controls, and the result shows that the total number of TMT's networks ($p < 0.10$), the female ratio on the board ($p < 0.01$), total asset ($p < 0.001$), market capitalization ($p<0.05$), and leverage ($p < 0.01$) had positive and significant influences on potential absorptive capacity, while TMT's functional diversity ($p < 0.001$) had negative impacts on potential absorptive capacity.

Insert Tables 1 and 2 here

Model 2 has controls and boards' and TMTs' aggregate experiences at companies that had higher environmental capabilities (KLD). The results find that only boards experiences had significant and positive influences on potential absorptive capacity supporting H1b ($b = 0.190$, $p = 0.018$), but not H1a. Model 3 has controls and boards and TMTs' collective accumulated experiences in large companies with best sustainable

practices in North America (DJSI), and neither board nor TMT experience was significant. Model 4 includes the full set of variables and reports similar results for the control variables for potential absorptive capacity. The independent variables had the same patterns of relationships with potential absorptive capacity. Specifically, only boards' experiences measured with KLD had a positive influence (b = 0.190, p = 0.020). The results suggest that within a firm, when the boards had more aggregate experiences in other companies that had better pro-environmental practices such as recycling, clean energy, and other management systems than the focal company, such board's experiences positively enhanced potential absorptive capacity of the focal company. Hence, I found support for H1b, but not for H1a.

Now, turning to the models with realized absorptive capacity as the dependent variable, Model 5 presents the impacts of controls on realized absorptive capacity. Female director ratio on the board ($p < 0.01$), total assets ($p < 0.10$), and market capitalization ($p < 0.001$) had positive impacts on realized absorptive capacity, while employee size ($p < 0.05$) had a significant and negative influence on realized absorptive capacity. Models 6 and 7 similarly report that only TMTs' experience had a significant and positive influence on realized absorptive capacity supporting only H2a (b= 0.064, p =0.04 for TMTs' experience measured with KLD; b= 0.078, p =0.04 for TMTs' experience measured with DJSI).

Model 8 presents the full coefficients for the realized absorptive capacity. The results for the control variables had the same patterns of relationships with realized absorptive capacity as in Model 5. Regarding the influences of the two leader groups' experiences, only TMT experience at organizations with higher KLD ratings and at companies listed in DJSI had positive impact on realized absorptive capacity (b = 0.064, p

= 0.04 for KLD measure; b = 0.079, p = 0.04 for DJSI), while boards' experience did not affect realized absorptive capacity. Therefore, only H2a, not H2b, is supported.

Next, I conducted F-tests to examine the differential impacts of TMTs' and boards' experiences on potential absorptive capacity and realized absorptive capacity using Models 4 and 8, respectively. Starting with model 4 with potential absorptive capacity as the dependent variable, the results showed that effects of boards' aggregate experience in organizations with better environmental capabilities were significantly more important for potential absorptive capacity than TMTs' such experience using KLD measure (F-value = 6.31; p = 0.013). On the contrary, Model 8 showed that the impact of the TMT's aggregate experience in organizations with the best practices in the sector (DJSI) on realized absorptive capacity was significantly more positive than that of board's aggregate experience (F-value = 5.14; p = 0.024), but I did not find significant difference between the impacts of TMT and board using KLD measures. Therefore, I found support for H5a in that the board members' aggregate experience at organizations with high KLD environmental strengths had more influence on potential absorptive capacity than the TMT members' such experience. Also, the impacts of TMT's experience at DJSI listed companies had a significantly higher impact on realized absorptive capacity than those of the board, supporting H5b.

Insert Table 3 here

Lastly, Table 3 reports the results with the two groups' accumulated prior experience in companies incorporated in other countries with top 25% strict environmental laws. Since the models with control variables are the same as above, I report only full models with

international experiences. Model 9 shows that only boards' such experience had a positive influence on potential absorptive capacity (b= 0.038, $p < 0.001$), supporting H3b. Similarly, Model 10 reports that only boards' international experience affected realized absorptive capacity positively and significantly (b = 0.093; $p < 0.001$), supporting H3d, but not H3c. I next tested differential effects of experiences of a TMT and a board on potential and realized absorptive capacity using F-test. (F-value = 4.71, p = 0.031 for potential absorptive capacity; F-value = 7.23, p =0.008 for realized absorptive capacity). Hence, I found support for H5c, but not for H5d.

