

ABSORPTIVE CAPACITY: AN EMPIRICAL EXAMINATION OF THE  
PHENOMENON AND RELATIONSHIPS WITH FIRM CAPABILITIES

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The field of strategic management addresses challenges that firms encounter in an attempt to remain competitive. The ability to explain variation in firm success through examination of knowledge flows has become a prominent focus of research in the strategic management literature. Specifically, researchers have sought to further examine how firms convert knowledge, a phenomenon conceptualized as absorptive capacity.

Absorptive capacity is the firm's ability to acquire, assimilate, transform, and exploit knowledge. Few studies have captured the richness and multi-dimensionality of absorptive capacity, and it remains to be understood how the dimensions of the phenomenon convert knowledge. Furthermore, how absorptive capacity influences the firm remains to be understood.

To address these research gaps, this dissertation seeks to (1) determine how absorptive capacity converts knowledge, and (2) determine how absorptive capacity influences firm capabilities. The research questions are investigated using structural modeling techniques to analyze data collected from software-industry firms.

The findings offer contributions to the absorptive capacity and capability literatures. For example, absorptive capacity is hypothesized to consist of complex relationships among its internal dimensions. However, findings of this study suggest the relationships among the dimensions are linear in nature. This finding is in line with the theoretical foundations of and early literature on absorptive capacity but contrary to

recent conceptualizations, which suggests relationships among the dimensions are more closely related to the theoretical origins of absorptive capacity.

Additionally, to examine how absorptive capacity influences the firm, a capability-based perspective is used to hypothesize the influence of absorptive capacity on firm capabilities. Findings suggest absorptive capacity positively influences each dimension of firm capabilities (e.g., operational, customer, and innovation capabilities); thus, absorptive capacity influences the firm by altering firm capabilities.

Given the richness of the findings, numerous fields are likely to benefit from this investigation. Through an examination of absorptive capacity and capabilities, this study contributes to the understanding of the absorptive capacity phenomenon and offers insight into how the phenomenon influences the firm. Furthermore, practical implications are offered for managers interested in enhancing firm competitiveness.

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# CHAPTER I

## INTRODUCTION

### Introduction

The field of strategic management addresses problems firms encounter in their attempt to remain competitive in dynamic environments (Overmeer, 1996). To remain competitive, firms must consistently learn from and adapt to their environments. Due to its importance in firm success, organizational learning has been a relevant topic in strategic management for decades. In the 1960s, the “experience curve” perspective was used to describe the link between firm learning and competitiveness, and through the use of economies of experience, market leaders were able to offer lower prices than competitors and achieve a competitive advantage (Leavy, 2004). This perspective, however, was limited in its assumption that all firms learn at the same rate. The perception of learning has since shifted given the value now attributed to firm uniqueness and core capabilities. The ability of a firm to learn is now viewed as an idiosyncratic source of competitiveness (Prahalad & Hamel, 1990).

The turbulent nature of firm environments has enhanced the study of learning and knowledge creation as a source of competitive advantage (Jansen, Van Den Bosch, & Volberda, 2005). The tacit nature of knowledge allows firms to create internal routines, processes, and activities that are not easily imitable by competitor firms and may lead to a sustained competitive advantage if used

properly (Barney, 1991). The ability to explain variation in firm success through the examination of knowledge use and organizational learning has become a prominent focus of recent theorizing in strategic management literature (Zollo & Winter, 2002). Researchers have sought to examine how firms take-in and convert knowledge, a process conceptualized as a firm's absorptive capacity.

Absorptive capacity is defined as the ability of the firm to recognize, assimilate, and exploit new knowledge for commercial means (Cohen and Levinthal, 1989, 1990, 1994). The phenomenon has emerged as an underlying theme in strategic management research (Jansen et al., 2005) given its ability to conceptualize the manner in which knowledge enters the firm, is applied and modified, and ultimately exploited. The ability of the firm to convert knowledge through absorptive capacity is believed to influence firm performance and competitive advantage (e.g., Zahra & George, 2002), yet the precise manner in which absorptive capacity influences firm outcomes is unspecified.

The richness of the absorptive capacity construct is recognized in the literature; however, Volberda, Foss, and Lyles (2010) state that the concept has not been used to its full potential in organizational studies. Similarly, Van den Bosch, Van Wijk, and Volberda (2003) acknowledge that absorptive capacity is a potentially powerful construct although the theoretical contributions of the construct are far ahead of related empirical studies. Furthermore, absorptive capacity has been conceptualized by some researchers as a dynamic capability in the literature (e.g., Zahra & George, 2002), and it has been stated that

(dynamic) capabilities research is a worthy stream of research given that capabilities-related questions are central and among the most difficult in strategic management literature (Teece, 2007; Helfat & Peteraf, 2009). Thus, the current study seeks to address this vital issue and minimize the existing chasms by examining unresolved issues related to absorptive capacity. The following discussion begins with an introduction to the theoretical perspective used in the study and is followed by a review of absorptive capacity prior to identifying the primary research questions addressed.

#### Capabilities-Based Perspective

Numerous theoretical perspectives have been used to examine absorptive capacity (e.g., economics perspective, knowledge-based perspective, etc.); however, prior perspectives are limited due to the static nature of their conceptualizations. Such perspectives generally view internal resources as immobile and static, which is a limitation in explaining the changing nature of the firm. The concept of capabilities has recently received more attention given that it offers a valuable perspective beyond classical theories of strategic management or industrial organization studies (Prahalad & Hamel, 1990; Itami & Numagami, 1992; Kusunoki, Nonaka, Nagata, 1998).

Capabilities enable the firm's integration of internal and external resources to remain dynamic and achieve a competitive advantage (Bartmess & Cerny, 1993). Firm-specific capabilities support resource reconfiguration, which allows the firm to remain in sync with the external environment. Viewed through the

capabilities-based perspective, the firm consists of mobile resources configured into capabilities through dynamic processes (Amit & Shoemaker, 1993; Andersen, 1997; Madhok, 1997).

For example, Grant (2002) identifies resources as consisting of tangible, intangible, and human resources. Tangible resources consist of financial resources (e.g., cash) and physical resources (e.g., physical equipment, land, etc.), while resources such as technology (e.g., patents), reputation, or culture are intangible. Additionally, human resources provide the skill necessary to enable the firm capabilities. Given that resources are not productive on their own, they must be configured in a manner suitable for a task. A fire department, for example, cannot fight a fire without specialized equipment, hoses, trucks, dispatch systems, firefighters, and similar resources. However, it is the configuration of such resources that enables the capability of the fire department to accomplish the task.

In organizations, various tangible, intangible, and human resources must be configured to create firm capabilities. The capabilities-based perspective offers insight into how firms utilize such capabilities to influence performance. The precise nature of these capabilities are discussed in following sections. However, examples of firms that have excelled at certain capabilities include: Toyota and Harley-Davidson (for operational-oriented capabilities), MTV and L'Oreal (for customer-oriented capabilities), and Google and 3M (for innovation-oriented capabilities).

Earlier theoretical perspectives that proposed reliance on specific, unwavering capabilities to remain competitive are becoming outdated given modern understandings of dynamic markets. The current theoretical focus is shifting away from static approaches toward the use of changeable (dynamic) capabilities to alter performance and achieve a sustained competitive advantage (Schreyögg & Kliesch, 2007). Thus, the dynamic capabilities literature has rapidly grown due to its ability to account for the changing nature of firm capabilities (Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000).

The capability-based perspective evolved from the economic and knowledge-based perspectives of the firm and was strongly influenced by the resource-based view (Barney, 1991; Grant, 1996). Because of its ancestral ties to earlier perspective, the capabilities-based perspective allows for an examination of knowledge as an essential resource in the firm, and with the dynamic nature of the capabilities perspective, the limitation of relatively static views of resources is overcome. Thus, the capabilities-based perspective is used in this investigation to examine how the internal dimensions of absorptive capacity convert knowledge and examine how absorptive capacity influences the firm (namely how absorptive capacity influences capabilities). In the next section, an overview of the various types of capabilities is offered to provide a framework for the relationship between absorptive capacity and firm capabilities.

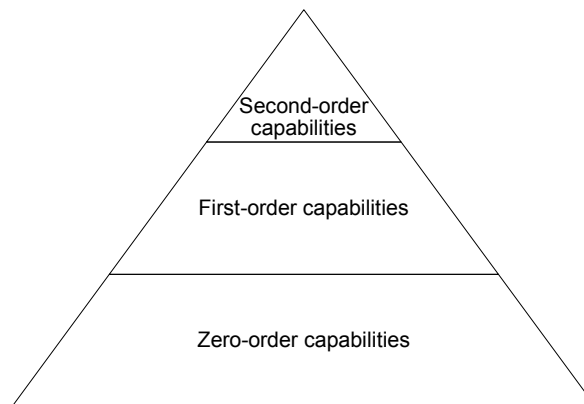
## Categories of Capabilities

Researchers have identified types of capabilities (e.g., Collis, 1994) found in multiple levels of the firm. One of the most widely cited typologies of capability levels is that of Winter (2003) who proposes a three-tiered hierarchical classification of capabilities consisting of zero-order, first-order, and second-order capabilities. Zero-order capabilities are collections of routines used to configure resources in a unique manner (Winter, 2000). For example, one type of zero-order capability is the firm's capability to engage in new product development. By configuring the necessary resources to engage in this form of innovation (i.e., by configuring the appropriate equipment, culture, and human resources needed), firms develop new products to remain competitive in an industry. Zero-order capabilities configure resources; however, firms exist in changing environments, and capabilities may need alteration to remain relevant.

First-order capabilities allow firms to integrate and extract value from zero-order capabilities in a dynamic fashion (Teece et al., 1997; Winter, 2000). These first-order capabilities allow the firm to remain in-sync with changing market expectations by reconfiguring zero-order capabilities when deemed necessary. First-order capabilities are also referred to as dynamic capabilities, and absorptive capacity is classified as one such dynamic capability (Zahra & George, 2002). A firm's absorptive capacity allows it to identify external changes, take-in new knowledge, and adapt to meet changing expectations (Cohen and Levinthal, 1990). Second-order capabilities consist of higher-order



learning capabilities that influence first-order capabilities. Although the influence of second-order capabilities is beyond the scope of this investigation, second-order capabilities consist, for example, of higher-order firm-level schemas that influence the actions of the firm (Cernas Ortiz & D'Souza, 2010). For example, the schemas (or dominant logic) of the top management team, which guide the actions of the firm and determine to what extent the firm engages in dynamic behaviors and capability development, are thought to influence capabilities at the highest level (Prahalad & Bettis, 1986). Even though second-order capabilities are outside the scope of the current study, an understanding of the hierarchical relationship among zero, first, and second-order capabilities is beneficial when conceptualizing how various levels of capabilities influence the firm. A graphical representation of the hierarchical relationships among all levels of capabilities as proposed by Winter (2003) is provided in Figure 1.



*Figure 1.* Hierarchy of capabilities. Based on Winter's (2003) conceptualization, and adapted from a graphical representation by Hoopes and Madsen (2008).

The capability-based perspective of the firm allows researchers and managers to examine the firm in terms of three levels of capabilities: zero, first, and second-order capabilities (Winter, 2003). The capability-based perspective is used in this study to examine the relationship between a specific first-order capability (i.e., absorptive capacity) and zero-order capabilities and the resulting influence on firm performance. Absorptive capacity is proposed in the literature as a first-order (dynamic) capability (Zahra & George, 2002; Sun & Anderson, 2010), thus given the focus of this investigation on absorptive capacity, the capability-based perspective is an appropriate conceptual framework because of its ability to offer insight on the relationships among various levels of capabilities in the firm. Therefore, prior to examining the relationship between first-order and zero-order capabilities, the absorptive capacity construct (as a first-order capability) is examined in more detail in the following section. Specifically, research gaps in absorptive capacity literature are first identified and the relationships among the internal dimensions of the construct are examined.

#### Research Gaps in Absorptive Capacity Literature

In a recent review of absorptive capacity literature, Volberda et al. (2010) note that numerous research gaps remain to be addressed including clarification on how knowledge is influenced by the absorptive capacity of the firm.

Additionally, through a detailed review of extant literature conducted for this investigation, it was determined that little progress has been made beyond the general linkages proposed by Cohen and Levinthal (1990), Zahra and George

(2002), and others toward specifying the manner in which absorptive capacity influences zero-order capabilities. Therefore, it is the purpose of this investigation to contribute to the current literature by further investigating (1) how absorptive capacity converts knowledge, and (2) how absorptive capacity influences firm capabilities.

Relationships among dimensions of absorptive capacity. Scholars recognize absorptive capacity as a multi-dimensional construct (e.g., Cohen & Levinthal, 1990). A general consensus exists in the literature that absorptive capacity consists of four primary internal dimensions: acquisition, assimilation, transformation, and exploitation. Acquisition is the firm's ability to take in new knowledge (Zahra & George, 2002). Assimilation allows the firm to comprehend and translate the new knowledge to fit the current knowledge structures of the firm (Lefkowitz & Lesser, 1988). Transformation of knowledge is the combination of the new knowledge and the current knowledge structures to allow the new knowledge to be integrated into the knowledge structures of the firm (Lane, Koka, & Pathak, 2006). Exploitation represents the use of new knowledge in the firm to create a competitive advantage (Spender, 1996; Cohen & Levinthal, 1990; Jansen et al., 2005; Fosfuri & Tribo, 2008).

Although general agreement exists in the literature that absorptive capacity is a multi-dimensional construct, the relationships among the internal dimensions of absorptive capacity are inconsistently conceptualized. This inconsistent conceptualization is a potential cause of the recent decline in

progress of absorptive capacity research, thus remedying the inconsistency is likely to support progress in the field.

The inconsistent conceptualizations are apparent when examining the evolution of the literature. Cohen and Levinthal (1989) were the first to apply the concept of absorptive capacity to strategic management literature. In their initial conceptualization, Cohen and Levinthal (1990) proposed the construct was best conceptualized by three dimensions related in a linear, sequential process. Zahra and George (2002) later extended Cohen and Levinthal's conceptualization of three primary dimensions into four dimensions and proposed the four dimensions work together in two broad groups. Todorova and Durisin (2007) further refined the conceptualization of absorptive capacity by proposing more complex relationships among the four primary dimensions of absorptive capacity citing the more complex nature of the knowledge conversion process. Further details on the inconsistent conceptualizations of absorptive capacity are provided in the following chapter; however, in an effort to enhance the unity of the field of absorptive capacity research, the manner in which the internal dimensions of the phenomenon are related is examined in this investigation.

Influences of absorptive capacity on the firm. This study also seeks to extend the literature by examining the manner in which absorptive capacity influences firm-level factors and performance. Conceptual investigations of absorptive capacity propose the influence of absorptive capacity on competitive advantage (i.e., flexibility, innovation, and performance) (Zahra & George, 2002;

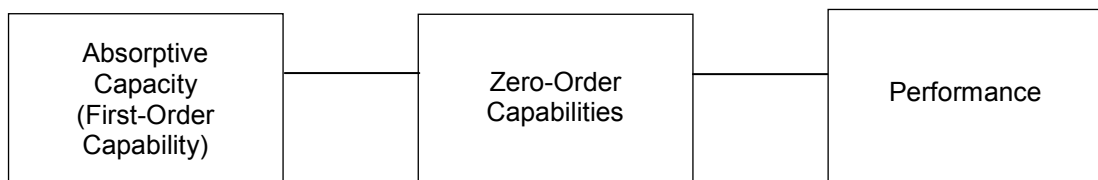
Todorova & Durisin, 2007). Additionally, empirical investigations support the relationship between absorptive capacity and performance outcomes (e.g., Fosfuri & Tribo, 2008; Tsai, 2001; George, Zahra, Wheatley, & Khan, 2001; Deeds, 2001; Chen, Lin, & Chang, 2009), yet based on an extensive review of the literature, few studies examine how absorptive capacity influences performance.

This study builds on previous conceptualizations of the link between absorptive capacity and performance. Numerous investigations have attempted to examine the indirect relationship using various types of performance measures. For example, Chen and Ching (2004) proposed the relationship between absorptive capacity and customer-related performance was mediated by customer relationship practices. Bergh and Lim (2008) found that absorptive capacity influences the restructuring mode of the firm, and restructuring mode thus relates to firm performance. Each of these studies proposes an indirect relationship and examines the influence of absorptive capacity on a specific measure of performance. However, when the capability-based perspective is applied to a firm, it is unclear in the extant literature how absorptive capacity influences zero-order capabilities and performance.

Even though firms may have internal and external resources similar to competitors, firm performance varies due to capabilities (Han, Lee, & Seo, 2008). Wang and Ahmed (2007) proposed that first-order (dynamic) capabilities influence zero-order capabilities, and zero-order capabilities influence

performance. Building on Zahra and George's (2002) notion that absorptive capacity is a first order (dynamic) capability, this study proposes that absorptive capacity will influence zero-order capabilities and performance in a manner similar to the relationships proposed by Wang and Ahmed (2007).

Extant research supports the positive relationship between zero-order capabilities and performance. Thus, at the broadest level, this investigation proposes that absorptive capacity, as a first-order (dynamic) capability, influences zero-order capabilities. A graphical representation of these relationships is provided in Figure 2, and the specific relationships among absorptive capacity and the dimensions of zero-order capabilities are investigated in-depth in the following chapter.



*Figure 2.* Construct-level graphical research model.

In summary, two primary areas of focus are examined in this study. First, the relationships among the internal dimensions of absorptive capacity are analyzed to determine the nature in which the dimensions work together to convert knowledge. Second, the influences of absorptive capacity on zero-order capabilities are examined. Both areas of focus are described in more detail and specific research questions are offered.

## Statement of Purpose

The aim of (dynamic) capabilities research is ambitious given that it seeks to understand how firms successfully respond to environmental change (Teece, 2007). Helfat and Peteraf (2009) identified such capabilities-related questions as the most central and difficult questions in strategic literature and are considered by some as the “Holy Grail” of strategic management. Therefore, in an attempt to bring partial resolution to the research gaps identified, this investigation applies the capabilities-based perspective to investigate the manner in which various levels of capabilities convert knowledge and influence firm performance.