5.1 Robustness Tests

Although I picked the year of 2000 as the starting point based on previous research (e.g., Flammer, 2013), I further test whether the year split was arbitrary. Researchers suggest that recent three years would be a good cut-off point to measure individuals' accumulated experience and knowledge (Geletkanycz & Hambrick1997; Hambrick & Fukutomi, 1999), and hence I choose the year 2005 to track more recent experience of TMTs and boards and compare the results using KLD, DJSI, and IMD.

Insert Tables 4 and 5 here

Table 4 reports the impact of TMT and board accumulated experience at other companies with high environmental capabilities since 2005 on potential and realized absorptive capacity. Model 11 presents the full coefficients for the potential absorptive capacity, and again I found similar findings as above. Only board's experience was significantly related to potential absorptive capacity using both KLD and DSJI (b = 0.184, p = 0.027 for KLD; b = 0.166, p = 0.030 for DJSI). Hence, again I found support for only H1b. Also, board's

experience was significantly more relevant to potential capacity using DJSI (F-value = 4.92, p = 0.027), supporting H5b. However, Model 12 shows that neither board nor TMT had a significant influence on realized absorptive capacity.

Table 5 reports the impact of TMT and board accumulated experience in other countries with top 25% stringent environmental laws. Both Models 13 and 14 show similar findings as before. Board experience had a significant and positive impact on both potential and realized absorptive capacity (b= 0.230, $p < 0.05$ for potential; b= 0.157, $p < 0.10$ for realized). TMT's experience was only significantly related to potential absorptive capacity (b= 0.064, $p < 0.05$). Finally, the Wald F-test indicated that board's impact on potential absorptive capacity was significantly different from TMT's impact, supporting H5c (F-value = 3.48, p = 0.06). However, there was no significant difference for the impact of board and TMT on realized absorptive capacity (F-value = 1.58, p = 0.210).

CHAPTER 6

DISCUSSION

6.1. Summary and Discussion

The study examines the roles of TMTs and boards as boundary spanners in influencing their organization's potential and realized absorptive capacity. Overall, the findings provide support for the positive and complementary roles of boards and TMTs in providing the knowledge for organizations. Table 6 reports the summary of results and suggests that while both boards and TMTs are essential boundary spanners, TMTs' roles may be more relevant to realized absorptive capacity while boards' roles may be more associated with potential absorptive capacity. For instance, TMT's prior experiences in organizations with high pro-environmental operational capabilities including supply chain management, recycling, and products had significantly greater impacts on realized absorptive capacity than boards' experiences in such organizations. In contrast, boards' experiences in the companies with high ratings for their environmental management processes had significantly stronger influences on potential absorptive capacity than the TMT's aggregate experience. Additionally, the board's role was important for both potential absorptive capacity and realized absorptive capacity when it comes to learning environmental knowledge with foreign country origins.

The findings related to the baseline hypotheses provide worth noting. The results seem to indicate that the TMT with experience in other companies known for their focuses on 'long-term shareholder value' (DJSI) are more likely to encourage the focal company to improve the environmental knowledge pool, while the board with experience of pro-environmental operations in other companies (e.g., KLD environmental strength

dimensions) may transfer external knowledge, expanding the organizational knowledge pool as well as enhancing exploitation of new knowledge. The findings in the study are consistent with the theories of boundary spanners, which states that both external and internal ties are crucial for boundary spanners to enhance absorptive capacity.

Moreover, findings related to the complementary roles of boards and TMTs in affecting absorptive capacity are also generally congruent with the theories of boundary spanners, transactive memory systems, and not-invented-here bias. Mainly, the ability of TMTs and boards to function as boundary spanners for the organizations differ systematically because of differences in the structure of each group, and also of the resulting differences in the amount of transactive memory system and not-invented-here bias. Accordingly, TMTs seem to be more able to affect realized absorptive capacity, while boards may be able to enhance potential absorptive capacity.

The study extends existing research on absorptive capacity, boundary spanners, and strategic leadership. While an essential stream of research has explored some factors leading to absorptive capacity, they mostly focused on either unit-level or organizational systems and rarely focused on people as a source. By showing the important roles of strategic leaders, the study broadens our understanding of the critical predictors of absorptive capacity. Specifically, the research suggests that successfully incorporating new strategic knowledge requires the presence of qualified gatekeepers in both the board and TMT.

Furthermore, I add to the conceptual and limited empirical literature on the role of TMTs and boards as a source of absorptive capacity in the context of environmental capability. While a substantial body of research on strategic leadership has examined the

role of leaders in influencing diverse outcomes such as strategic directions and financial performance, these studies were mostly in the contexts of functional knowledge. Also, there is very little systematic research on the role of leaders in the pro-environmental learning context. By empirically demonstrating how strategic leaders' past and current pro-environmental encounters and experience can affect organizational capabilities, this study fills a gap in the strategic leadership literature.

6.2. Limitations and Future Studies

There are several limitations in the study. First, I focused on environmental capacities of public companies in North America that responded to CDP during the study period of 2008-2015. Because the most popular governance structure may be different across countries (e.g., boards of directors could be composed almost entirely of internal members), the findings may not generalize to firms in other countries.

Second, the results of the analysis are limited by the specificity of CDP data. I focused on strategic leaders' experience related to overall environmental management, yet the outcome of environmental absorptive capacity measures only a facet of environmental management, particularly greenhouse gas emissions. Although greenhouse gas emissions is a pressing environmental concern for public companies around the world, firms could be more engaged in other types of environmental management such as recycling or searching for alternative energy. Future studies could extend the work by examining more diverse efforts of firms to be sustainable.

Third, the study focused on the aggregate experiences of TMTs and boards. However, even though the aggregate experience of a leader group may better reflect the organizational ability to channel and distribute new information, some members'

experiences could matter more than the others' experiences. For instance, CEOs are the decision makers who sit in both TMTs and boards, connecting both groups. Hence, the CEO's experiences could have higher impacts on organizational capabilities.

Lastly, while the focus of the study was on the relative impacts of TMTs and boards' experiences on potential and realized absorptive capacity, the two sets of absorptive capacity are sequential processes. Hence examining the moderating impacts of boards and TMTs for the relationship of potential and realized absorptive capacity would provide valuable insight as to the role of leader groups in the process of transferring new knowledge to exploiting it.

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TABLE 1. DESCRIPTIVE STATISTICS

		Observation	Mean	Standard deviation
1	Potential absorptive capacity	2,414	5.389	4.474
2	Realized absorptive capacity	2,414	5.755	4.006
3	Total asset	2,267	70027.930	233736.500
4	Market capitalization	2,254	32105.650	51904.440
5	Employee size	2,258	57.399	133.813
6	Leverage	2,262	3.721	30.994
7	Duality	2,142	0.065	0.247
8	Board network	2,142	44819.550	38716.840
9	TMT network	1,562	4982.279	6424.079
10	CEO tenure	2,137	6.859	5.738
11	Functional diversity	2,187	0.294	0.745
12	Female director ratio	2,142	0.378	0.291
13	Number of directors	2,142	11.080	2.027
14	Independent director ratio	2,142	1.446	0.902
15	Board average tenure	2,142	25.374	19.958
16	TMT average tenure	2,187	7.985	3.624
17	Board experience (KLD)	2,142	5.757	5.477
18	TMT experience (KLD)	1,854	6.207	5.410
19	Board experience (DJSI)	2,142	7.461	8.919
20	TMT experience (DJSI)	2,187	0.094	0.510
21	Board experience (IMD)	2,142	0.097	1.246
22	TMT experience (IMD)	2,187	3.544	7.487

TABLE 1. DESCRIPTIVE STATISTICS (CONTINUED)