## Research Questions

This investigation addresses two primary research questions:

- (1) How does absorptive capacity convert knowledge?
- (2) How does absorptive capacity influence firm capabilities?

The first research question relates to the relationships among the dimensions used to convert knowledge for use in the firm. In the next chapter, the multidimensional nature of absorptive capacity is discussed, and the relationships among the dimensions are later proposed. It should be noted that the term “convert” in the first question pertains to the broad, multidimensional process of absorptive capacity. Nonaka (1994) and others use the term “convert” to describe the process of transforming knowledge from a tacit to explicit state. Similarly, in this investigation, the manner in which external knowledge is

converted into a useable form of knowledge is referred to as the knowledge conversion process.

The second research question examines the influence of absorptive capacity using the capabilities-based perspective of the firm. In an effort to examine these questions, it is noted that inter-industry contexts are shown to influence knowledge capabilities (e.g., Notebloom, Haverbeke, Duysters, Gilsing, and Van den Oord, 2007). Thus, to obtain an accurate representation of absorptive capacity, the phenomenon is examined at the firm level. Therefore, to examine these primary research questions, the analysis is conducted at the organizational, or firm, level of analysis.

#### Contributions of the Study

This study seeks to add value to the existing literature in strategic management. It addresses a topic central to the field and is likely to have long-term implications for researchers and managers. Even though the study of capabilities (as illustrated in Chapter 2) is extensive, robust empirical research on the strategic nature of capabilities has been slow to develop, which has resulted in many interpretations of capabilities remaining at a high level of abstraction (Dosi, Nelson, & Winter, 2000). An in-depth, empirical study of capabilities – like the current study – is valuable to the field given that “most studies concerning organizational capabilities stop at the development of conceptual ideas, and there are few comprehensive studies conducting empirical analysis of organizational capability as a multi-dimensional construct” (Kusunoki, Nonaka, &



Nagata, 1998: 700). Additionally, in a recent review of absorptive capacity literature, Volberda et al. (2010) state that few studies have captured the richness and multi-dimensionality of absorptive capacity, and the internal relationships remain to be investigated in detail.

This investigation will add value to absorptive capacity literature through an organizational-level examination of the relationships among the dimensions of the construct. This investigation will conduct an in-depth examination of the internal dimensions to determine the manner in which knowledge is converted for use in the firm, thus supporting the further examination of how absorptive capacity influences firm-level (zero-order) capabilities.

#### Presentation Format

This dissertation is presented in five chapters. Following this first chapter, which introduces the study and research questions, the second chapter begins with an overview of relevant perspectives used to examine absorptive capacity, and the capabilities-based perspective is selected as the most appropriate perspective for the current study. Following, capabilities are defined and a synthesized definition of the concept is offered. Various categories of capabilities are then introduced to demonstrate that absorptive capacity is a first-order (dynamic) capability and to reiterate that the study will focus specifically on first-order and zero-order capabilities. The dimensions of absorptive capacity are investigated to determine the manner in which the dimensions of the construct are related. The chapter concludes with a discussion of the relationship between

zero-order capabilities and performance and ends with the presentation of hypotheses supporting the relationship between absorptive capacity and the dimensions of zero-order capabilities.

In Chapter III, the research design and methodology used in the study are discussed. The operationalization of the study variables are first presented followed by a discussion of the sample of firms used for the study, which are selected from the software industry in the United States. Then, the measures used in the study and the pilot studies conducted are detailed. The data collection procedure for the main study is then outlined, and demographic data about the sample is presented.

Chapter IV consists of the results from the study. Given that two of the five hypotheses proposed related to the dimensions of absorptive capacity are not supported, a revised model of the phenomenon is offered. The revised model of the relationships suggests a more linear relationship among the dimensions than was previously suggested. Furthermore, the remaining hypotheses are supported, which suggest absorptive capacity significantly influences zero-order capabilities, and more specifically, is found to be significantly related to each dimension of zero-order capability (i.e., operational, customer, and innovation capabilities).

The final chapter contains a discussion of the findings. Specifically, implications for researchers are offered, and managerial implications are provided to translate the practical benefits garnered from this investigation.

Future research recommendations, limitations, and a conclusion of overall findings are also presented.

## CHAPTER II

### LITERATURE REVIEW

#### Introduction

Given the research questions stated in the preceding chapter, the purpose of this chapter is to specifically address both research questions and offer hypotheses suitable for empirical testing. Absorptive capacity was previously identified as a dynamic capability (Zahra & George, 2002; Sun & Anderson, 2010). This chapter offers an in-depth discussion of the theoretical perspectives behind absorptive capacity and zero-order capabilities to establish a foundation for both concepts. An investigation into the internal dimensions of absorptive capacity is conducted along with an examination of the influences of absorptive capacity on the firm.

This chapter begins with an overview of theoretical perspectives used to examine absorptive capacity. After this discussion, the capability-based perspective is identified as the most appropriate perspective given its ability to conceptualize dynamic phenomena and its extension of earlier perspectives used. Next, a synthesized definition of capabilities is presented, and three levels of capabilities are identified using Winter's (2003) hierarchical classification. Absorptive capacity is then positioned in this classification scheme as a first-order (dynamic) capability.

Two research questions are subsequently addressed. First, the question of how the dimensions of absorptive capacity convert knowledge is discussed. Based on a review of the literature, the relationships among the internal dimensions of absorptive capacity are hypothesized. Following, the relationship between zero-order capabilities and firm performance is discussed prior to presenting hypotheses related to the relationships among absorptive capacity and zero-order capabilities. In summary, this chapter provides the theoretical foundation to support the investigation of how absorptive capacity converts knowledge and influences the zero-order capabilities of the firm.

#### Scope of the Study

The purpose of this study is not to investigate all levels of the capability hierarchy. Instead, given that the primary purpose of the investigation is to examine absorptive capacity and zero-order capabilities, the scope of this study is limited to investigating first-order and zero-order capabilities at the organizational level of analysis. Second-order capabilities are beyond the scope of the current investigation. First-order capabilities represent the firm's ability to integrate and reconfigure firm resources and zero-order capabilities to remain in concert with changing environmental demands (Eisenhardt & Martin, 2000; Teece et al., 1997). (Additional information on the hierarchy of capabilities is presented in a later section of this chapter.)

Absorptive capacity is viewed as a first-order (dynamic) capability (Zahra & George, 2002; Sun & Anderson, 2010). Researchers (e.g., Jansen et al.,

2005; Todorova & Durisin, 2007) have shown that absorptive capacity consists of four dimensions (i.e., acquisition, assimilation, transformation, and exploitation). However, the manner in which the internal dimensions are related remains unclear in the literature. Additionally, the manner in which absorptive capacity is related to zero-order capabilities remains to be examined. Therefore, in this investigation, the relationships among the dimensions of absorptive capacity are examined and hypothesized, and the relationship between absorptive capacity and firm-level (zero-order) capabilities is hypothesized.

Before examining the detailed manner in which the internal dimensions of absorptive capacity are related, emphasis is first placed on the theoretical perspectives utilized in absorptive capacity-related research. A review of perspectives is offered, and the most relevant perspective (the capabilities-based perspective) is selected as a framework for assessing the current study. The discussion begins with a review of the perspectives used in absorptive capacity research.

## Theoretical Framework

### Perspectives Articulated in Absorptive Capacity Research

Research related to absorptive capacity has employed numerous conceptual frameworks to investigate the construct and its relationships with other variables. Through a detailed review of the literature, the three primary frameworks found in the literature are introduced and reviewed: the economics, knowledge-based, and capability-based perspectives. Eventually, the capability-

based framework is selected for examining the relationships in this investigation given its ability to most wholly examine dynamic relationships.

Economics perspective. Early models of absorptive capacity were rooted in the notion of economic rents. Mahoney and Pandian (1992: 205) define economic rents “as return in excess of a resource owner’s opportunity costs” and as “above-normal rates of return.” The perspective of Ricardian rents (Ricardo, 1817) views variation in firm performance as a result of the differential productivity of resources (Makadok, 2001). Assumptions that the firm consists of resources which provide idiosyncratic value to the firm suggest that firms may possess resources different from competitors (Barney, 1991; Penrose, 1959; Wernerfelt, 1984). In this view, absorptive capacity is conceptualized as a unique internal resource with the ability to influence the competitive advantage of the firm (Schreyögg & Kliesch-Eberl, 2007).

The economics perspective was used by Cohen and Levinthal (1989) in one of the earliest conceptualizations of absorptive capacity to demonstrate the economic value of a “second face” of R&D (i.e., absorptive capacity) and its implications for the firm. Despite the value of these perspectives to the conceptualizations of absorptive capacity, one criticism is the static nature of this perspective (Priem & Butler, 2001). That is, this perspective assumes that internal firm resources are, by and large, immobile.

Knowledge-based perspective. Although the economics perspective offers insight into value created from internal firm resources, the knowledge-

based perspective views the value added by one unique resource: knowledge. The knowledge-based perspective conceptualizes the firm as a bundle of knowledge elements and focuses on the role of knowledge in firm-related contexts. The perspective is anchored in the notion that knowledge is the most valuable resource of a firm (Grant, 1996). March (1991) suggests that firms engage in two types of knowledge management activities: exploration for new knowledge and exploitation of current knowledge. Thus, according to this perspective of the firm, knowledge is a resource that can be tailored to enhance the competitive advantage of the firm (Kogut & Zander, 1992; Teece, 1998).

In this perspective, the absorptive capacity represents the firm's ability to manage its stock and configuration of knowledge (e.g., Jansen et al., 2005). Similar to perspectives anchored in economic theory, the knowledge-based view also lacks a dynamic conceptualization of how knowledge influences the firm. Thus, both perspectives are limited due to their static approaches.

Capability-based perspective. The capability-based perspective of the firm is rooted in earlier conceptualizations of the distinctive/core competencies of a firm (e.g., Hofer & Schendel, 1978; Prahalad & Hamel, 1990). These authors identified the specialized abilities of firms to deploy resources in a manner unique from competitors. Various forms of capabilities are noted to exist in firms, and Winter (2000, 2003) offered a typology of capabilities, which proposes that firms consist of three levels of capabilities, namely zero-order, first-order, and second-order capabilities. (Each level of capability is discussed in detail in a later



section.) The capability-based perspective has been applied to absorptive capacity studies, and absorptive capacity is identified as a first-order (dynamic) capability (Zahra & George, 2002; Sun & Anderson, 2010).

The capability perspective addresses the shortcomings of the aforementioned perspectives by accounting for the changing nature of resources and capabilities (Teece, Pisano, & Shuen, 1997; Eisenhardt & Martin, 2000). In this dynamic view, firms reconfigure resources to meet the changing demands of the environment. This perspective resolves the limitation of static resources present in the aforementioned perspectives, and it is used to conceptualize the firm as consisting of mobile resources able to be transformed into capabilities using dynamic, idiosyncratic processes (Amit & Shoemaker, 1993; Andersen, 1997; Madhok, 1997).

The capabilities-based view is seen as an extension of the economics- and knowledge-based perspectives given that capabilities provide economic rents and are subject to change due to the shift in environmental demands. This dynamic perspective focuses on the value of the firm's capabilities and the resulting influence on the performance of the firm (Andersen, 1997). Additionally, the capability-based perspective extends the knowledge-based perspective given that knowledge-related capabilities are firm-specific and can be utilized by firms in dynamic environments (Eisenhardt & Martin, 2000; Teece et al., 1997). In all, the capability-based framework is built on a culmination of influences from the

aforementioned theoretical frameworks, and additionally, it addresses the static shortcomings of previous perspectives.

#### An Appropriate Theoretical Framework for this Study

This investigation is primarily concerned with addressing the influence of absorptive capacity on zero-order capabilities. Given that this research focuses on how knowledge is converted, the knowledge-based perspective could be suitable for the study. However, its ability to assess the dynamic nature of the firm is limited. The capability-based perspective supports a dynamic conceptualization of the firm and is not limited by a static perspective.

Both the economic and knowledge-based perspectives have contributed to the development of the capability-based perspective. However, the dynamic nature of the capability-based perspective provides an additional advantage that makes it a suitable framework from which to conduct an in-depth examination of how knowledge integration and exploitation influence firm capabilities. Thus, the capability-based perspective is applied to further understand how knowledge integration and exploitation influence zero-order capabilities. A comparison of the three theoretical frameworks applied to absorptive capacity is provided in Table 1 to summarize the contributions of each perspective.

Table 1

*Comparison of Perspectives Used to Conceptualize Absorptive Capacity*

| Contribution of Perspective   | Economics Perspective | Knowledge-Based Perspective | Capability-Based Perspective |
|-------------------------------|-----------------------|-----------------------------|------------------------------|
| Values tangible resources     | ✓ ✓ ✓                 | ✓ ✓ ✓                       | ✓ ✓ ✓                        |
| Values intangible resources   | ✓ ✓                   | ✓ ✓ ✓                       | ✓ ✓ ✓                        |
| Incorporates a dynamic nature | ✓                     | ✓                           | ✓ ✓ ✓                        |

*Note.* ✓✓✓ = strong support; ✓✓ = moderate support; ✓ = marginal or no support

Capabilities-Based Perspective

Roots of the Capabilities Phenomenon

The capability-based perspective suggests that a change in the capabilities of the firm alters its value creation potential, and consequently, its performance. Hence, the preliminary objective of this section is to understand capabilities and the role they play in the firm. The role of resources and routines in creating capabilities is first presented. Following this, an overview of capabilities is provided, definitions of capabilities are reviewed, and a synthesized definition of the construct is offered.

Resources. Resources are defined as the firm's assets and are commonly referred to as the building blocks of a firm (Wheelen & Hunger, 2010). Grant (2002) identifies three types of firm resources: tangible resources (e.g., property, office buildings, equipment), intangible resources (e.g., patents,

copyrights, reputation), and human resources (employees). While firms may exhibit similar stocks of resources, the manner in which firms configure relevant resources is supported by unique firm capabilities.

Theoretical developments on the concept of capabilities are evident in the early works of Selznick (1957), Penrose (1959), and Andrews (1971). Penrose (1959) theorized that while all firms have access to certain resources, the “capability” to utilize the resources is not constant among firms. That is, while firms may possess similar resources, the capability to configure the resources in a unique manner varies across firms. Selznick (1957) referred to a firm’s ability to perform well in a specified area as the competitive advantage of the firm. Similarly, Andrews (1971) suggested that a firm’s competitive advantage was built on its reputation to produce a product or service particularly well. Common in each of these conceptualizations is the perceived ability of firms to create value by combining internal resources in unique ways.

Routines. Firms are able to achieve a competitive advantage through unique resource configuration because the manner in which the resources are combined is valuable and not easily imitated by competitors (Barney, 1991). The ability to create unique resource configurations occurs over time through the development of firm routines. As knowledge is acquired, firms develop routines. Nelson and Winter (1982) define routines as the regular and predictable patterns of behavior. For example, firms may exhibit technical routines for production, routines for hiring and firing, and routines for R&D (Nelson & Winter, 1982).

Routines allow for the use of resources and for coordination, control, and stability of activities (Becker, 2004).

Routines generally exhibit firm-specific characteristics given their development from unique knowledge and experience of the firm. Such idiosyncratic routines allow firms to develop specialized and unique firm capabilities (Dierickx & Cool, 1989; Nelson & Winter, 1982; Nonaka, 1994); thus, routines are the building blocks of capabilities (Dosi, Nelson, & Winter, 2000). Given that capabilities are created on a foundation of routines, capabilities are developed with firm-specific, unique knowledge. Thus, the unique routines that exist in firms give rise to unique capabilities, which influence performance. Therefore, capabilities have a vital influence in how firms perform and achieve competitive advantage. This investigation seeks to better understand this relationship and how absorptive capacity influences zero-order capabilities.

Before examining the detailed relationships among the dimensions of absorptive capacity and the resulting influence on zero-order capabilities, an in-depth review of capabilities is warranted. In the next section, capabilities are defined and several synonyms and relevant definitions of capabilities are reviewed prior to defining the construct. Commonalities among the definitions will be discussed, and four common characteristics of capabilities are identified. Ultimately, a synthesized definition of capabilities is proposed, which includes the four identified characteristics. The synthesized definition is used in the study.

## Defining Capabilities

Researchers have defined capabilities in different ways. Collis (1994) notes numerous definitions of capabilities exist. An in-depth review of capabilities literature revealed numerous definitions and synonyms used to describe capabilities. Table 2 contains the most referenced descriptions of capabilities.

Table 2

### *Definitions of Capabilities*

| Definition of Capabilities  | Citation                           |
|---|------------------------------------|
| Distinctive competencies are “patterns of...resource and skill deployments that will help it [the firm] achieve its goals and objectives.”  | Hofer & Schendel (1978: 2)         |
| “Core competencies are the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies.”   | Prahalad & Hamel (1990: 82)        |
| “Capabilities...refer to a firm’s capacity to deploy resources, usually in combination, using organizational processes, to affect a desired end.”   | Amit & Schoemaker (1993: 35)       |
| Capabilities are “the socially complex routines that determine the efficiency with which firms physically transform inputs into outputs.”   | Collis (1994: 145)                 |
| A capability is “a firm's ability to perform repeatedly a productive task which relates either directly or indirectly to a firm's capacity for creating value through effecting the transformation of inputs into outputs.” | Grant (1996: 377)                  |
| Organizational routines/competences are constituted by assembling firm-specific assets in integrated clusters spanning individuals and groups so that distinctive activities may be performed.                              | Teece, Pisano, & Shuen (1997: 516) |

*(table continues)*

Table 2 (continued).

| Definition of Capabilities   | Citation                              |
|--|---------------------------------------|
| "To be <i>capable</i> of something is to have a generally reliable capacity to bring that thing about as a result of intended action. Capabilities fill the gap between intention and outcome."  | Doci, Nelson, & Winter (2000: 2)      |
| "A capability is a set of business processes strategically understood...Capability-based competitors identify their key business processes, manage them centrally, and invest in them, looking for a long-term payback."   | Stalk, Evans, & Shulman (2000: 62)    |
| "An organizational capability is a high-level routine (or collection of routines) that, together with its implementing input flows, confers upon an organization's management a set of decision options for producing significant outputs of a particular type." | Winter (2000: 983)                    |
| "A 'capability' is defined as a special type of resource – specifically, an organizationally embedded nontransferable firm-specific resources whose purpose is to improve the productivity of <i>other</i> resources possessed by the firm."                     | Makadok (2001: 389)                   |
| "Business processes can be thought of as the routines or activities that a firm develops in order to get something done."  | Ray, Barney, & Muhanna (2004: 24)     |
| Capabilities do not "represent a single resource in the concert of other resources...but rather a distinctive and superior way of allocating resources."   | Schreyögg & Kliesch-Eberl (2007: 914) |

As noted, researchers have used various terms to describe the capabilities of a firm. For example, Hofer and Schendel (1978) refer to "distinctive competencies" as patterns of resources and skills that allow the firm to achieve its goals. Prahalad and Hamel (1990) use the term "core competencies" to describe how coordination and integration exists among

various skills and technologies in the firm. Teece et al. (1997) simply use the term “competencies” to describe how firm assets are integrated to support distinctive activities. Capabilities are even discussed as “business processes” that consist of the coordination of routines developed to accomplish a specific task (Ray, Barney, & Muhanna, 2004). Most references to this phenomenon, however, use the term “capability.” Given the vast terminology used to refer to the concept, the term “capability” is used in this study (and is interchangeably used with “firm capability”) given that “capability” is the most prominent term used in the change literature to describe this phenomenon (Schreyögg & Kliesch-Eberl, 2007).

Amit and Schoemaker (1993) state that capabilities are the capacity of a firm to combine resources through firm processes to achieve an end goal, and Makadok (2001) states capabilities are idiosyncratic resources used to improve the productivity of other firm resources. Collis (1994: 145) states that capabilities are the “socially complex routines that determine the efficiency with which firms physically transform inputs into outputs,” which is similar to Grant’s (1996) definition that also highlights the transformational ability of capabilities. Likewise, Doci, Nelson, and Winter (2000) state that capabilities are the vital link of transformation that exists between input and outcome. Stalk, Evans, and Shulman (2000) emphasize the long-term benefits of capabilities and the importance of managerial direction in the success of investments in capabilities.



Additionally, Winter (2000) emphasizes the influence of managerial decisions in guiding the capabilities, which are defined as a collection of routines.

In summary, numerous definitions have been proposed to describe the nature of capabilities in the firm. However, each definition generally emphasizes the value of capabilities in influencing the success of the firm whether through transformation of input or through unique value added. In the next section, common characteristics of definitions of capabilities are identified from which a synthesized definition will be used to support the conceptualization of capabilities used in this study.

#### Characteristics of Capabilities

Kusunoki, Nonaka, and Nagata (1998) acknowledge the array of definitions used to describe capabilities, and they propose that most definitions of capabilities have the following characteristics: (1) capabilities are not easily obtainable, are difficult to imitate, and idiosyncratic; (2) capabilities are created through long-term continuous learning, (3) capabilities transform an input into an output; and (4) capabilities have the potential to be a source of sustained competitive advantage. (Note the characteristics of “capabilities transform input into an output” is not originally proposed by Kusunoki et al.; however, it is a commonly included characteristics of capabilities definitions, so it is included here as a characteristic to assess definitions.) Therefore, the following review of capabilities definitions is presented using the framework of the four identified characteristics.

Capabilities are idiosyncratic. Routines consist of firm-specific knowledge and processes that result from the unique experience of the firm. Ray et al. (2004) state that capabilities (although termed “business processes”) are the set of routines developed to accomplish a task. Given capabilities are high-level collections of routines (Winter, 2000), capabilities are not easily imitated by firm competitors because of the tacit nature of routines and knowledge. The unique patterns that emerge within a firm can be used to a firm’s advantage in achieving its goals (Hofer & Schendel, 1978).

The imitability of capabilities is also attributed to the manner in which resources are combined (Amit & Shoemaker, 1993). While it is possible all firms in an industry have similar resources, the unique combination in which the resources are utilized adds value to the firm. This way of using resources is distinctive from other firms (Schreyögg & Kliesch-Eberl, 2007), and the unique combination of resources allows the firm to add value in the process of transforming an input into an output (Grant, 1996). In all, because firms create capabilities based on learning experiences and use the gained knowledge to create unique combinations of resources, the capabilities employed are idiosyncratic and not easily imitated by competitors.

Long-term development of capabilities. As previously stated, routines are a building block of capabilities. Routines are created and refined through the development of knowledge derived from past experiences. Given the relationship of routines and capabilities, the development and refinement of

capabilities is not a short-term process. Capabilities are activities developed to accomplish firm goals (Ray et al., 2004). Firms must invest substantially in gathering, storing, and utilizing the knowledge necessary to create and develop useful capabilities. The investment in capabilities is one that will be beneficial over the long-term assuming capabilities are continuously refined and the appropriate capabilities are used to address market needs (Stalk et al., 1992).

Capabilities transform. With established routines and idiosyncratic capabilities, firms possess the ability to produce a unique output. Although firms have a desire to produce an output, a gap exists between the desire to produce an output and the actual outcome. “Capabilities fill the gap between intention and outcome” (Doci et al., 2000). To produce an output, a transformation of input into output occurs via the capability of a firm (Collis, 1994; Grant, 1996).

This transformation is referred to as a “business process” consisting of routines and activities to accomplish a task (Ray et al., 2004), and it is described as an assimilation of assets to perform specific transformative activities (Teece et al., 1997). However described in the respective literature, capabilities support the transformation of an input into a desired output. Thus, through the process, unique value is added to the output, which supports the competitive advantage of the firm.

Capabilities yield sustained competitive advantage. The use of capabilities to integrate and configure resources is a complex, time-intensive process, and capabilities are not quickly generated (Stalk, Evans, & Shulman,

2000). This raises an interesting question. Why do firm invest in a long-term development of capabilities knowing that the market may potentially change and nullify the need for a specific capability? The answer is two-fold.

First, firms create capabilities based on routinized processes and past experiences. Thus, firm capabilities are unique to the firm in which they exist. By housing unique capabilities and routines, firms are able to perform activities distinct from competitors (Teece et al., 1997). When firms possess a unique capability, and are able to produce an output that meets a market need in a way that is inimitable, firms possess a sustained competitive advantage. By transforming inputs into outputs using a distinct capability, firms create value for the customer, which yields a competitive advantage for the producing firm (Grant, 1996; Stalk et al., 1992).

Furthermore, if capabilities are dynamic in nature, the capabilities can be adjusted to meet the needs of the firm. Thus, even though capability development is a long-term process, once capabilities are created, their dynamic nature (e.g., Teece et al., 2007) allows for adaptation to changing contexts. In all, by possessing established routines that support the creation of unique capabilities, firms are able to yield a sustained competitive advantage. Table 3 displays the authors of each proposed definition of capabilities and compares its relevance to the four identified commonalities discussed.

Table 3

*Description of Authors and Components of Capabilities Referenced*

| Author(s)                        | Component of Capabilities Referenced |                       |                         |                                 |
|----------------------------------|--------------------------------------|-----------------------|-------------------------|---------------------------------|
|                                  | Idiosyncratic Nature                 | Long-term Development | Transformational Nature | Sustained Competitive Advantage |
| Hofer & Schendel (1978)          | R                                    | N                     | I                       | I                               |
| Prahalad & Hamel (1990)          | I                                    | N                     | I                       | N                               |
| Stalk, Evans, & Shulman (1992)   | R                                    | R                     | R                       | R                               |
| Amit & Shoemaker (1993)          | I                                    | N                     | R                       | I                               |
| Collis (1994)                    | I                                    | N                     | R                       | I                               |
| Grant (1996)                     | I                                    | I                     | R                       | I                               |
| Teece, Pisano, & Shuen (1997)    | I                                    | N                     | I                       | I                               |
| Docj, Nelson, & Winter (2000)    | N                                    | N                     | R                       | I                               |
| Winter (2000)                    | I                                    | N                     | R                       | I                               |
| Makadok (2001)                   | R                                    | N                     | R                       | I                               |
| Ray, Barney, & Muhanna (2004)    | I                                    | N                     | I                       | N                               |
| Schreyögg & Kliesch-Eberl (2007) | I                                    | N                     | N                       | N                               |

*Note.* R = directly referenced; I = indirectly referenced; N = not referenced

Synthesized Definition of Capabilities

Through an assessment of relevant literature, it is shown that capabilities display four primary characteristics as noted. Therefore, given the vast array of

definitions used to describe capabilities, a value-added component of this study is to offer a synthesized definition of the construct in an effort to develop a consensus among the extant literature. Based on an extensive literature review, a definition of capabilities that synthesizes the commonalities and definitions used in the literature is proposed. In line with seminal definitions of capabilities reviewed, the following definition is used to define capabilities in this study without denying merit to any other conceptualizations:

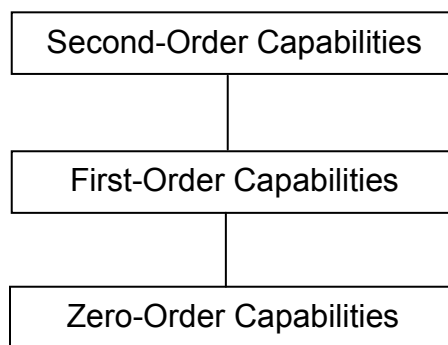
Capabilities are intentionally created by management to transform input into output with the goal of achieving competitive advantage through the long-term adaptation, integration, and reconfiguration of resources using idiosyncratic routines.

This definition of capabilities is adopted for use in the current study. In the next section, an in-depth examination of the types of capabilities is offered. Specifically, an overview of the categories of capabilities is presented, and the scope of this study addresses only zero-order and first-order capabilities.

#### Hierarchy of Capabilities

Researchers have acknowledged various categories of capabilities. For example, Collis (1994) identified three categories of capabilities. Although the classifications were unnamed, the first category consists of functional firm activities. The second category comprises the dynamic improvement activities in a firm, and the third category consists of the metaphysical abilities that allow firms to develop new strategies prior to competitors.

Winter (2003) extend the earlier three-category classification of capabilities to include hierarchical relationships among the various type of capabilities. Winter proposes a three-category model in which zero-order capabilities are the foundation on which higher-order capabilities exist. It is through zero-order capabilities that firm resources are utilized. First-order (dynamic) capabilities serve to reconfigure zero-order capabilities as needed by the firm to remain competitive in a changing environment. Second-order capabilities exist at the highest level in the hierarchy. Second-order capabilities consist of routines used to influence first-order capabilities of the firm. Thus, second-order capabilities are at the top of the hierarchy and zero-order capabilities are the foundation, with first-order capabilities occupying a central position. A graphical representation of the relationships is presented in Figure 3, and descriptions of each category of capabilities immediately follow.



*Figure 3.* Relationships among capabilities. Adapted from graphic presented by Hoopes and Madsen (2008).

Zero-order capabilities. Zero-order capabilities are referred to as the “how we earn a living now” activities in a firm (Winter, 2003: 992). These lower-level capabilities are collections of routines used to combine resources in a unique fashion resulting in the production of outputs supportive of a competitive advantage (Winter, 2000). Zero-order capabilities configure resources in a manner that provides firms with a unique ability to compete with peer firms. The idiosyncratic nature of zero-order capabilities supports a firm’s competitive advantage. An example of a zero-order capability is the customer capability of a firm, which encompasses the capability of the firm to promote a positive reputation and to respond to changing market trends (Kaplan & Norton, 2006; Crossan, Rouse, Fry, & Killing , 2009) and will be discussed in further detail in a later section. Examples of customer capabilities in firms include Johnson & Johnson, which is known for its reputation of providing quality products, and the social networking site, Facebook, that has proven responsive to market demands. Customer capabilities, such as these, allow firms to meet market demands and “earn a living now.”

First-order capabilities. First-order capabilities are also commonly referred to as dynamic capabilities. First-order (dynamic) capabilities are required to engage in actions that facilitate change in the firm (e.g., new product development). First-order capabilities allow firms to dynamically integrate and exploit zero-order capabilities (Teece et al., 1997; Winter, 2003) and facilitate firm adaptability in dynamic environments. For example, assume that Johnson &



Johnson currently has a recognized reputation for high-quality products at a slightly higher price. Now, consider an alternative scenario in which the market demand patterns shift and customers begin demanding a lower-quality product for a cheaper price. Johnson & Johnson would then need to adjust to the market shift. The firm may consider the use of specific first-order (dynamic) capabilities that enable it to alter an existing zero-order capability – possibly the operational capability – to address the change in the product mix demanded by customers. In such contexts, first-order capabilities can be used to integrate and reconfigure zero-order capabilities given changing market demands and competitive influences (Eisenhardt & Martin, 2000). The manner in which first-order capabilities identify and exploit knowledge is the absorptive capacity of a firm. (The concept of absorptive capacity is discussed briefly and in further detail in a later section.)

Second-order capabilities. Second-order capabilities are higher-order learning influences on first-order (dynamic) capabilities. Collis (1994: 145) defines second-order capabilities as the “metaphysical strategic insights,” which allow firms to recognize value in and develop new strategies ahead of competition. Several second-order capabilities that support this role of firm management exist. One example of a second-order capability is the dominant logic of the firm, which is defined as the set of schemas among the top management team that are the conceptualization of the firm and the way that resource allocation decisions are made (Prahalad & Bettis, 1986). These

highest-order capabilities are thought to influence the lower-order (first and zero-order) capabilities of the firm.

## Absorptive Capacity

### Positioning Absorptive Capacity in the Hierarchy of Capabilities

The purpose of this study is to examine the relationships among the dimensions of absorptive capacity and the resulting influence on zero-order capabilities and performance. Thus, before proceeding, it is important to apply the capability-based view to the context of this study and position absorptive capacity in the hierarchy of capabilities as proposed by Winter (2003).

Absorptive capacity is defined as the acquisition, assimilation, transformation, and exploitation of new knowledge by firms (Cohen & Levinthal, 1990; Zahra & George, 2002). Absorptive capacity allows a firm to obtain and integrate new knowledge to remain in sync with its changing environment. Similarly, first-order capabilities allow firms to dynamically integrate and exploit zero-order capabilities to meet changing market demands (Teece et al., 1997; Eisenhardt & Martin, 2000). Thus, Zahra and George (200) classify absorptive capacity as a first-order (dynamic) capability. Therefore, through the perspective of the capability-based view, absorptive capacity is viewed as a first-order (dynamic) capability.

Given that the focus of this study is on absorptive capacity and its influences, a detailed discussion of absorptive capacity is presented in the next section. The following section addresses the first research question of this

investigation which is related to how the dimensions of absorptive capacity are related. This question is addressed through a discussion of the internal structure of absorptive capacity, and the discussion begins with an overview of the conceptual development of absorptive capacity followed by a review of the internal dimensions of the construct. Various seminal models are presented to demonstrate the various conceptualizations of absorptive capacity proposed in the literature, and theoretical justification is offered to support the adoption of an accepted model and examine each relationship in the adopted model. The second research question is addressed following the detailed examination of absorptive capacity presented.

#### Foundations of the Absorptive Capacity Phenomenon

At the most basic level, the absorptive capacity construct was conceptualized to provide an understanding of how firms adapt in the context of changing environmental influences; thus, the following discussion begins with an overview of organization change to describe the basic foundation on which absorptive capacity was developed. More specifically, systems theory and organizational learning theory have contributed to the conceptual development of the absorptive capacity phenomenon as it is known today. Organization change is discussed to provide a broad foundation for the nature of absorptive capacity and its role in the firm, while systems theory and organizational learning theory are presented to provide insight into the theoretical foundations of the construct.

Organization change. Organization change has been defined as a “modification of the way we do things,” which consists of (but is not limited to) structural changes, decision making changes, and/or alterations to the vision of the organization (Burke, 2002). All organizations experience change to some degree, and given that documented evidence of organizations exists from well before 2000 BC, organization change has existed in some form for centuries (Starbuck, 2003). One of the earliest examples of organization change is recorded in the Old Testament (Burke, 2002). Moses had become leader, counselor, judge, and minister to thousands of Israelite followers, and his father-in-law, Jethro, suggested a reorganization in which Moses would appoint trusted delegates to oversee groups of followers and establish a hierarchical system of authority. While this is likely not *the* earliest occurrence of organization change in history, it is among the first documented and is an example of an organization adapting to better serve its constituents.

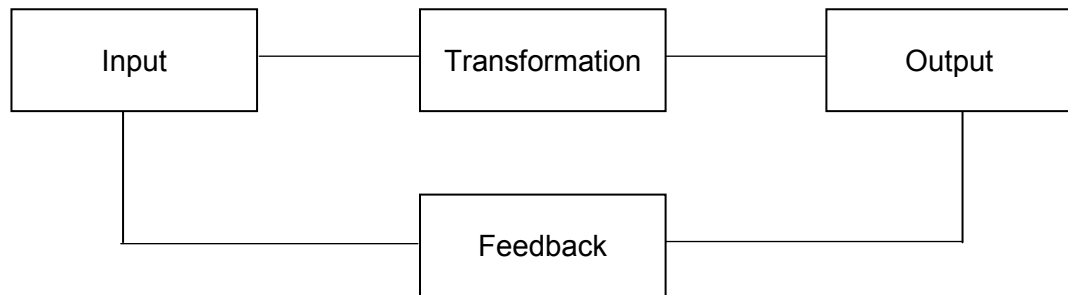
Modern examples of organization change are prevalent in today’s society. For example, in 2000, Proctor & Gamble was experiencing stagnated growth with Tide, their leading fabric and household care brand. The brand was not growing at a rate able to support the firm’s needs. Therefore, executives chose to invest in R&D, and as a result the Connect + Develop program was created to bring in external innovations. By 2010, revenues for the Tide brand doubled, increasing from \$12 billion to nearly \$24 billion (Brown & Anthony, 2011). Even though a

product may have served the firm well in the past, the firm must continue seeking change to support a sustained competitive advantage.

Operationalizing the manner in which firms change is not straightforward; however, researchers have sought to characterize the nature of how change occurs. To this end, theoretical frameworks have allowed researchers to better conceptualize the manner in which change occurs. Systems theory and organizational learning theory are discussed to provide insight into the evolutionary development of the absorptive capacity construct.