		1	2	3	4	5	6	7	8	9	10	11
1	Potential absorptive capacity											
2	Realized absorptive capacity	0.36***										
		(0.00)										
3	Total asset	0.10***	0.09***									
		(0.00)	(0.00)									
4	Market capitalization	0.20***	0.17***	0.42***								
		(0.00)	(0.00)	(0.00)								
5	Employee size	0.14***	0.07***	0.21***	0.41***							
		(0.00)	(0.00)	(0.00)	(0.00)							
6	Leverage	0.0100	-0.0100	0.0300	0	0.0200						
		(0.78)	(0.73)	(0.12)	(0.88)	(0.44)						
7	Duality	0	-0.0200	0.04*	0.04*	0	-0.0300					
		(0.98)	(0.35)	(0.05)	(0.06)	(0.83)	(0.24)					
8	Board network	0.17***	0.13***	0.31***	0.50***	0.20***	0	0.0100				
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.99)	(0.72)				
9	TMT network	0.17***	0.12***	0.21***	0.37***	0.10***	-0.0300	0.0100	0.63***			
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.29)	(0.69)	(0.00)			
10	CEO tenure	-0.04**	-0.0300	-0.04**	-0.0300	-0.04*	0.0200	0.06***	-0.05**	-0.06**		
		(0.04)	(0.11)	(0.04)	(0.23)	(0.10)	(0.30)	(0.01)	(0.04)	(0.01)		
11	Functional diversity	-0.12***	-0.04*	-0.10***	-0.07***	-0.12***	-0.0100	-0.0100	-0.04**	0	0.10***	
		(0.00)	(0.06)	(0.00)	(0.00)	(0.00)	(0.67)	(0.67)	(0.05)	(0.96)	(0.00)	
12	Female director ratio	0.11***	0.11***	0.10***	0.21***	0.08***	0.06***	0	0.58***	0.39***	-0.09***	-0.0300
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.89)	(0.00)	(0.00)	(0.00)	(0.15)
13	Number of directors	0.13***	0.08***	0.24***	0.23***	0.22***	0.0300	0	0.35***	0.06**	-0.09***	-0.06***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.15)	(0.89)	(0.00)	(0.01)	(0.00)	(0.01)
14	Independent director ratio	0.05**	0.0200	0.06**	0.14***	0.0100	0	0	0.69***	0.47***	-0.0200	-0.04*
		(0.03)	(0.47)	(0.01)	(0.00)	(0.78)	(0.99)	(0.93)	(0.00)	(0.00)	(0.38)	(0.07)
15	Board average tenure	0.05**	0.0200	-0.0100	0.15***	0.04**	-0.0100	0	0.62***	0.43***	0.15***	0
		(0.04)	(0.44)	(0.63)	(0.00)	(0.05)	(0.50)	(0.93)	(0.00)	(0.00)	(0.00)	(0.89)
16	TMT average tenure	0	-0.0200	-0.07***	0.07***	0.06***	-0.0300	0.0100	0.0200	0	0.42***	-0.0200
		(1.00)	(0.44)	(0.00)	(0.00)	(0.01)	(0.21)	(0.75)	(0.39)	(0.86)	(0.00)	(0.37)
17	Board experience (KLD)	-0.0200	0.04*	0.19***	0.11***	0.12***	0.04*	0.0300	0.24***	0.08***	-0.04*	0.0100
		(0.41)	(0.05)	(0.00)	(0.00)	(0.00)	(0.07)	(0.16)	(0.00)	(0.00)	(0.07)	(0.51)
18	TMT experience (KLD)	0.0100	0.05**	0.0200	-0.05**	-0.06**	-0.0100	0	-0.0300	-0.18***	0.0100	-0.0100
		(0.71)	(0.05)	(0.42)	(0.04)	(0.01)	(0.77)	(0.89)	(0.24)	(0.00)	(0.75)	(0.59)
19	Board experience (DJSI)	0.05**	0	0.0300	0.14***	0.08***	-0.0100	0	0.23***	0.08***	0.11***	-0.07***
		(0.02)	(0.83)	(0.20)	(0.00)	(0.00)	(0.66)	(0.90)	(0.00)	(0.00)	(0.00)	(0.00)
20	TMT experience (DJSI)	0.0200	0.07***	0.0100	0.04*	0.05**	0	0.0200	0.11***	0.29***	0.04*	0.0300
		(0.38)	(0.00)	(0.74)	(0.07)	(0.02)	(0.91)	(0.48)	(0.00)	(0.00)	(0.06)	(0.12)
21	Board experience (IMD)	0	0.0100	-0.0100	0.0100	0	0	0.0200	0.04*	0.08***	0.0100	0.0100
		(0.99)	(0.54)	(0.62)	(0.76)	(0.98)	(0.83)	(0.47)	(0.06)	(0.00)	(0.68)	(0.73)
22	TMT experience (IMD)	0.0200	0.0100	0.0300	0.0100	0.0300	0	0.04*	0.09***	0.17***	0.0200	-0.0100
		(0.24)	(0.56)	(0.13)	(0.69)	(0.13)	(0.95)	(0.08)	(0.00)	(0.00)	(0.36)	(0.62)

TABLE 1. DESCRIPTIVE STATISTICS (CONTINUED)

		12	13	14	15	16	17	18	19	20	21
3	Total asset										
4	Market capitalization										
5	Employee size										
6	Leverage										
7	Duality										
8	Board network										
9	TMT network										
10	CEO tenure										
11	Functional diversity										
12	Female director ratio										
13	Number of directors	0.09***									
		(0.00)									
14	Independent director ratio	0.68***	0.08***								
		(0.00)	(0.00)								
15	Board average tenure	0.58***	0.05**	0.82***							
		(0.00)	(0.03)	(0.00)							
16	TMT average tenure	-0.05**	0.05**	0.0100	0.27***						
		(0.02)	(0.01)	(0.80)	(0.00)						
17	Board experience (KLD)	0.15***	0.31***	0.09***	0.09***	-0.0300					
		(0.00)	(0.00)	(0.00)	(0.00)	(0.16)					
18	TMT experience (KLD)	0.0300	-0.0400	-0.0100	-0.06***	-0.14***	0				
		(0.18)	(0.13)	(0.70)	(0.01)	(0.00)	(0.95)				
19	Board experience (DJSI)	0.0300	0.22***	0.08***	0.14***	0.08***	0.14***	-0.0200			
		(0.22)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.48)			
20	TMT experience (DJSI)	0.08***	0.0100	0.04**	0.11***	0.04**	0.05**	-0.10***	-0.0100		
		(0.00)	(0.52)	(0.04)	(0.00)	(0.04)	(0.02)	(0.00)	(0.77)		
21	Board experience (IMD)	0.0100	0.0300	0.10***	0.0100	0.0400	0.05**	0.0100	0.0100	0.14***	
		(0.60)	(0.20)	(0.00)	(0.77)	(0.11)	(0.01)	(0.58)	(0.64)	(0.00)	
22	TMT experience (IMD)	0.06***	0.04**	0.04*	0.13***	0.17***	0.0200	-0.25***	0.0200	0.16***	0.0300
		(0.00)	(0.05)	(0.07)	(0.00)	(0.00)	(0.32)	(0.00)	(0.43)	(0.00)	(0.17)