Systems theory. Von Bertalanffy (1950) introduced the concept of systems theory in which he proposed interconnections among characteristics of natural, living systems. Systems theory was originally used to explain cellular biology and the manifestation of larger organisms resulting from interactions of smaller subunits. Systems theory employs a macro perspective to understand the interrelationships among subparts to explain observable actions or results of larger phenomena.

Systems theory has been used to explain numerous phenomena in organizations. Katz and Kahn (1966: 17) stated that “all social systems, including organizations, consist of the patterned activities of a number of individuals.” In general, adaptable organizations exhibited certain general characteristics: importation of input, transformation of the input, output of the final product, and feedback on the output. A graphical model of general systems theory is displayed in Figure 4.



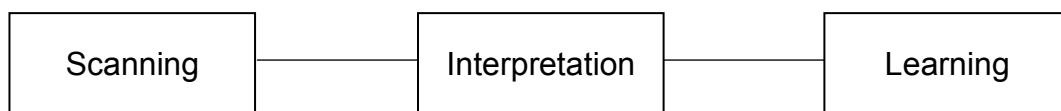
*Figure 4.* Graphical model of systems theory. Based on Katz and Kahn (1966).

When applied to firms, systems theory helps explain how firms adapt to their changing environment. Firms can be classified as open systems given that they remain in contact with their environment and seek adaptation (Katz & Kahn, 1978). The adaptation is theorized as an ordered sequence. For example, if knowledge is viewed as the input, as new knowledge is absorbed from the environment (input), the firm makes changes to become better aligned with its context (transformation), and the performance (output) of the firm indicates the success of the realignment. Results from the output then influence the next iteration of change (i.e., the influence of the feedback on the subsequent input). Argyris and Schön (1978) state that these type of behaviors result in the refinement of knowledge and incorporation of new knowledge, which are behaviors referred to as “single-loop learning” and “double-loop learning,” respectively. The concept of organizational learning provides insight into how firms adapt to changing environments.

Organizational learning theory. Environmental change tends to occur at a faster rate than most firms can learn (Dilworth, 1998). Firms therefore have to

selectively choose the areas of change that need to be addressed. Revans (1983) notes that firms unable to adequately adapt to environmental changes are soon in trouble. Thus, firms constantly struggle to engage in learning to “keep up” with ever-changing environments by engaging in learning.

Organizational learning allows firms to remain competitive. Fiol and Lyles (1985: 803) define organizational learning as “the process of improving actions through better knowledge and understanding.” Through organizational learning, firms are better able to adapt to their environment by altering internal resources, processes, and capabilities. Organizational learning is proposed to occur through a series of stages in which the firm collects knowledge (scanning), internalizes the knowledge, and ultimately takes action based on the knowledge (Daft & Weick, 1984). A graphical representation of this model is displayed in Figure 5. Organizational learning provides a general framework for assessing how firms capture and apply knowledge. Absorptive capacity specifies the manner in which organizational learning occurs.



*Figure 5.* Graphical model of organizational learning. Based on Daft and Weick (1984).

Both systems theory and organizational learning theory are conceptual foundations of the absorptive capacity phenomenon. Systems theory provided a framework that views firms as open, living systems adaptable to changing

environments. Organizational learning theory offers a linear and systematic process by which firms improve performance through the integration of new knowledge. Theoretical developments related to absorptive capacity further detail the manner in which firms take-in and utilize new knowledge for competitive purposes.

#### Development of Absorptive Capacity

The concept of absorptive capacity is rooted in the theoretical frameworks of systems theory and organizational learning given their relation to the dynamic nature of the firm. The term absorptive capacity, however, originated in macroeconomics literature where it was used to explain the ability of a nation's economy to utilize domestic and foreign assets (Adler, 1965). Later, the concept was applied at the firm level to describe the additional in-house benefit that allowed firms to stay atop the latest trends in the industry and assimilate new, external technologies (Tilton, 1971) using rationale from the theoretical frameworks previously referenced.

Traditionally, investments in R&D were seen as enhancing the firm's ability to generate new, innovative knowledge. However, by applying the concept of absorptive capacity, researchers realized an additional benefit from R&D investment. In addition to creating new knowledge for a firm, R&D was seen as enhancing the firm's ability to assimilate and exploit information from outside the boundary of the firm. Thus, in addition to the new knowledge generated from



inside the boundary of the firm, through investments in R&D, the firm is also able to enhance its ability to acquire knowledge.

Although not the first to conceptualized the idea, Cohen and Levinthal (1989) are credited with applying a valuable industrial-organization (IO) economics framework to theoretically explain how this additional benefit was received through R&D investment, and they were the first to clearly term this concept “absorptive capacity” (Lane et al., 2006). Cohen and Levinthal (1989, 1990, 1994) propose that absorptive capacity is the ability of the firm to recognize, assimilate, and exploit new, knowledge for commercial means. While slight variations of the definition are present in the literature, the seminal definition offered by Cohen and Levinthal (1989, 1990) is the most widely cited. Most researchers agree that absorptive capacity is a multi-dimensional construct, although variation exists in their operationalization. The various conceptualizations of absorptive capacity dimensions are reviewed and investigated to determine which operationalization most appropriately represents the construct.

In their seminal definition, Cohen and Levinthal (1990) propose that the ability to recognize value is influenced by the extent of prior knowledge in the firm. If a firm possesses relevant, prior knowledge, then the ability of the firm to identify and recognize the value in new knowledge is enhanced. Conversely, if a firm does not have relevant prior knowledge, it will not appropriately identify new knowledge nor will it recognize the value in new knowledge if it is encountered.

Cohen and Levinthal also propose that once value is recognized, the new knowledge can be assimilated into the firm, and exploited for commercial use.

Following Cohen and Levinthal's (1990) introduction of the construct, Mowery and Oxley (1995) defined absorptive capacity as the skills needed to facilitate the tacit knowledge of technology and the need for modification of external technology for internal application. Kim (1998) stated that absorptive capacity develops problem-solving skills through the firm's capacity to assimilate and modify new knowledge for innovation. The work of Mowery and Oxley (1995) and Kim (1998) are examples of how researchers initially conceptualized absorptive capacity following its introduction to the strategic management literature. As this evolution continued, the manner in which the construct was conceptualized continued to change more distinctly as evidenced by later works.

In 2002, Zahra and George offer a reconceptualization of absorptive capacity, which includes revised internal dimensions of the construct. The first dimension added is acquisition, which refers to the identification of valuable new knowledge as emphasized by Mowery and Oxley (1995) and Kim (1998). This dimension encompasses Cohen and Levinthal's (1990) initial dimension of value recognition. The knowledge assimilation and exploitation dimensions offered by Cohen and Levinthal (1990) are retained, and Kim's suggestion that new knowledge may need modification is the basis for the addition of the dimension of transformation.

The four dimensions proposed by Zahra and George (2000) are categorized into two broad dimensions: potential absorptive capacity (consisting of the acquisition and assimilation dimensions) and realized absorptive capacity (consisting of the transformation and exploitation dimensions). The potential absorptive capacity allows the firm to value and acquire knowledge, while realized absorptive capacity modifies (transforms) and exploits the knowledge. The broad dimensions are used to explain the nature of the internal dimensions and how they work together to constitute the dynamic capability of absorptive capacity

Jansen et al. (2005) perform an empirical examination on the antecedents of absorptive capacity and find that antecedents influence potential and realized absorptive capacity differently, indicating that the functional differences between the dimensions are indeed relevant. Todorova and Durisin (2007), however, propose removing the broad dimensions of potential and realized absorptive capacity citing the more complex nature among acquisition, assimilation, transformation, and exploitation. Additionally, Todorova and Durisin (2007) propose reintroducing the dimension related to recognizing the value of knowledge, which is claimed to be more in line with the original conceptualization by Cohen and Levinthal (1990).

Although the noteworthy contributions by Todorova and Durisin (2007) are acknowledged, more recent conceptualizations of absorptive capacity (e.g., Volberda et al., 2010), operationalize the construct with four internal dimensions.

In the four-dimension models, the recognition of value is assumed to occur during the initial process of knowledge acquisition. Therefore, if knowledge is deemed to have value, it is acquired by the firm; if no value is perceived, its acquisition is less likely to occur. Thus, in line with more widely accepted operationalization, this study uses four dimensions to describe the internal nature of the absorptive capacity construct: acquisition, assimilation, transformation, and exploitation. A review of the literature and a more detailed discussion on each of these dimensions is presented.

#### Dimensions of Absorptive Capacity

Acquisition. Acquisition represents the firm's ability to identify and acquire beneficial knowledge (Zahra & George, 2002). Hamel (1991) notes that the potential to acquire new knowledge will motivate the firm to engage in external relationships (e.g., inter-firm collaborations, partnerships, etc.). Such relationships support the transfer of knowledge, and allow the firm to obtain knowledge from varied sources.

When searching for knowledge, firms engage in "active listening" to frequently and broadly scan the environment (Liao, Welsch, & Stoica, 2003: 67), and as a result of listening and communicating, new knowledge can be acquired from a variety of sources across a diverse spectrum (Fosfuri & Tribo, 2008). By surveying a vast landscape, firms are more likely to identify new, beneficial knowledge. Once the new knowledge is identified and perceived as having

value, the knowledge is then transferred across the boundary of the firm, and other knowledge-based dimensions are utilized.

Assimilation. Assimilation enables the absorption of new knowledge (Daghfous, 2004). The notion of knowledge assimilation is rooted in the work of Piaget (1952), who identified learning processes as consisting of assimilation and accommodation. Although this conceptualization was conducted at the individual level, it has been applied to the firm to describe the assimilation of knowledge (e.g., Todorova & Durisin, 2007). Thus, assimilation represents a firm's ability to "analyze, process, interpret, and understand" (Zahra & George, 2002: 189) newly acquired knowledge.

Assimilation also allows the firm to understand the new knowledge, determine whether the new knowledge fits with the prior knowledge of the firm, and whether the new knowledge must be altered to fit with the existing knowledge structures (Lefkowitz & Lesser, 1988). It is through the assimilation dimension that knowledge is translated to ensure proper fit with the existing knowledge structures in the firm. In other words, assimilation is the analysis and understanding of new knowledge by the firm (Jansen et al., 2005).

Transformation. Transformation allows the firm to refine knowledge routines. After knowledge is internalized and understood, it is then combined with the internal knowledge structures of the firm. Piaget (1952) suggests that accommodation (or transformation) is needed to alter the current schemas to properly fit the new knowledge.

When new knowledge enters the firm, incompatibility may exist between the new and existing knowledge; thus, the cognitive structures of the firm will warrant transformation to ensure proper fit (Todorova & Durisin, 2007).

Transformation allows the firm to modify, adapt, and combine new knowledge with internal knowledge (Fosfuri & Tribo, 2008), and once the knowledge is integrated into the firm, it can then be utilized by the firm. Put differently, the transformation dimension represents the process of combining newly acquired knowledge with existing knowledge when the new knowledge does not have a precise fit with the current knowledge structures of the firm (Lane et al, 2006).

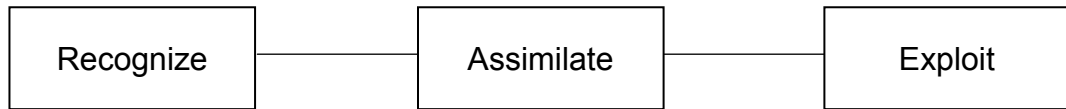
Exploitation. Exploitation supports the process of using the transformed new knowledge to create an incremental change or refinement to the firm's existing value-creating capabilities (Benner & Tushman, 2003; March, 1991). The end result of such change is the creation of new goods, processes, or new organizational forms (Spender, 1996). When newly transformed knowledge is exploited, it results in enhanced competitive advantage for the firm (Cohen & Levinthal, 1990; Jansen et al., 2005; Fosfuri & Tribo, 2008). Exploitation is a component of the link between the acquisition of knowledge and competitive advantage, such that prior to achieving a competitive advantage, the firm must first implement the knowledge acquired and apply it for use.

#### Conceptualizations of Absorptive Capacity Models

The manner in which the internal dimensions of absorptive capacity are related has evolved with the maturation of the phenomenon. Through a review of

the literature, inconsistency was discovered in the conceptualizations of absorptive capacity models. Specifically, various models used to describe the nature of the relationships among the four dimensions of absorptive capacity have different interpretations of the nature of the relationships. The theoretical foundations of the construct, as described by systems theory and organizational learning theory, suggest that firm-based learning occurs through a series of process-oriented stages in which the firm collects knowledge, internalizes and interprets the knowledge, and ultimately takes action based on the knowledge (Daft & Weick, 1984). Thus, the organizational learning lens suggests that the absorptive capacity phenomenon consists of at least three, process-oriented dimensions.

Cohen and Levinthal (1990) proposed a similar process model wherein the relationships among the dimensions are represented as linear and sequential. This conceptualization was similar to the process-oriented model of organization learning in that both conceptualizations consist of a three-dimensional conceptualization in which all dimensions are linearly related. Specifically, Cohen and Levinthal (1990) propose that the recognition of new knowledge is directly related to knowledge assimilation, and knowledge assimilation is directly related to knowledge exploitation. This conceptualization suggests that absorptive capacity converts knowledge in a parsimonious, linear process. A graphical representation of the Cohen and Levinthal (1990) model is proposed in Figure 6.



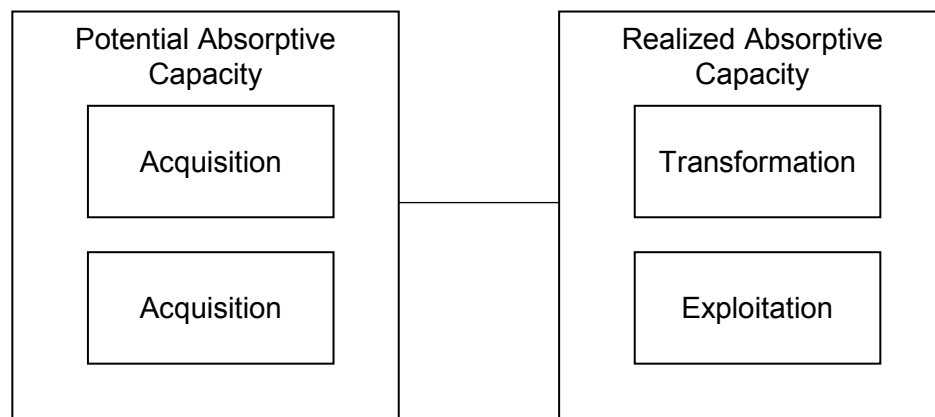
*Figure 6.* Graphical model of absorptive capacity as conceptualized by Cohen and Levinthal (1990).

Zahra and George (2002) later proposed that absorptive capacity is best conceptualized as two, larger dimensions that are directly and sequentially related. This conceptualization varied from earlier models in that (1) four dimensions were proposed, and (2) the four dimensions were suggests to be related as two, higher-level constructs (i.e., potential and realized absorptive capacity). The higher-level constructs were proposed to be directly related given that potential absorptive capacity is related to the exploration-based abilities of the firm, and realized absorptive capacity is more closely related to the exploitation-based capabilities of the firm. Thus, the model proposed by Zahra and George (2002) retained the linear nature of the relationships, yet conceptualized the internal dimensions in a manner unique to earlier models. A graphical representation of the relationships among the internal dimensions of absorptive capacity as proposed by Zahra and George (2002) is provided in Figure 7.

Other research suggests the relationships among the dimensions are more complex. For example, Lane et al. (2006) proposed that after knowledge is obtained through exploratory learning, it is then assimilated through transformational learning prior to being exploited. This operationalization of



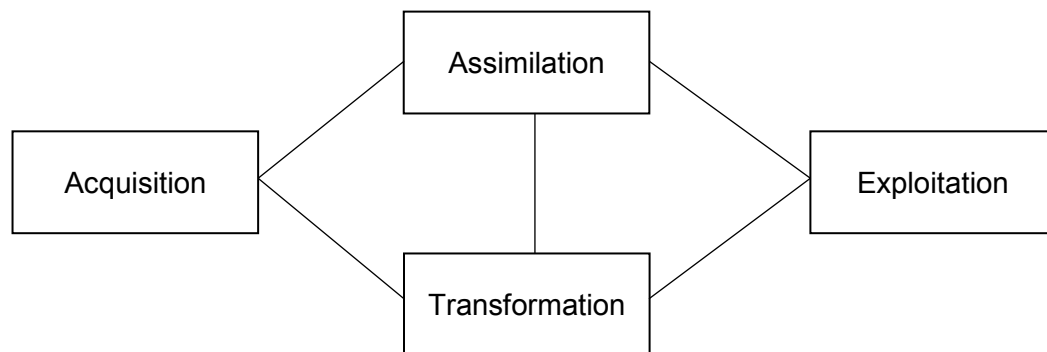
absorptive capacity suggests that an additional transformational dimension is present. The conceptualization by Lane and colleagues (2006) also suggests the internal dimensions are best described as having more than two primary components.



*Figure 7.* Graphical model of absorptive capacity as conceptualized by Zahra and George (2002).

Furthermore, numerous subsequent studies have proposed more complex, multi-dimensional relationships among the dimensions of the construct citing the complexity of knowledge and the multifaceted process needed to refine knowledge for use by the firm (e.g., Lichenthaler, 2009; Sun & Anderson, 2008). Specifically, Todorova & Durisin (2007) proposed that absorptive capacity is more complex than previously conceptualized. To convey the manner in which knowledge is converted, a model of absorptive capacity is offered that incorporates a more central role of the assimilation and transformation dimensions. These dimensions are given a more central process due to the

complexity of the knowledge conversion process. Todorova and Durisin (2007) state that multiple avenues of knowledge conversion are needed to facilitate the transfer and conversion of various forms of knowledge. Specifically, the authors argue that multiple avenues of knowledge conversion are present, which facilitate the conversion of various types of knowledge. A graphical representation of the more complex relationships proposed by Todorova and Durisin (2007) is presented in Figure 8.



*Figure 8.* Graphical model of absorptive capacity as conceptualized by Todorova and Durisin (2007).