Note: $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; two-tailed

TABLE 2. REGRESSION RESULTS: OTHER COMPANY EXPERIENCE

	Potential absorptive capacity				Realized absorptive capacity			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
CEO duality	0.054	0.067	0.059	0.072	0.006	0.009	0.002	0.005
	(0.069)	(0.069)	(0.070)	(0.069)	(0.093)	(0.092)	(0.092)	(0.090)
Total board network	-0.184+	-0.205+	-0.187+	-0.207*	-0.136	-0.161+	-0.131	-0.156
	(0.104)	(0.104)	(0.103)	(0.104)	(0.093)	(0.097)	(0.092)	(0.096)
Total TMT network	0.136*	0.126+	0.136+	0.127+	0.048	0.065	0.027	0.044
	(0.068)	(0.066)	(0.070)	(0.068)	(0.070)	(0.074)	(0.066)	(0.071)
TMT average tenure	0.012	0.010	0.011	0.010	0.014	0.013	0.014	0.012
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Board average tenure	0.002	0.001	0.000	-0.000	0.002	0.001	0.003	0.002
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
CEO tenure	-0.011+	-0.013*	-0.012+	-0.013*	-0.013+	-0.016*	-0.014*	-0.017*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
TMT functional diversity	-0.074**	-0.071**	-0.077**	-0.074**	-0.041+	-0.039	-0.039	-0.038
	(0.024)	(0.025)	(0.024)	(0.026)	(0.025)	(0.024)	(0.025)	(0.025)
Female director ratio	0.489*	0.458*	0.486*	0.455*	0.569*	0.519*	0.546*	0.496*
	(0.199)	(0.194)	(0.201)	(0.197)	(0.251)	(0.243)	(0.250)	(0.243)
Number of directors	0.018	0.006	0.010	-0.001	0.049+	0.043	0.054+	0.047
	(0.028)	(0.028)	(0.029)	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)
Independent director ratio	-0.066	-0.024	-0.043	-0.004	-0.099	-0.069	-0.108	-0.077
	(0.126)	(0.125)	(0.128)	(0.128)	(0.128)	(0.125)	(0.127)	(0.124)
Total asset	1.057***	1.043***	1.083***	1.066***	0.631*	0.575*	0.613*	0.559*
	(0.196)	(0.196)	(0.197)	(0.197)	(0.245)	(0.241)	(0.243)	(0.240)
Market capital	0.227**	0.197*	0.226**	0.197*	0.472***	0.450***	0.469***	0.447***
	(0.087)	(0.089)	(0.087)	(0.090)	(0.102)	(0.103)	(0.103)	(0.103)
Employee size	-0.415+	-0.411+	-0.461*	-0.455*	-0.786**	-0.752**	-0.760**	-0.730*
	(0.226)	(0.218)	(0.214)	(0.206)	(0.291)	(0.282)	(0.291)	(0.283)
Leverage	0.152*	0.147*	0.158*	0.154*	0.146+	0.145+	0.135+	0.135+
	(0.063)	(0.062)	(0.063)	(0.062)	(0.074)	(0.076)	(0.072)	(0.073)
Board experiences (KLD)		0.190*		0.190*		0.176+		0.174+
		(0.080)		(0.081)		(0.102)		(0.099)
TMT experiences (KLD)		-0.033		-0.030		0.064*		0.064*
		(0.026)		(0.027)		(0.031)		(0.031)
Board experiences (DJSI)			0.133	0.126			-0.114+	-0.103
			(0.122)	(0.121)			(0.069)	(0.069)
TMT experiences (DSJI)			0.006	0.003			0.078*	0.079*
			(0.027)	(0.026)			(0.039)	(0.039)
Constant	-11.887***	-11.322***	-11.892***	-11.326***	-9.198***	-8.433***	-9.113***	-8.358***
	(1.682)	(1.698)	(1.698)	(1.714)	(1.955)	(1.985)	(1.946)	(1.974)
Observations	1489	1486	1489	1486	1489	1486	1489	1486
R2	0.125	0.136	0.127	0.138	0.103	0.116	0.110	0.123
F	8.958	7.857	8.278	7.425	4.497	4.487	4.326	4.231

Note: Standard errors are provided below coefficient estimates. $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; two-tailed tests.

TABLE 3. REGRESSION RESULTS: OTHER COUNTRY EXPERIENCE

	Model 9	Model 10
Board experiences (Environmental Law)	0.038***	0.093***
	(0.010)	(0.010)
TMT experiences (Environmental Law)	-0.031	0.008
	(0.032)	(0.032)
CEO duality	0.056	0.003
	(0.070)	(0.093)
Total board network	-0.190+	-0.146
	(0.105)	(0.094)
Total TMT network	0.142*	0.039
	(0.069)	(0.072)
CEO tenure	-0.012+	-0.014*
	(0.006)	(0.007)
TMT functional diversity	-0.071**	-0.041+
	(0.023)	(0.025)
Female director ratio	0.483*	0.529*
	(0.200)	(0.250)
Number of directors	0.020	0.047+
	(0.028)	(0.028)
Independent director ratio	-0.072	-0.082
	(0.128)	(0.129)
Board average tenure	0.002	0.002
	(0.005)	(0.005)
TMT average tenure	0.012	0.013
	(0.014)	(0.014)
Total asset	1.056***	0.614*
	(0.196)	(0.245)
Market capital	0.221*	0.473***
	(0.086)	(0.103)
Employee size	-0.409+	-0.790**
	(0.228)	(0.291)
Leverage	0.155*	0.152*
	(0.063)	(0.074)
Constant	-11.839***	-8.993***
	(1.682)	(1.964)
Observations	1489	1489
R^2	0.127	0.107
F	371.225	214.759

Note: Standard errors in parentheses, + $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 4. ROBUSTNESS TEST RESULTS: OTHER COMPANY EXPERIENCE

	Model 11	Model 12
Board experience since 2005 (KLD)	0.184*	0.171+
	(0.083)	(0.088)
TMT experience since 2005 (KLD)	0.068	-0.007
	(0.054)	(0.033)
Board experience since 2005 (DJSI)	0.166*	0.131
	(0.076)	(0.088)
TMT experience since 2005 (DSJI)	-0.013	0.078+
	(0.024)	(0.041)
CEO duality	0.059	0.014
	(0.068)	(0.091)
Total board network	-0.206+	-0.155+
	(0.106)	(0.093)
Total TMT network	0.132*	0.025
	(0.066)	(0.069)
CEO tenure	-0.013*	-0.017*
	(0.006)	(0.007)
TMT functional diversity	-0.067**	-0.036
	(0.024)	(0.024)
Female director ratio	0.320+	0.423+
	(0.191)	(0.238)
Number of directors	0.002	0.036
	(0.027)	(0.027)
Independent director ratio	0.001	-0.028
	(0.129)	(0.122)
Board average tenure	0.001	0.001
	(0.005)	(0.005)
TMT average tenure	0.010	0.014
	(0.013)	(0.013)
Total asset	0.927***	0.536*
	(0.193)	(0.250)
Market capital	0.119	0.390***
	(0.088)	(0.104)
Employee size	-0.332	-0.735*
	(0.219)	(0.289)
Observations	1487	1487
R^2	0.151	0.127
F	8.061	4.324

Note: Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 5. ROBUSTNESS TEST RESULTS: OTHER COUNTRY EXPERIENCE

	Model 13	Model 14
TMT experience since 2005 (Environmental Law)	0.064*	0.048
	(0.029)	(0.042)
Board experience since 2005 (Environmental Law)	0.230**	0.157*
	(0.086)	(0.070)
CEO duality	0.037	-0.006
	(0.070)	(0.093)
Total board network	-0.170+	-0.126
	(0.099)	(0.092)
Total TMT network	0.103	0.024
	(0.068)	(0.071)
CEO tenure	-0.011+	-0.013+
	(0.006)	(0.007)
TMT functional diversity	-0.075***	-0.042+
	(0.022)	(0.025)
Female director ratio	0.390*	0.499*
	(0.193)	(0.247)
Number of directors	0.016	0.047+
	(0.027)	(0.028)
Independent director ratio	-0.015	-0.063
	(0.123)	(0.127)
Board average tenure	0.000	0.001
	(0.005)	(0.005)
TMT average tenure	0.013	0.015
	(0.014)	(0.014)
Total asset	1.008***	0.595*
	(0.192)	(0.244)
Market capital	0.164+	0.428***
	(0.088)	(0.104)
Employee size	-0.406+	-0.780**
	(0.214)	(0.294)
Leverage (Ln)	0.146*	0.141+
	(0.062)	(0.072)
Constant	-10.791***	-8.422***
	(1.649)	(1.906)
Observations	1489	1489
R^2	0.146	0.113
F	9.008	4.076

Note: Standard errors in parentheses; $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

TABLE 6. SUMMARY OF FINDINGS

	Potential absorptive capacity	Realized absorptive capacity
TMT's experiences (KLD)	x	√
Board's experiences (KLD)	√	x
TMT's experiences (DJSI)	x	√
Board's experiences (DJSI)	x	x
TMT's experiences (Environmental law)	x	x
Board's experiences (Environmental law)	√	√
TMT’s impacts > Board’s impact (KLD)	-	x
TMT’s impacts < Board’s impacts (KLD)	√	-
TMT’s impacts > Board’s impacts (DJSI)	-	√
TMT’s impacts < Board’s impacts (DJSI)	x	-
TMT’s impacts > Board’s impacts (Environmental law)	-	x
TMT’s impacts < Board’s impacts (Environmental law)	√	-