Given that the literature has evolved to propose more complex relationships among the dimensions of absorptive capacity, and given that the knowledge conversion process is intricate, the relationships among the dimensions are likely to be more complex as described by Todorova and Durisin (2007). For example, Sun and Anderson (2008) argue that the absorptive capacity phenomenon is represented by a multi-stage, multi-faceted process that is beyond the more simplistic conceptualizations offered by earlier frameworks of absorptive capacity researchers. Furthermore, Lichenthaler (2009) finds

preliminary empirical support for a more complex conceptualization of the knowledge conversion process represented by absorptive capacity. Thus, in line with recent conceptualizations, a more complex model of absorptive capacity most appropriately conceptualizes the relationships among the dimensions of the construct. However, the precise nature of the interrelationships among the individual dimensions remains unclear. Therefore, in the following section, guided by prior research, the relationships among the dimensions are individually examined.

#### Relationships among Dimensions of Absorptive Capacity

Acquisition and assimilation. A firm's acquisition enables the firm to obtain knowledge from external sources (Flatten, Engelen, Zahra, & Brettel, 2011). When new knowledge is perceived as valuable, it is acquired by the firm with the potential to be internalized and integrated (Daft & Weick, 1984; Inkpen, 2002). The value of the new knowledge is assessed using the stock of prior knowledge of the firm (Cohen & Levinthal, 1990), and once valuable knowledge is acquired, it then must be understood by the firm. The analysis and interpretation of knowledge occurs via the assimilation capability.

Szulanski (1996) describes knowledge transfer as a process-oriented sequence in which knowledge resources are obtained by a firm, and following acquisition, the knowledge is then interpreted for use. If the acquired knowledge enters the firm in a form that is not immediately understood, the knowledge must be first interpreted (i.e., assimilated) before it can be further utilized. Given that

knowledge capture and interpretation are positively related in Szulanski's (1996) model, it is likely a similar relationship exists between the acquisition and assimilation dimensions. Therefore, a positive relationship is proposed to exist between acquisition and assimilation.

*Hypothesis 1: Acquisition positively influences assimilation.*

Acquisition and transformation. Transformation is used by firms to refine existing routines (Zahra & George, 2002). Refinement occurs through the combination of existing and newly acquired knowledge, which becomes evident through alterations to internal processes (Jansen et al., 2005). The acquisition dimension is used to identify and attain external knowledge that holds value for the firm. Zahra and George (2002) propose that acquisition and transformation are classified differently (i.e., acquisition is a dimension of PACAP and transformation is a dimension of RACAP), and Sun and Anderson (2010) suggest that acquisition and transformation are not directly related.

Other studies, however, suggest a direct relationship exists between acquisition and transformation. For example, based on findings from Piaget's (1952) study on individual cognition and learning, Todorova and Durisin (2007) suggest transformation acts as an alternative dimension to the assimilation dimension and is more valuable than previously suggested. If the new knowledge acquired by the firm via the acquisition dimension is valuable and similar to the current knowledge structures, the transformation dimension is used to incorporate the similar knowledge into the existing knowledge structures, and no

need exists for the knowledge to be interpreted (i.e., assimilated) by the firm. Once acquired, transformation utilizes the newly acquired knowledge to refine existing routines. With a more integrative role in the utilization of knowledge, the transformation dimension is viewed as an alternative process to assimilation; thus, acquisition is likely to directly influence both the assimilation and transformation dimensions. Therefore, a positive relationship is proposed to exist between acquisition and transformation.

*Hypothesis 2: Acquisition positively influences transformation.*

Assimilation and transformation. Both the assimilation and transformation dimensions are related to the manner in which knowledge is converted for use in the firm. As previously stated, assimilation develops new routines through the interpretation of new knowledge; whereas, the transformation refines existing routines. Through assimilation, knowledge is prepared (via interpretation) to be combined with existing knowledge structures. The transformation dimension enables firms to combine existing knowledge with assimilated knowledge for future use (Zahra & George, 2002). Through assimilation, knowledge is converted and prepared for combination with the existing knowledge structures.

Several studies have examined the nature of this relationship and have proposed a direct relationship between assimilation and transformation (e.g., Todorova & Durisin, 2007; Sun & Anderson, 2010). Lichenthaler's (2009) investigation finds general support for the relationship between exploratory learning (assimilation) and transformative learning (transformation) although the

study used an alternative operationalization of absorptive capacity. Thus, in accordance with the existing literature, as the assimilation dimension is enhanced, the transformation dimension is likely to be similarly enhanced. Therefore, a positive relationship is proposed between assimilation and transformation.

*Hypothesis 3: Assimilation positively influences transformation.*

Assimilation and exploitation. Knowledge analyzed through assimilation is used to develop new routines. However, the manner in which knowledge is utilized post acquisition is inconsistent in the literature. Specifically, Sun and Anderson (2010) propose that the assimilation dimension is indirectly related to the exploitation dimension and the transformation dimension is utilized following knowledge assimilation. An indirect relationship is also assumed in the Zahra and George (2002) model with the relationship between the potential and realized absorptive capacity dimensions.

Alternatively, it is proposed that assimilation is directly related to exploitation (Malhotra, Gosain, & El Sawy, 2005; Todorova & Durisin, 2007) given that the knowledge is utilized by the firm immediately following its interpretation (e.g., assimilation). Furthermore, Lichtenthaler (2009) finds a significant direct relationship between exploratory learning and exploitative learning dimensions of absorptive capacity, which provides empirical support for the link between exploratory (acquisition and assimilation) and exploitation dimensions.

Firms with greater assimilation abilities are better equipped to comprehend a broader scope of knowledge than firms with attenuated assimilation abilities. Thus, firms with expanded assimilation abilities are more likely to have greater exploitation ability due to the firm's ability to comprehend a greater array of knowledge. Therefore, a positive relationship is proposed between assimilation and exploitation.

*Hypothesis 4: Assimilation positively influences exploitation.*

Transformation and exploitation. The transformation dimension of absorptive capacity enables firms to refine existing routines given newly assimilated and acquired knowledge, and the exploitation dimension is used to extract the value from knowledge by applying the new knowledge (Van den Bosch, Volberda, & De Boer, 1999). Firms with relevant, refined routines are more likely to engage in the application of such routines in pursuit of a competitive advantage, and to engage in achieving a competitive advantage, the knowledge must be exploited.

Zahra and George (2002) propose that transformation and exploitation are closely related and exist as components of the realized absorptive capacity dimension. Similarly, Volberda et al. (2010) suggest in their review of absorptive capacity that the dimensions are related, yet the manner in which they are related is not specified. However, Sun and Anderson (2010) offer a conceptualization of the relationship and propose transformation is directly related to exploitation, which is similar to Crossan, Lane, and White's (1999) 4-I

framework that suggests a direct relationship between integration and institutionalization.

Based on the discussion above, the use of transformation to refine internal routines will result in new knowledge ready for the firm to employ. After transformation is used to combine existing knowledge with newly acquired knowledge, routines are expected to be altered so that new knowledge can be used for commercial means. Thus, it is proposed that exploitation is positively related to transformation.

*Hypothesis 5: Transformation positively influences exploitation.*

Given that each relationship among the dimensions of the absorptive capacity construct has been examined (to address the first research question posed), the following discussions move to a higher level of analysis and explain how absorptive capacity influences zero-order capabilities (to address the second research question posed). To begin this discussion, a review of zero-order capabilities is presented followed by the development of the conceptual framework used to operationalize three primary dimensions of zero-order capabilities (namely operational, innovation, and customer capabilities). Following, the relationship between zero-order capabilities and performance is discussed, and last, the relationships between absorptive capacity and the dimensions of zero-order capabilities are hypothesized.



## Relationships among Absorptive Capacity, Zero-Order Capabilities, and Performance

The second primary research question of this investigation is to determine whether a relationship exists between absorptive capacity and zero-order capabilities of the firm. To answer this question, an overview of the development of zero-order capabilities is presented, which identifies three general dimensions of zero-order capabilities that will be used in the study. Then the relationships among the constructs of absorptive capacity, zero-order capabilities, and performance are assessed.

### Development of Conceptual Framework of Zero-Order Capabilities

As noted earlier in this chapter, capabilities are defined as being intentionally created by managers to transform input into output with the goal of achieving competitive advantage through the long-term adaptation, integration, and reconfiguration of resources using idiosyncratic routines. To better understand the precise manner in which capabilities are manifested in the firm, a review of the literature and relevant frameworks was conducted, and three dimensions of zero-order capabilities were synthesized. Rather than identifying new, separate dimensions of zero-order capabilities, this study focuses on synthesizing the major contributions of capability-related studies to better understand the relevance of zero-order capabilities to the firm and to provide a common framework for future studies of capabilities. (See Table 4 for the analysis conducted to synthesize the three dimensions of zero-order

capabilities.) Through an in-depth review of the literature, three overarching dimensions of zero-order capabilities are identified: operational, innovative, and customer capabilities. Operational capabilities are the internal, functional capabilities of a firm that allow for organizational excellence (Hall, 1992, 1993; Treacy & Wiersema, 1993; Day, 1994). Crossan et al. (2009) propose that productivity and cross-unit synergy are beneficial to firm operations, and collectively these attributes are synthesized as operational capabilities. Customer capabilities consist of the capability to provide products/services to the customer in a timely manner, through close, external relationships is essential to success (Crossan et al., 2009; Kaplan & Norton, 2006; Day, 1994; Treacy & Wiersema (1993). The firm's reputation and perception are also considered important factors attributed to the customer capability (Hall, 1992, 1993; Kay, 1996). Last, innovation capability is identified as a dimension of zero-order capabilities because of the importance of learning and innovation (Crossan et al., 2009; Kaplan & Norton, 2006; Kay, 1996). Achieving competitive advantage through unique products/services is a successful strategy supported by innovation capabilities (Hall, 1992, 1993; Treacy & Wiersema, 1993; Day, 1994). Next, each dimension of zero-order capabilities is examined in further detail.

Table 4

*Classification of Zero-Order Capability Dimensions*

Underlying Theoretical Dimensionality of  
Capability Descriptors Found in Literature

| Dimensions of Capabilities Found in the Literature | Proposed Synthesized Dimensions       | Operational Capability                        | Customer Capability           | Innovation Capability   |
|--|---------------------------------------|---|-------------------------------|-------------------------|
|  | Hall (1992, 1993)                     | Functional Capability                         | Positional Capability Results | Regulatory Capability   |
|  | Treacy & Wiersema (1993)              | Operational Excellence                        | Customer Intimacy             | Product Leadership      |
|  | Day (1994)                            | Inside-out Capabilities                       | Outside-in Capabilities       | Spanning Capabilities   |
|  | Kay (1996)                            | Architecture                                  | Architecture; Reputation      | Innovation              |
|  | Kaplan & Norton (2006)                | Process Capabilities; Financial Capabilities  | Customer Capabilities         | Learning Capabilities   |
|  | Crossan, Rouse, Fry, & Killing (2009) | Cross-Unit Synergy; Productivity Capabilities | Speed                         | Innovation Capabilities |

Operational capabilities. Operational capabilities are the internal zero-order capabilities of a firm, or “inside-out” capabilities, influenced by external competition and opportunities (Day, 1994). These internal capabilities relate to

the firm's ability to allocate resources and share common processes across multiple business units (Kaplan & Norton, 2006) and to support cooperation among the various units of the firm (Crossan, Rouse, Fry, & Killing, 2009). Kay (1996) refers to these cross-unit synergies as resulting from architecture of implicit (and sometimes explicit) relationships between firm units.

The internal capabilities resulting from cross-unit synergy and process efficiency result in the firm's ability to produce reliable products/services at competitive prices and deliver to the end user with minimal difficulty (Treacy & Wiersema, 1993; Crossan et al., 2009). The internal capabilities result from the knowledge, skills, and expertise of the firm's employees and others in the value chain that perform specific operational functions (Hall, 1992, 1993). Thus, the following definition of operational capabilities proposed:

Operational capabilities are developed by management using idiosyncratic routines to support cooperation among units and properly configure operational resources with the intent to create a competitive advantage for the firm.

Customer capabilities. Customer capabilities relate to the firm's ability to meet customer demands and the firm's reputation with customers. Treacy and Wiersema (1993) state that successful firms possess the capability to be intimate with customers: to know customer markets precisely and appropriately meet the demands of relevant markets. The capability to respond to customer demands

quickly is vital to success given the dynamic nature of demands (Crossan et al., 2009).

Additionally, through categorically meeting customer demands, firms are able to build a valuable reputation with customers (Hall, 1992, 1993). Kay (1996) views relationships with customers as a type of firm architecture given the importance of the relationships. By investing in “outside-in” capabilities, as termed by Day (1994), firms create durable relationships with customers and are able to anticipate market changes ahead of competition. This ability to leverage customer relationships provides firms with a competitive advantage (Kaplan & Norton, 2006). Thus, the following definition of customer capabilities is proposed:

Customer capabilities are developed by management using idiosyncratic routines to respond to changing customer needs and maintain a valuable firm reputation with the intent to create a competitive advantage for the firm.

Innovation capabilities. Innovation capabilities relate to a firm’s ability to create new products/services (Crossan et al., 2009). Innovation capabilities arise from the ability of the firm to develop its human capital and engage in knowledge management practices (Kaplan & Norton, 2006). Day (1994) states that innovation capabilities arise from the integration of “inside-out” and “outside-in” capabilities that result in the development of new products/services.

The development of innovative outputs allows firms to offer customers leading-edge products/services (Treacy & Wiersema, 1993). If value exists in the innovative output, innovation capabilities may be supported by the possession of legal protections (e.g., trade secrets, property rights, etc.) to minimize the imitability of the firm's products/services that yield a competitive advantage (Hall, 1992, 1993). Thus, the following definition of innovation capabilities is proposed:

Innovation capabilities are developed by management using idiosyncratic routines to create new products/services perceived as valuable by the customer with the intent to create a competitive advantage for the firm.

#### Integrated Research Model

To this point, the relationships among the dimensions of absorptive capacity were hypothesized to conceptualize the manner in which knowledge is converted in the firm. Furthermore, three dimensions of zero-order capabilities were identified through an extensive literature review and synthesis of the extant capability frameworks. In the next section, the relationship between zero-order capabilities and firm performance is discussed, and following, the relationships between absorptive capacity and the dimensions of zero-order capabilities are discussed and hypothesized.

Through the integration of discussions presented in this chapter, a broad perspective of the relationships among capabilities emerges. Specifically, it is demonstrated that first and zero order capabilities are directly related. Furthermore, this analysis goes beyond the highest-level examination and

investigates the relationships among the dimensions of first and zero-order capabilities. This detailed examination will provide researchers and managers enhanced insight into the precise manner in which first and zero-order capabilities are related. To support the lower-level hypothesized relationships of this study, a graphical research model of the relationships is presented in Figure 9, which integrates the relationships proposed from both primary research questions and includes the influence of the relationships on firm performance.

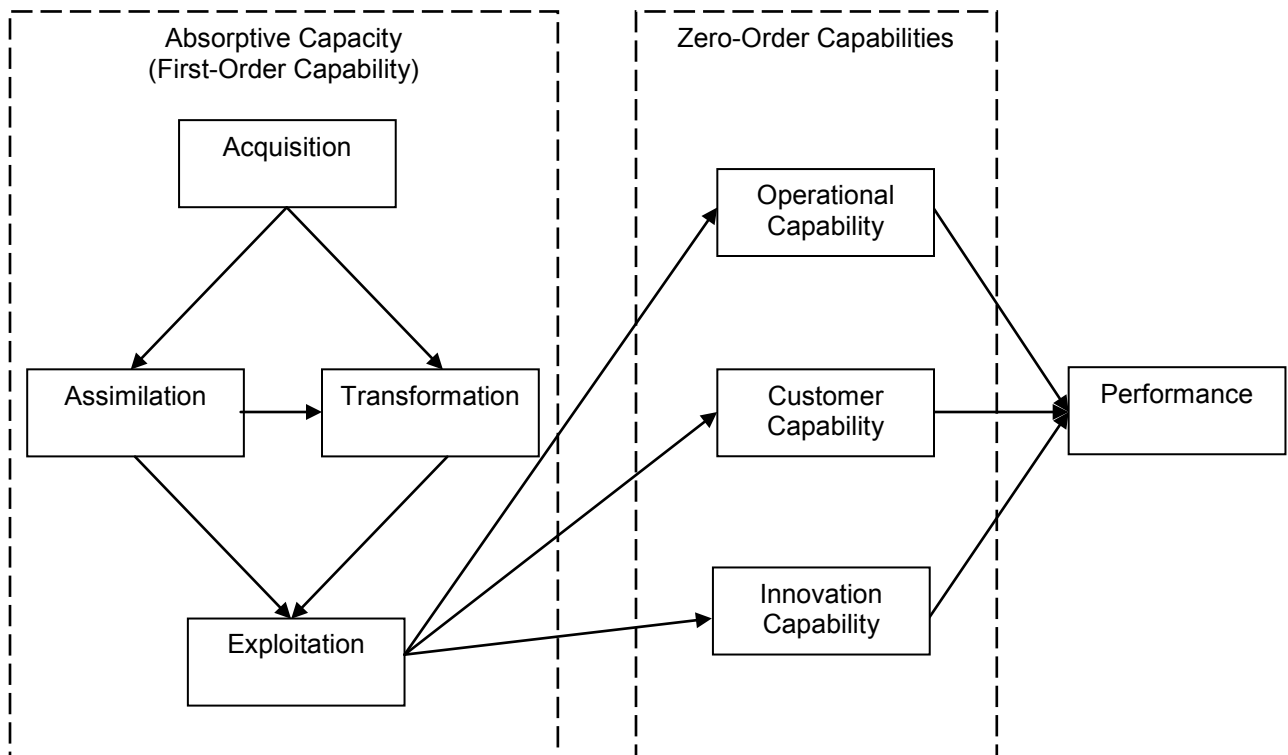


Figure 9. Integrated research model.

It should be noted that the following figures incorporate arrows on lines to indicate relationships among constructs. Arrows are used to provide insight into the process-oriented nature of the hypothesized relationships as demonstrated in

supporting research. Specifically, absorptive capacity researchers (e.g., Todorova & Durisin, 2007) use arrows to indicate the process-oriented nature of relationships among dimensions. Similarly, capability researchers use arrows in graphical models to demonstrate the sequential nature in which dynamic capabilities occur in the firm (e.g., Cepeda & Vera, 2007). Thus, in line with previous research, arrows are included in the theoretical and empirical models of this study to extend the process-oriented nature of the existing literatures.

#### Relationship between Zero-Order Capabilities and Performance Constructs

The relationship between zero-order capabilities and performance is well documented in the literature. Rather than hypothesizing relationships that have been proposed, empirically tested, and are well-accepted in the literature, highlights of the relationship are presented to substantiate the accepted relationships.

Schreyögg and Kliesch-Eberl (2007) state that “[zero-order] capabilities are bound to performance” (p. 915) emphasizing the relationship of zero-order capabilities on firm success. Capabilities are comprised of numerous components including routines. Firm routines do not develop instantaneously; they are developed and refined over time. Thus, investments in capabilities are costly in terms of time and financial resources. If zero-order capabilities were not sufficiently linked with performance, managers would have little incentive to make investments of time and resource to develop zero-order capabilities. Furthermore, given that capabilities are composed of tacit knowledge embedded



in routines, the knowledge is not easily imitated by competitors (Barney, 1991; Spender, 1996). Researchers have examined the link between zero-order capabilities and performance using conceptual and empirical methods. For example, Zahra, Sapienza, and Davidsson (2006) explored a conceptual link between what they term “substantive” (i.e., zero-order) capabilities and performance. Specifically, it is proposed that dynamic (first-order) capabilities are directly related to substantive (zero-order) capabilities, and substantive (zero-order) capabilities are directly related to performance (i.e., zero-order capabilities mediate the relationship between first-order capabilities and performance). Tanriverdi (2005) conducted a study of 250 Fortune 1000 firms and found empirical support for the influence of knowledge management capabilities on cross-unit synergies. Cross-unit synergies support the cooperation among business units and relate to the operational capabilities of the firm. Further, it was found that the resulting synergies influence the firm’s financial performance. Therefore, evidence suggests that zero-order capabilities influence firm performance.

Slater and Narver (1993) found that market responsiveness (in the form of customer capabilities) is associated with high levels of performance for firms categorized as prospectors and analyzers (based on the typology from Miles and Snow, 1978). Building on this finding, Matsuno and Mentzer (2000) found that similar capabilities were beneficial for the performance of all firms notwithstanding their strategic orientation classification. Additionally, Roberts

and Dowling (2002) show that firm reputation is related to performance, and firms with positive reputations are better able to sustain above-normal profits than firms with less positive reputations. Thus, customer capabilities (i.e., remaining responsive to the market, leveraging customer relationships, and firm reputation) influence performance.

Innovation-related capabilities are also shown to be associated with firm performance. Specifically, Pavlou and El Sawy (2011) find support for the influence of zero-order capabilities on performance of new product development, which was measured by product effectiveness and process efficiency.

Calantone, Cavusgil, and Zhao (2002, 2003) conducted two studies of R&D vice presidents from a cross-section of manufacturing and service industries. The findings from their investigations indicate that higher levels of a firm's innovation capability are associated with higher levels of performance. Furthermore, in a comparison of firms, Bharadwaj (2000) found that firms with high levels of information technology capabilities exhibited higher levels of performance than firms with lower levels of information technology capabilities.

In summary, the conceptual and empirical research presented above supports the influence of zero-order capabilities on firm performance. Likewise, operational capabilities (e.g., cross-unit synergies), customer capabilities (e.g., market responsiveness), and innovative capabilities (e.g., new product development) are all shown to have empirically-tested, positive relationships with firm performance. It is accepted in the literature that zero-order capabilities

positively influence performance. In the next section, the relationship between absorptive capacity and zero-order capabilities is further examined.

## Relationship between Absorptive Capacity and Zero-Order Capabilities

### Constructs

Absorptive capacity allows firms to reconfigure zero-order capabilities as market conditions vary (Eisenhardt & Martin, 2000). Conceptual and empirical examinations of research on the relationship between absorptive capacity and zero-order capabilities at the construct level are reviewed, and relationships between absorptive capacity and the dimensions of zero-order capabilities are presented in the following section.

At a broad level, the general influence of dynamic capabilities on zero-order capabilities is acknowledged. For example, Zahra et al. (2006) offer conceptual arguments to support the relationship between dynamic capabilities and “substantive capabilities” (i.e., zero-order capabilities). In their discussion, substantive capabilities are proposed as a mediating influence on the relationship between dynamic capabilities and firm performance. Additionally, Helfat, Finkelstein, Mitchell, Peteraf, Singh, Teece, and Winter (2007: 4) state that “a dynamic capability is the capacity of an organization to purposefully create, extend, and modify its resource base.” Further support is found in the work of Schreyögg and Kliesch-Eberl (2007) who argued that capabilities consist of complex tasks influenced by absorptive capacity. Complex tasks result from the problem-solving nature of capabilities, and absorptive capacity is needed to

adequately manage the complexity of zero-order capabilities. Furthermore, the authors state that zero-order capabilities are the result of an organizational learning process (e.g., absorptive capacity). Thus, adequate research exists to suggest that absorptive capacity influences zero-order capabilities.

Work by Volberda et al. (1999) is among the few theoretical developments to specifically propose a dynamic relationship between absorptive capacity and zero-order capabilities (specifically systems, coordination, and socialization capabilities). They examined the influence of the change in absorptive capacity on the change in zero-order capabilities. They found that when firms take-in and integrate new knowledge, the firm leverages the knowledge through alteration of zero-order capabilities. If firms enhance acquisition, assimilation, transformation, and exploitation abilities, the expanded abilities provide increased leverage to alter other firm capabilities.

Tu, Vonderembse, Ragu-Nathan, and Sharkey (2006) conducted an empirical investigation of a large sample of manufacturing firms (n = 303). Using structural modeling techniques, a strong, positive relationship between absorptive capacity and manufacturing capabilities was found in the firms surveyed. Additionally, through the process of dynamic modeling, Zott (2003) demonstrated that dynamic capabilities influence zero-order capabilities. Specifically, findings indicated that the costs and variation in timing in which dynamic capabilities are used influence performance differences across firms.

Nonetheless, the relationship between dynamic capabilities and zero-order capabilities is supported.

Additional evidence is found in the research by Pavlou and El Sawy (2011) who conducted an empirical investigation of capabilities in the context of new product development. The findings of the research yielded support for the influence of dynamic capabilities on firm performance. More specifically, the relationship between dynamic capabilities and performance was found to be mediated by zero-order capabilities.

Based on conceptual arguments and empirical findings, it is likely that absorptive capacity influences zero-order capabilities. Furthermore, as described by the capability framework proposed by Winter (2003), capabilities are appropriately conceptualized in a hierarchical model. The implications of this model assume that higher-order capabilities influence lower-order capabilities. Thus, it is hypothesized that at the construct level, absorptive capacity influences the zero-order capabilities of firms.

*Hypothesis 6: Absorptive capacity positively influences zero-order capabilities.*

Relationships among Absorptive Capacity and Zero-Order Capabilities

Dimensions

Operational capabilities. Additional research exists supporting the relationship between absorptive capacity and zero-order capabilities at the dimensional level. Levinthal and March (1993) discuss the relationship between

exploitation and efficiency. Specifically, the authors state that through knowledge exploitation (a dimension of absorptive capacity) firms are able to refine internal activities to enhance the efficiency in which the product/service is provided, which conceptually supports the relationship between absorptive capacity and operational capabilities.

Empirical evidence also supports the relationship. For example, Cepeda and Vera (2007) find support for the influence of dynamic capabilities on operational capabilities of a firm through a survey of information technology and communication industries in Spain. Absorptive capacity – as a dynamic capability – has a likely influence on the internal manner in which the firm operates. Tanriverdi (2005) examined knowledge management capabilities, which are related to absorptive capacity, and stated that knowledge management capabilities influence cross-unit synergies, a component of a firm's operational capabilities. Furthermore, another component of operational capabilities is operational efficiency, which is said to be achieved through the utilization of a high level of absorptive capacity (Malhotra et al., 2005). Thus, given the support found in prior literature, it is hypothesized that at the dimensional level, absorptive capacity influences the operational capabilities of the firm.

*Hypothesis 6a: Absorptive capacity positively influences operational capabilities.*

Customer capabilities. The ability to anticipate market requirements before competitors, along with the first-order (dynamic) capabilities to change the

organizational configuration to address the anticipated need allows firms to remain competitive in dynamic industries. Oliver and Holzinger (2008) examine dynamic capabilities in the framework of strategic political management. In their conceptual propositions, the authors state that dynamic capabilities are related to firm reputation, a component of customer capabilities. Specifically, they propose that dynamic capabilities used to enhance reputation (among other factors) will influence the effectiveness of firms' political strategies. Additionally, in a theoretical contribution, Rebolledo, Halley, and Nagati (2009) propose that absorptive capacity is related to tacit and explicit knowledge acquired from the customer. Specifically, they propose the acquisition and assimilation (potential absorptive capacity) dimensions are proposed to have the most influence in the context of customer relationships.

Empirical evidence also supports the relationship between absorptive capacity and dynamic capabilities. For example, Welsch, Liao, and Stoica (2001) find that knowledge acquisition – a dimension of absorptive capacity – is positively related to the responsiveness of firms in a study of small and medium sized firms in the United States. Information collected allows firms to better adapt to changing consumer demands. Additionally, in an investigation of Taiwanese financial service companies, Chen and Ching (2005) find that customer relationship management practices are influenced by the absorptive capacity of the firm. Thus, they recommend that firms seeking to enhance customer relationship management performance focus on altering the absorptive

capacity. Given this and previous evidence, it determined that at the dimensional level, absorptive capacity is likely to have a positive influence on the customer capabilities of a firm.

*Hypothesis 6b: Absorptive capacity positively influences customer capabilities.*

Innovation capabilities. Using case study methodology, Weeks and Thomason (2011) examined the relationship between human resource management practices, absorptive capacity, and innovation. Through the investigation, a model was developed which proposes three human resource practices that influence absorptive capacity and ultimately influence the innovation of the firm. Li (2011) conducted a study that found investment in R&D has a positive influence on firm innovation. Although measures of R&D are not precise measures of absorptive capacity, R&D has been used as a proxy for absorptive capacity in past studies (e.g., Lane & Lubatkin, 1998).

Additionally, other studies have supported the influence of absorptive capacity on innovation capabilities. For example, Liao, Fei, and Chen (2007) examine the influence of absorptive capacity on the innovation capability and find the presence of a relationship. Garcia-Morales, Ruiz-Moreno, and Llorens-Montes (2007) examine a comprehensive theoretical model of absorptive capacity and firm performance. Through empirical testing from data collected from a sample of Spanish technological firms, the authors find that absorptive capacity is positively related to organizational innovation in a study.



Furthermore, in a study of firms from manufacturing and financial industries in Taiwan, Liao, Wu, Hu, and Tsui (2010) find that absorptive capacity directly influences innovation capabilities of a firm using structural modeling techniques. Therefore, it can be determined that at the dimensional level, absorptive capacity has a positive influence on the innovation capabilities of a firm.

*Hypothesis 6c: Absorptive capacity positively influences innovation capabilities.*

### Summary

In summary, this chapter began with an overview of relevant theoretical frameworks used to examine absorptive capacity. Justification was offered for the selection of the capability-based perspective of the firm as an appropriate theoretical perspective for analyzing dynamic phenomena in the context of the firm. The evolution and nature of capabilities was then discussed to provide an overview of the theoretical development of the study of capabilities. Given that research on capabilities is expansive, and numerous definitions have been used in the literature, a review of relevant definitions was presented, and common characteristics that exist in definitions of capabilities were presented. Then, a synthesized definition of capabilities was offered that includes the most frequently cited characteristics of capabilities.

Following the presentation of the synthesized definition, various categories of capabilities were reviewed using the hierarchical framework of capabilities presented by Winter (2003). The hierarchy consists of three levels of capabilities

(namely zero, first, and second-order capabilities). Absorptive capacity was identified as a first-order (dynamic capability), and the scope of this investigation was limited to the examination of first and zero-order capabilities.

The first research question of how absorptive capacity converts knowledge through configuration of the internal dimensions was then examined. To address this question, a conceptual development of the absorptive capacity construct was presented, and its four internal dimensions were identified and defined. While researchers have inconsistently conceptualized the relationships among the dimensions of absorptive capacity, a review of absorptive capacity models was presented and rationale was offered for hypothesizing more complex relationships among dimensions given the complexity of the knowledge conversion process.

Next, the influence of absorptive capacity on firm (zero-order) capabilities was examined. First, conceptual and empirical studies were used to provide support for the existing relationship between zero-order capabilities and performance. Then, the relationships among absorptive capacity (first-order capability) and the dimensions of zero-order capabilities were addressed. To properly identify the dimensions of zero-order capabilities, a review of the literature was conducted, and a framework was developed to synthesize commonly used dimensions of zero-order capabilities. Based on the framework developed, zero-order capabilities are determined to consist of three primary dimensions: operational, customer, and innovation capabilities. The relationship

between absorptive capacity and zero-order capabilities was discussed, and positive relationships were hypothesized to exist between absorptive capacity and zero-order capabilities at both the construct and dimensional levels. In the next chapter, the methodology used to examine the hypotheses presented is discussed.

## CHAPTER III

### METHOD

#### Introduction

This investigation focuses on understanding how absorptive capacity, at the organizational level, converts knowledge and how absorptive capacity influences zero-order capabilities. In an attempt to address these objectives, a quantitative research design is employed. In the previous chapter, both research questions were examined in detail. Following the research questions, hypotheses were developed to support empirical examination of the research questions posed. The hypotheses depict (1) the relationships among the dimensions of absorptive capacity to characterize the knowledge conversion process, and (2) the relationships among absorptive capacity and zero-order capabilities. Additionally, the already substantiated relationships between zero-order capabilities and performance are included in the examination of the integrated research model.

In this chapter, the constructs and measures are first discussed. Specifically, each construct and dimension is operationalized. Additionally, to support a detailed operationalization of measures, sub-dimensions are offered to further quantify dimensions when pertinent. Following the variable operationalizations, the sample used for the study is described. Then, the research design is reviewed, which includes the use of a preliminary study

(consisting of a panel of experts and a student pilot study), an industry pilot study, and the main dissertation study. The sample used in the main study is discussed, and the procedure for collecting data from the sample is outline. Also, the data is evaluated for suitability of empirical testing. The data for the main study are quantitative in nature given that data were collected from the firms and analyzed to examine the proposed hypotheses.

#### Data Collection Method

The data collection method for this study was a survey design. The instrument was administered to top managers in firms. A survey-based design was selected due to the detailed nature of the phenomena studied in this investigation. It was determined that given the rich complexity of the constructs under study, perceptions of the phenomena from managers is more likely to yield rich data specific to the multidimensional constructs. Other forms of data collection (e.g., archival data collection techniques and experimental design techniques) are limited in the ability to capture the richness of multidimensional constructs pertaining to knowledge and capability-oriented measures.

#### Constructs and Measures

This study addresses the relationships among absorptive capacity, zero-order capabilities, and performance. Absorptive capacity was measured using the four dimensions described in detail in Chapter 2. The zero-order capabilities construct was measured using three dimensions also detailed in Chapter 2.

Given the nature of the zero-order capabilities construct and its dimensions, sub-dimensions were identified for each dimension to ensure precise measurement.

Because the main study will need to include control variables to parcel out variance resulting from external influences, an overview of the control variables to be used and the corresponding operationalizations is also provided. Detailed descriptions of the variables are offered to portray the manner in which each was operationalized in this study. Furthermore, when warranted, the items from the original scales described were adapted to fit the generalized context of the array of industries surveyed. In the later section titled “Research Design Enhancements,” specific examples of how items were adapted for the pilot study are described. All items are measured on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) unless otherwise noted.

#### Absorptive Capacity

The absorptive capacity construct was measured using a previously validated scale developed by Jansen et al. (2005). This operationalization of absorptive capacity was used for several reasons. First, the scale conceptualizes absorptive capacity using a well-established, four-dimensional conceptualization (consisting of acquisition, assimilation, transformation, and exploitation), which is in line with previous research of the construct (e.g., Todorova & Durisin, 2007, and others; see Chapter 2 for a detailed discussion on the dimensions). Second, the scales were tested and found to be reliable by Jansen et al. (2005), indicating the measures had reasonable internal validity.

Third, discriminant validity was found to exist among the measures. Fourth, the Jansen et al. (2005) measure is among the only comprehensive measures of absorptive capacity. Given its relative infancy in the literature, few comprehensive measures exist. Therefore, another value added of this study is the ability to contribute to the literature through an additional test of this relatively new measurement scale.

A total of 21 items were adapted for use from the Jansen et al. (2005) scale of absorptive capacity. The dimension of acquisition was operationalized using 6 items, the acquisition dimension had 3 items, the transformation dimension had 6 items, and the exploitation dimension contained 6 items. A sample item of the scale is, "Our firm has frequent interaction with other firms to acquire new knowledge."

#### Operational Capabilities

The operational capabilities construct was measured using a previously validated scale developed by Wu, Melnyk, and Flynn (2010). This operationalization was selected for several reasons. First, the development of the scale of operational capabilities was conducted rigorously and included a panel of experts to review the items, a pilot test with a sample of managers, and validation based on data collected from two samples. Second, the scale was validated in terms of unidimensionality, convergent validity, reliability, discriminant validity, and predictive (nomological) validity. Third, the operationalization included numerous sub-dimensions, which allowed for a more

in-depth investigation into the nature of the phenomenon. This measure of operational capabilities consists of six sub-dimensions; however, given that this scale was developed in the context of operations management, two sub-dimensions were not relevant for the current study. Thus, four sub-dimensions of operational capabilities were used and deemed reliable by Wu et al. (2010): operational cooperation, operational customization, operational responsiveness, and operational reconfiguration.

Cumulatively, these sub-dimensions measure the components of operational capabilities (see Chapter 2). The sub-dimensions can be classified into two, broad groups: (1) the capability to support cooperation among business units and (2) the capability to properly configure operational resources. The operational cooperation sub-dimension describes the capability to support cooperation among units, and the sub-dimensions of operational customization, operational responsiveness, and operational reconfiguration describe how firms properly configure operational resources. Each sub-dimension is further described and operationalized.

Operational cooperation. Operational cooperation is part of a broader operational capability and relates to the ability to bring multiple parties together to share information (Wu et al., 2010). Operational cooperation includes ability to create and sustain healthy relationships among functional areas (Kim, 2006; Swink & Hegarty, 1998). As the uncertainty in the environment increases, operational cooperation capabilities are needed to acquire and synthesize



information and allow parties to gain a mutual understanding of the goals to be accomplished (Wu et al., 2010).

In contexts of increasing change and diversity (among internal business units, suppliers, partners, etc.), coordinating capabilities allows firms to process information effectively and quickly (Koufteros, Voderembse, & Doll, 2002). Furthermore, when multiple business units share common processes, synergies may develop from exploiting core competencies across multiple business units (Kaplan & Norton, 2004). Crossan et al. (2009) propose that cross-unit synergies may further enhance the internal and external cooperation among units.

Operational customization. Operational customization is defined as a firm's capability to possess idiosyncratic abilities that allow for specialized processes and systems. The differentiated sets of skills, processes, and routines for knowledge creation result from the extension and customization of processes and systems (Wu et al., 2010). These internal capabilities may be directed by market requirements, competitive challenges, and/or external opportunities (Day, 1994).

As proprietary processes are developed, firms develop inimitable processes and employees' abilities to improve processes are enhanced, which further increases specific knowledge capital for the firm (Wheelwright & Hayes, 1985). The development of specialized knowledge may result in the firm's possession of legal entities of protection (e.g., intellectual property rights, trade secrets, etc.) (Hall, 1992, 1993). Such operational capabilities that are firm

specific may result in the development of idiosyncratic processes that provide a competitive advantage (Schroeder, Bates, and Juntilla, 2002).

Operational responsiveness. Operational responsiveness is defined as the differentiated skills, processes, and routines that allow a firm to react quickly to changes in input and output requirements to meet customer needs in a timely fashion (Swink, Naraimhan, & Kim, 2005). Having operational responsiveness allows a firm to manage resources (e.g., machines, labor, materials, etc.) in a context of uncertainty (Wu et al., 2010). Providing products/services in the context of changing environment may impose difficulties for a firm; thus, remaining responsive to consumers and providing reliable products/services with minimal difficulty is paramount to possessing operational excellence (Treacy & Wiersema, 1993). Day (1994) refers to such operational capabilities as “inside-out capabilities,” and having the ability to react to changing market requirements and competition in a timely manner supports a firm’s competitive advantage.

Operational reconfiguration. Operational reconfiguration is the capability that allows firms to remain flexible and able to adjust to remain in sync with external forces. Operational reconfiguration focuses on the reshaping (investing and divesting) of resources to remain in line with environmental changes (Wu et al. 2010); the ability to deal with consistent changes becomes a standard “way of life” for firms. Capabilities can be reconfigured through substitution, transformation, and/or exploitation (Lavie, 2006). The extent of the reconfiguration capability – the agility and flexibility – influence performance

(Swafford, Gosh, & Murthy, 2006). Thus, maintaining the capability to reshape, as deemed necessary by a changing environment, is vital for firms in dynamic contexts.

Overall measure of operational capabilities. A total of 13 items were adapted to measure operational capabilities from the scale developed by Wu et al. (2010). The sub-dimension of operational customization contains 4 items, while the remaining sub-dimensions each contain 3 items. A sample item of the scale is, "Our formal procedures facilitate teamwork across departments."

#### Customer Capabilities

The dimension of customer capabilities was measured using scale adapted from a previously validated instrument created by Jayachandran, Hewett, and Kaufman (2004). This operationalization was used for several reasons. First, the development of the scale of operational capabilities used new items and previous items adapted from Kohli, Jaworski, and Kumar (1993). This technique allowed for refinement of the customer capability construct by refining sub-dimensions of the previously used measure. Second, the study incorporated in-depth interviews with managers and confirmatory factor techniques to assess the psychometric properties of the scales. Given that confirmatory techniques were used, the interviews with managers provided additional insight and verification of the items used. Third, this measure was developed in the context of marketing, thus customer expertise was present in the development of the measure. Fourth, the operationalization of customer capabilities included two

primary sub-dimensions that are found to be reliable in the Jayachandran et al. (2004) study: customer response speed and customer response expertise.

Together these two sub-dimensions measure the identified components of customer capabilities: the capability to respond to changing customer needs and the capability to maintain a valuable firm reputation. The response speed sub-dimension describes the capability to support changing customer demands, and the sub-dimension of response expertise describes the capability of the firm to develop durable and reputable relationships with customers. Both sub-dimensions are further described and operationalized.

Response speed. The rate at which firms adapt to changing consumer demands is the response speed capability of the firm. Speed is an important capability as it supports a competitive advantage through first (or early) entry into a market with new products, development of new products, first to obtain government approvals, or first to respond to customer needs (Crossan et al., 2009). As the first to enter a new market or introduce a new product, firms obtain the first-mover benefits.

The ability to obtain the market-leader position is developed through expertise in satisfying customer needs and the use of outside-in (i.e., external customer) capabilities, which are used to anticipate market requirements prior to competitors (Day, 1994). A delay in response speed may limit a firm's capability to take advantage of a new market opportunity (Krubasik, 1988); therefore, prompt action is essential to firm success in dynamic markets.

Response expertise. Response expertise capability is the refined ability to effectively meet changing consumer demands. Firm expertise is developed to appropriately satisfy customer needs (Jayachandran et al., 2004), and it is essential for firms to possess such expertise to effectively meet changing market demands.

Expertise is developed through the use of external customer capabilities to create durable relationships with customers and allow for a more accurate interpretation of consumer needs (Day, 1994). Hall (1992, 1993) proposes that expertise is formed through the creation of a reputation with customers. Furthermore, firms may obtain expertise through proper market segmentation, which allows for precise tailoring of products/services to match market demands (Treacy & Wiersema, 1993).

Overall measure of customer capabilities. A total of 8 items were adapted to measure customer capabilities, and the measure consists of 4 items to measure customer response speed and 3 items to measure response expertise. A sample item of the scale is, "We can easily satisfy new needs of customers."

#### Innovation Capabilities

The dimension of innovation capabilities was measured using a previously validated scale adapted from Liao, Fei, and Chen (2007). First, measurement scale of innovation capabilities used previously developed items. Therefore, this study reconfirmed the validity and reliability of the measures. Second, the study used structural modeling techniques to validate the reliability of the measures

and found that the composite reliabilities, goodness-of-fit measures, and other measures to support a confirmatory factor analysis were within acceptable limits. The validity assessments also yielded support for both convergent and discriminant validities. Third, the operationalization of innovation capabilities included numerous dimensions, which allowed for a more in-depth investigation into the nature of the phenomenon. This measure of operational capabilities consists of three sub-dimensions; however, the dimension of managerial innovation was deemed irrelevant to the current study of innovation capabilities within the context of the capability-based view employed in this study. Therefore, this dimension was removed due to lack of compatibility with the current context, and two sub-dimensions of innovation capabilities were adapted from Liao et al. (2007): product innovation and process innovation.

The sub-dimensions of product innovation and process innovation measure the underlying capability of the firm to create new and valuable products/services, which is defined as an innovation capability. The product innovation sub-dimension describes the capability of the firm to provide a unique product/service to the market, and the process innovation sub-dimension describes the manner in which unique products/services are carried out. Each sub-dimension is further described and operationalized.

Product innovation. Product innovation is defined as the capability to provide a differentiated product/service that satisfies consumer demands. The new products/services are used to obtain satisfaction from customers (Liao et al.,

2007). Differentiated products/services must meet consumer demands in a timely manner. Furthermore, the efficiency with which the product/service is produced will influence the outcomes of the firm (Crossan et al., 2009) due in part to the idiosyncratic nature of the routines used to create the products/services of the firm.

Process innovation. Process innovation incorporates spanning capabilities that integrate inside-out and outside-in capabilities to develop new products/services and internal processes (Day, 1994). The firm's capacity to stimulate and support strategies based on new ideas is essential to innovative responsiveness (Crossan et al., 2009). Through the implement of new systems and/or methods, the firm is able to provide a unique service that is difficult to imitate by competitors (Liao et al., 2007).

Overall measure of innovation capabilities. A total of 11 items were adapted to measure innovation capabilities. The overall measure consists of 6 items to measure product innovation and 5 items to measure process innovation. A sample item of the scale is, "Our firm often develops new products/services that are well accepted by the market."

## Performance

The field of strategic management is primarily concerned with the study of influences on firm performance. Therefore, firm performance is measured in this study to examine the overall influence of the aforementioned constructs on the overall performance of the firm. The assessment of firm performance, however,

is a complex and multidimensional phenomenon (Dess & Robinson, 1984), and the wide-range of measures used to assess performance supports the expansive nature of the construct. To assess performance, researchers have used measures of financial performance (e.g., Davis, Schoorman, Mayer, & Tan, 2000; Robins & Wiersema, 1995), operating performance (Brown, Soybel, & Stickney, 1994), international joint venture performance (Luo, 2002), export performance (Wolff & Pett, 2000), long-term performance (Richard, Murthi, & Ismail, 2007), new product performance (Montoya-Weiss & Calantone, 1994), and innovation performance (Laursen & Salter, 2006). None of the aforementioned measures, however, provides a broad yet comprehensive indicator of performance. Therefore, the performance literature was examined for a multidimensional operationalization of performance that offered insight into the overall performance of the firm.

Bourgeois (1980) conducted an empirical investigation of performance and found that firm goals (e.g., net profit, market share) are as important as the methods used to achieve the goals (e.g., employee morale, customer service), whereas previous studies focused primarily on the achievement of the end-result. Similarly, in a comparison of approaches taken to measure performance in strategic management research, Venkatraman and Ramanujam (1986) propose that firm performance, “which reflects the perspective of strategic management, is a subset of the overall concept of organizational effectiveness” (p. 803). A



broader conceptualization of performance is recommended by the authors that includes emphasis on financial and non-financial performance measures.

In their study on measuring firm performance, Dess and Robinson (1984) agree that firm performance is a multi-dimensional measure, and it is proposed that subjective performance assessments may be useful in operationalizing non-financial performance measures. This is recommended in light of their findings, which yield correlations between measures of objective and subjective performance indicating that there is overlap between the measures, yet the level of unshared variance suggests that subjective measures may be capturing a broader phenomenon. In their conclusions, the authors state that subjective measures are likely to be useful in obtaining broader, non-economic dimensions of firm performance.

Therefore, to obtain a comprehensive measure of firm performance, a multi-dimensional operationalization is appropriate. In line with the work of Dess and Robinson (1984), this study employs a synthesized measure of firm performance that contains dimensions of financial performance (including market performance) and organizational health (based on the goal approach examined by Ford and Schellenberg, 1982).

Financial performance. Financial performance was measured using financial indicators to assess the fulfillment of economic goals of the firm (Venkatraman & Ramanujam, 1986). To measure output performance several indicators were used. Measures of firm sales, revenue, and net profit were used

to measure firm output performance (Bourgeois, 1980). Specifically, this measure captures the financial performance in terms of: ROA, net profit, sales growth, market share, and overall financial performance. All measures were provided to describe output for the most recent year-end.

Organizational health. The second dimension used to measure performance was organizational health. Ridgway (1956) was among the first to propose a broad measure of firm performance rather than a single indicator, and Grady (1991) suggests that performance measures should be balanced to include multiple measures of evaluation. A complement to financial indicators of performance is the organizational health of the firm (Crossan et al., 2009). Organizational health consists of indicators such as job satisfaction, employee morale, and similar internal measures to offer insight into non-tangible factors of the firm (Gilly & Rasheed, 2000). Thus, the measure of organizational health was included to offer an overall assessment of firm effectiveness beyond traditional measures of performance. The overall health of the firm was measured using the manager's perception of numerous factors including (but not limited to) employee morale, employee turnover, and customer relationships.

#### Control Variables

The use of control variables is essential to empirical research given their ability to nullify unwarranted effects on the dependent variable (Kerlinger & Lee, 2000). Numerous variables are used in absorptive capacity research to minimize external influences. Firm size (Lenox & King, 2004), nature of competition/

industry (Tsai, 2001), firm age (Minbaeva, Pedersen, Björkman, Fey, & Park, 2003), type of firm (e.g., product or service oriented) (Jansen et al., 2005), and whether the firm is a subsidiary of another firm (Vinding, 2006) are examples of a few most commonly used control variables in this line of research. A control variable for the type of firm is not relevant to the current context given that the items were adapted to suit both product and service firms. Additionally, controlling for whether a firm is a subsidiary is inconsequential given that the measurement items used are specific to the firm level of analysis. Furthermore, the data was collected from all firms in the software industry; thus, a control variable to assess the influences of various industries is unnecessary. Therefore, control variables incorporated in the main study will be used to control for firm size and firm age.

Firm size. The size of the firm is shown to be influential on the manner in which the firm utilizes knowledge and engages in innovation. Specifically, smaller firms are generally more innovative than larger firms (Nootebloom et al., 2007). Thus, to minimize such differences in the data analysis, a control variable for firm size was used. To measure firm size, the number of employees was used to determine the size of the firm. Respondents were asked to report the exact number of employees in the firm for the most recent year end.

Firm age. Research suggests that established firms, which have had time to develop and refine capabilities, have an advantage over younger firms that are in the process of developing and refining capabilities related to knowledge

processing and innovation (Nootebloom et al., 2007). To account for the variation present among firms, a control variable of age was used. This variable was measured using an item included on the questionnaire, which includes six categories of age: fewer than 5 years, 6-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, and 50 + years.

#### Common Method Variance

Common method variance exists when “the measurement technique introduces systematic variance into the measure” (Doty & Glick, 1998: 374). To minimize the potential of effects from common method variance, Podsakoff, MacKenzie, Lee, and Podsakoff (2003) recommend including controls in the design of the procedures of the study and incorporating statistical controls. Prior to administering the survey, numerous procedural controls were instituted to minimize the presence of common method variance. For example, the anonymity of respondents was guaranteed in the cover letter and in the survey instructions with the reporting of identifying information being optional.

Additionally, the scale items were refined prior to administration of the survey to avoid vague concepts, keep questions simple, ensure items were concise, and forego complicated syntax.

Furthermore, statistical remedies were used to assess common method variance. First, Harman’s single-factor test was conducted, which is one of the most widely used techniques (Podsakoff et al., 2003). In this test, the constructs are examined to assess whether a single factor emerges from the factor analysis

and account for the majority of the covariance. Through the use of Harman's test, it was determined that common method variance did exist given that one factor accounted for 53 percent of the overall variance. Therefore, to remedy the influence of common method variance, a statistical technique was used to partial out the unexplained variance due to the common method bias. Specifically, a marker variable was included in the structural model to eliminate the presence of unaccounted variance due to the bias (Lindell & Whitney, 2001). It is recommended that a marker variable be a construct that is unrelated to the phenomena examined in the study; thus, a measure of the affective state of the respondent was included in the questionnaire. The measure consisted of 3 items adapted from a scale used by Menguc and Auh (2010). A sample item is "Minor setbacks tend to irritate me substantially."

#### Pilot Studies

Numerous advantages exist to conducting pilot studies prior to a larger scale investigation. Pilot studies help researchers minimize uncertainty by testing the appropriateness of research instruments, determine the feasibility of a full study, establish the effectiveness of the research design, and identify logistical problems (Van Teijlingen & Hundley, 2001). De Vaus (1993: 45) cautions, "Do not take the risk. Pilot test first." Given the benefits associated with pilot testing, a pre-test pilot study (consisting of a panel of experts and a student sample) was conducted followed by a pilot test conducted using a multi-industry sample. The details of each phase are discussed.

## Pre-Testing

Although pilot testing is generally advised to provide the researcher insight into the measurement instrument used prior to conducting the main study, pre-testing the instrument was exceptionally important in this investigation for numerous reasons. Primarily, the absorptive capacity construct and respective measures are relatively new to the literature. Unlike other phenomena that have been studied for many decades (or longer), the absorptive capacity construct remains in its early phases of development. Therefore, pre-testing the measurement instrument was important to determine potential weaknesses of the items and to allow the items to be refined prior to administration. Additionally, pre-testing the instrument provides an insight into the context of the sample. As was determined after the pilot study of numerous industries, the number of industries sampled warranted restriction, thus the focus of the primary data collection occurred in a single industry to provide a deeper insight into the phenomena studied by eliminating unnecessary influences resulting from a multi-industry analysis. Overall, the pre-testing phase of this study provided valuable insight that strengthened the main study. Details of the process and refinements are described.

Prior to conducting the pilot study, a panel of three strategic management experts was assembled. Each panelist was familiar with the concept of absorptive capacity and its role in the firm. Panelists were asked to separately review the items used to measure absorptive capacity and zero-order

capabilities, and each expert was asked to comment on (1) whether the items used seemed to measure the respective dimension of the construct specified, and (2) whether the items were appropriately and clearly worded. Suggestions received from each panelist were compared, and modifications were made to the items as warranted by a majority of panelists (i.e., if two of three experts offered a recommendation, the recommendation was implemented).

After feedback on the items was incorporated from the panelists, the items were combined into an online survey and pre-tested with a sample of students. The questionnaire was incorporated in an ongoing instrument used to test classroom technology, and approval was received from the Institutional Review Board (IRB) of the university at an earlier date. Students from the Business Policy (Capstone) course were used for this pre-test given that (1) the students in the course consist of a cross-section of majors (i.e., students from all business disciplines are required to take the course prior to graduation); (2) students take the course in their final semester prior to graduation, so most have work experience or (at minimum) numerous semesters of exposure to business-related concepts, and (3) the course is based on a case model of experiential learning in which students are organized in teams to act in the capacity of consultants to solve real-world business issues.

The survey was combined with additional items and was offered to students for a minimum amount of course credit (an amount that was equivalent to less than 0.01 percent of the overall grade). A total of 252 students

participated in the study, and when the responses were aggregated to the group level, the student sample consisted of data from 44 teams. The items were adapted to fit the context of the student team in the course; therefore, the student team was proposed to exist in a competitive industry (i.e., the classroom) much like firms exist in a competitive industry of peer firms. The aggregated data was used to examine the factors and items. From the data, it was concluded that minor alterations should be made to ensure the appropriateness of the survey items. Those refinements are discussed.

Refinement of survey items. To ensure the measurement items were appropriate for the sample, the items were adapted to fit the context of a cross-section of firms. With the information gathered from pre-testing, items were selected for refinement due to one or more of the following factors: (1) to enhance item generalizability to a broader cross-section of industries (i.e., the original item was specific to a specific type of firm/industry), (2) to minimize the common method variance (in line with the recommendations from Podsakoff et al. (2003), and/or (3) to address issues surfaced from the student pilot study. Details are provided on examples of specific alterations made given the criteria of the aforementioned factors.

Refinement of item generalizability. Each item was reviewed to ensure it was relevant to firms in high-growth contexts. For example, the scale used to measure operational capabilities was developed in the context of operations management, thus some items included references to equipment or specific



operational processes that were not generalizable across firms. Such items were identified and adapted to enhance overall generalizability. A specific example of this type of adaptation is found in the sub-dimension of operational customization, where the original item stated, “Our equipment has been used in unique ways that differentiate us from competitors.” To enhance the generalizability of this item to a cross-section of firms, the item was adapted to state, “Our resources are used in ways that differentiate us from our competitors.”

Refinement to minimize common method variance. Another factor considered when examining items was the reduction of common method variance. Podsakoff et al. (2003) state that common method variance can be reduced through the use of numerous procedural remedies including avoiding vague concepts, ensuring simplicity of items, and avoiding complicated wording. Each item was reviewed and assessed for its “readability” in line with the recommendations offered by Podsakoff and colleagues. When complex or confounding items were identified, the syntax of the question was altered with careful intent to retain the underlying meaning of the item. For example, an item measuring the sub-dimension of customer response speed originally stated, “When we find that customers are unhappy with the appropriateness of our product or service, we take corrective action immediately.” This item was adapted to a simpler form: “We take corrective action immediately when we find that customers are unhappy with our product/service.”

Refinement from student pilot study feedback. Items were also examined using empirical data obtained from the student pilot study. From data obtained, correlational analyses were used to determine to what extent the items exhibited convergent and divergent validity. In dimensions or sub-dimensions where items did not correlate highly with items in which it was intended to do so (an indicator of low convergent validity), special attention was given to items respective items. For example, three items are used to measure the sub-dimension of operational responsiveness. The Pearson Product-Moment Correlation Coefficient (or simply the Pearson correlation) was used to examine the relationship between the variables. The correlational analysis indicated that the items have moderate correlation (0.50, 0.60, and 0.514) compared to an expected value of 0.70 or greater to indicate a strong, positive correlation (Pearson, 1907). For example, one item originally stated, "We reduce uncertainty of equipment availability by quickly and easily changing the route of a job flow." Thus, the item was revised to state, "We can reduce uncertainty of resource availability by changing the operational processes" to emphasize the underlying phenomena being questioned. Similar adaptations were made to each of the three identified items in this case to emphasize the focus on operational responsiveness and thereby enhance the overall convergent validity.

#### Industry Pilot Study

After the survey items were refined, a pilot study of firms in high-growth industries was conducted. Prior to commencing the industry pilot study,

authorization was obtained from the university's Institutional Review Board (IRB) to conduct the study (application number 11-257). Approval was granted to administer a written survey to top executives of firms in high-growth industries in the United States. The questionnaire consisted of 13 sections and 132 total questionnaire items pertaining to the absorptive capacity, zero-order capabilities, performance, and related constructs.

To better understand the general nature of the underlying phenomena examined, a cross-section of firms from high-growth industries was sampled for the pilot study. First, an assessment of industries in the United States was conducted to determine which industries are classified as high growth. According to the United States Department of Labor Bureau of Labor Statistics, 20 industries are identified as "fastest growing" based on past and projected employment from 2008-2018 (United States Department of Labor, 2010).

Of the 20 identified industries, not all were relevant to the context of this study. For example, health care and secondary education were among the high-growth industries identified, but due to the public nature of these industries and additional restrictions imposed by federal and state governments, which may influence the competitive nature of firms in the respective industries, the elimination of less relevant industries was conducted to ensure the industries were applicable to the context of the study. Thus, after review of each industry, only industries that related to professional and business services, information, financial activities, or other services were included. Thus, the following 11

industries were identified as relevant high-growth industries relevant to this study (as displayed in Table 5): Computer Systems Design and Related Services; Data Processing, Hosting, and Related Services; Facilities Support Services; Lessors of Nonfinancial Intangible Assets (Except Copyrighted Works); Management, Scientific, and Technical Consulting Services; Other Information Services; Personal Care Services; Scientific Research and Development Services; Software Publishers; Specialized Design Services; and Waste Management and Remediation Services.

Table 5

*Study-Relevant High-Growth Industries*

| Industry Name  | NAICS Code | Industry Sector                    | Brief Description  |
|--|------------|------------------------------------|--|
| Computer systems design and related services                         | 5415       | Professional and business services | <ul style="list-style-type: none"> <li>• Design computer and information systems</li> <li>• Develop custom software programs</li> <li>• Provide computer facilities management services</li> <li>• Other functions such as software installation and disaster recovery services</li> </ul>   |
| Data processing, hosting, and related services                       | 518        | Professional and business services | <ul style="list-style-type: none"> <li>• Provide infrastructure for hosting and/or data processing services</li> </ul>   |
| Facilities support services  | 5612       | Professional and business services | <ul style="list-style-type: none"> <li>• Engage in a combination of services including janitorial, maintenance, trash disposal, guard and security, mail routing, reception, laundry, and related services to support operations in facilities</li> <li>• Provide operating staff to carry out these support activities, but not involved with or responsible for the core business or activities of the client</li> </ul> |
| Lessors of nonfinancial intangible assets (except copyrighted works) | 533        | Financial activities               | <ul style="list-style-type: none"> <li>• Assign rights to assets (such as patents, trademarks, brand names, and/or franchise agreements) for which a royalty payment or licensing fee is paid to the asset holder</li> <li>• Typically own patents, trademarks, and/or franchise agreements and allow others to use or reproduce for a fee</li> </ul>  |
| Management, scientific, and technical consulting services            | 5416       | Professional and business services | <ul style="list-style-type: none"> <li>• Provide advice and assistance to organizations on diverse management issues (e.g., strategic and organizational planning, financial planning and budgeting, marketing objectives and policies, etc.)</li> </ul>   |

*(table continues)*

Table 5 (continued).

| Industry Name                                | NAICS Code | Industry Sector                    | Brief Description   |
|--|------------|------------------------------------|---|
| Other information services                   | 519        | Professional and business services | <ul style="list-style-type: none"> <li>Supply, store, and provide access to information; search and retrieve information; operate web sites that allow searching of information or publishing and/or broadcasting content exclusively on the Internet</li> </ul>  |
| Personal care services                       | 8121       | Other services                     | <ul style="list-style-type: none"> <li>Provide appearance care services to individual consumers (e.g., barbers and beauty shops)</li> </ul>   |
| Scientific research and development services | 5417       | Professional and business services | <ul style="list-style-type: none"> <li>Conduct original investigations to gain new knowledge (research) for the creation of new or significantly improved products or processes (experimental development)</li> </ul>   |
| Software publishers                          | 5112       | Information                        | <ul style="list-style-type: none"> <li>Produce and distribute computer software (e.g., designing, providing documentation, assisting in installation, and providing support services to software purchasers)</li> </ul>   |
| Specialized design services                  | 5414       | Professional and business services | <ul style="list-style-type: none"> <li>Provide specialized design services (except architectural, engineering, and computer systems design)</li> <li>Includes interior, industrial, graphic, and other specialized design services</li> </ul>   |
| Waste management and remediation services    | 562        | Professional and business services | <ul style="list-style-type: none"> <li>Collection, treatment, and disposal of waste materials</li> <li>Including services in local hauling of waste materials, operating materials recovery facilities, providing remediation services, and providing septic pumping and other miscellaneous waste management services</li> </ul> |

*Note.* Relevant industries considered high-growth for 2008-2018 as identified by the United States Department of Labor Bureau of Labor Statistics (2010) are displayed. Data obtained from United States Department of Labor (2010) and United States Census Bureau (2011).

Firm selection. Detailed information for all firms in the aforementioned 11 high-growth industries was obtained from D&B's Million Dollar Database. The available information included, but was not limited to, the following data: name of firm, full mailing address, telephone and fax numbers, website address, year established, previous year sales amount, number of employees, type of ownership (e.g., minority/women owned), lines of business (classified as primary and top five NAICS codes), names of top executives (e.g., chief executive; vice president; director; engineering, human relations, IT, marketing, plant, sales, and other manager).

Once the data for all firms was downloaded, only firms listing one of the identified high-growth industries as the primary NAICS (North American Industry Classification System) code were retained. This ensures the firms have a primary focus in the industry identified. Then, given that some firms existed in multiple industries, the dataset was cleaned of duplicate firms, and the existence of duplicate CEOs and firm addresses were examined to ensure that multiple descriptions of the same firm were eliminated. (For example, Ventura Holdings and Ventura, LLC, both with the same address, are not likely to be completely separate entities). Firms with similar cases were investigated and removed on a case-by-case basis if warranted. Also, firms that were established in the year 2006 or later were removed to minimize the influence of external influences resulting from recent establishment of the firm.

Once the database was cleaned, complete information for 10,964 firms in the 11 industries remained. The distribution of firms in the full dataset is provided in Table 6. The distribution of firms (obtained from information available from the D&B Million Dollar Database) was compared with data available on the total sales receipts available for the identified industries. An analysis of the sales receipts identified the Computer Systems Design and Related Services industry (NAICS code 5415) and the Management, Scientific, and Technical Consulting Services industry (NAICS code 5416) as the largest industries in terms of receipts (shares of approximately 25% and 29% respectively).

The entire database of firms was ordered based on industry type and size of the firm (size ranked by number of employees). A sample of approximately 20 percent of the firms in the overall database was used. Specifically, 2,000 of the 10,964 firms were sampled for this pilot study. This estimate was calculated based on estimates garnered from a power analysis. To calculate the needed sample size, Cohen (1992) recommends a power value of 0.80 or higher, an alpha level of 0.05, and a suitable effect size: small (0.20), medium (0.50), or large (0.80). A small effect size is assumed, thus a sample size of at least 40 is required for a power value of 0.95 and an alpha of 0.05 based on a calculation using GPOWER statistical software version 3.1. Shih and Fan (2008), in a meta-analysis of web and mail surveys, indicated that mail surveys range from 10 percent to higher depending on technique used and other factors. Therefore, a sample of 400 would be needed (at a 10 percent response rate) to yield a sample



of 40. However, a sample of 2,000 was used to enhance the likelihood that an appropriate sample was achieved in a timely manner.

The survey was then mailed via the United States Postal Service to the top executive of each firm, and in cases where information on the CEO/president was unavailable, the individual with the next highest rank of executive office was targeted. The survey was sent with an enclosed cover letter explaining the nature of the survey. Respondents were asked to complete the survey within two weeks (a specific deadline date was provided) and to return the survey using the enclosed, pre-printed and pre-paid business reply envelope. No cash reward was provided; however, participants were offered a free, customized report of their firm's absorptive capacity and zero-order capabilities compared to the industry average surveyed. Participants interested in receiving the complimentary report were asked to provide a name and mailing address at the end of the report to ensure delivery upon completion of the study. Two weeks after the stated deadline for surveys to be returned (and four weeks after the initial mailing), the final survey count was taken, and the survey was closed to assess the current data.

Table 6

*Distribution of Firms by Industry*

| Industry Name  | NAICS Code | Industry Sector                    | Number of Firms in Industry Dataset | Percentage of Firms in Industry Dataset |
|--|------------|------------------------------------|-------------------------------------|---|
| Computer systems design and related services                         | 5415       | Professional and business services | 3,274                               | 29.86                                   |
| Data processing, hosting, and related services                       | 518        | Professional and business services | 455                                 | 4.15                                    |
| Facilities support services  | 5612       | Professional and business services | 222                                 | 2.02                                    |
| Lessors of nonfinancial intangible assets (except copyrighted works) | 533        | Financial activities               | 222                                 | 2.02                                    |
| Management, scientific, and technical consulting services            | 5416       | Professional and business services | 3,575                               | 32.61                                   |
| Other information services   | 519        | Professional and business services | 188                                 | 1.71                                    |
| Personal care services   | 8121       | Other services                     | 101                                 | 0.92                                    |
| Scientific research and development services                         | 5417       | Professional and business services | 1,017                               | 9.28                                    |
| Software publishers  | 5112       | Information                        | 634                                 | 5.78                                    |
| Specialized design services  | 5414       | Professional and business services | 185                                 | 1.69                                    |
| Waste management and remediation services                            | 562        | Professional and business services | 1,091                               | 9.95                                    |
|  |            |                                    | Total:<br>10,964                    | Total:<br>100%                          |

Pilot study descriptive statistics. In total, 2,000 firms were surveyed from industries classified as high growth. Of the firms surveyed, 184 were returned for undeliverable addresses. Of the 1,816 firms receiving the survey, 20 useable responses were received yielding a response rate of 1.10 percent. While the percentage of responses received from the industry pilot study were discouraging, valuable feedback was provided on what may be expected in the main study, which prompted a reconsideration of the research design techniques to be employed. Alternatives for supplemental research designs are discussed later in this chapter. In Table 7, is a distribution of the responses received from each industry. As noted, the majority of responses received were from the Computer Systems Design and Related Services industry.

The firms from which data was collected consisted of between approximately 100-250 employees. Five firms were described as having fewer than 100 employees, while 4 firms were described as having greater than 250 employees. Furthermore, most of the firms in the analysis were between 10-30 years old. Additionally, of the respondents, 18 described his/her position as the top manager of the firm (e.g., CEO), and 1 respondent self-reported a classification of a middle manager (e.g., general manager). The majority of the respondents had between 20-39 years of professional experience, while no respondents indicated having fewer than 10 years of experience. This confirms that the majority of respondents had ample experience in the business context and was appropriately qualified to answer the questionnaire items.

Based on the data received from the industry pilot study, the survey items were assessed using the reliability values to obtain information for refinements to be made to the questionnaire items prior to administration of the main survey. Next, details of reliability are provided along with the results of the respective tests from the industry pilot study.

Table 7

*Response Rate from Respective Industries Surveyed*

| NAICS Code | Name of Industry   | Responses Received |
|------------|--|--------------------|
| 5415       | Computer systems design and related services                   | 6                  |
| 518        | Data processing, hosting, and related services                 | 2                  |
| 5612       | Facilities support services                                    | 1                  |
| 533        | Lessors of nonfinancial intangible assets (except copyrighted) | 0                  |
| 5416       | Management, scientific, and technical consulting services      | 3                  |
| 519        | Other information services                                     | 0                  |
| 8121       | Personal care services   | 0                  |
| 5417       | Scientific research and development services                   | 0                  |
| 5112       | Software publishers  | 1                  |
| 5414       | Specialized design services                                    | 0                  |
| 562        | Waste management and remediation services                      | 1                  |
|            | Unspecified (not provided)                                     | 6                  |

Refinement of survey items. The internal reliabilities for the items from the pilot study were examined, and all reliability scores indicate exemplary or extensive reliability, except for three, which indicate moderate reliability. The acquisition dimension has a reliability score of 0.69, which is classified as moderate. Through an examination of the reliabilities, it was determined that upon removal of the item stating “Our firm periodically organizes special meetings with customers or third parties to acquire new knowledge,” the internal reliability increased to 0.76. This increase may be indicative of poor wording of the item. Specifically, this item, and no other item in this dimension refers to “special meetings” being arranged between the firm and external third parties. Other items refer to the general acquisition of new knowledge through rather general, informal means. Therefore, for the main study, this item was rephrased to eliminate the emphasis on the arrangement of specialized meetings and refocus on the more generalized knowledge acquisition between the firm and third parties (e.g., customers).

The transformation dimension of absorptive capacity has a reliability of 0.68, which is classified as moderate. After reviewing the items, it was determined that the reliability could be increased to 0.78 if the item stating, “Our firm periodically meets to discuss consequences of market trends or new product development” was removed. No other item removal warranted as large of a positive change in the reliability upon removal. This warranted a re-examination of the question. For the main study, the double-barreled component of this

question (which may have confounded participant responses to the item) was removed.

Additionally, the exploitation dimension of absorptive capacity yielded a reliability value of 0.60. Upon examination of the items and reliabilities, it was determined that removal of the item stating, “Our firm has a clear division of roles and responsibilities” produced the largest positive change in the reliability score of all items. This indicates that the item should also be reconsidered. To add clarity to the statement, the item was rephrased as follows for the main study: “Our firm has a clear division of job duties.” Generally referring to a division of roles and responsibilities may be interpreted differently depending on the context of the firm. Thus, an attempt was made to standardize the relevance of the question as much as possible to ensure the item examines a similar phenomenon across firms.

Overall, the results of the reliability analysis indicate the items used were appropriately adapted to the context of the current study and are likely to be suitable for use in the main study. Although this interpretation should be taken cautiously given the low response rate, no reliabilities were substantially recommended levels to indicate the absence or minimal presence of internal reliability among the items. Next, details about the data collection for the main study are reviewed.

## Main Study

### Research Design Enhancements

Given the information gathered from the preliminary and pilot studies, numerous enhancements were garnered that benefitted the research design of the main study. Those enhancements included refinements of scope, survey administration, length, incentive offered, terminology, and format. Each of the refinements made to the main study is discussed.

Refinement of scope. The pilot study was conducted using a broad cross-section of industries identified as high growth. Of the eleven industries surveyed, zero responses were received from six industries. Thus, a more narrow scope was implemented for the main study to provide more focus to the survey and to conduct the study in a context where firms are more likely to respond to questions related to changes concerning their firms. Specifically, the software industry was used as the context for the main study given the high rate of change in the software industry. Specific details of the sample will be provided in a later section; however, numerous studies have used the software industry as a context for absorptive capacity-related studies (e.g., Matusik & Heeley, 2005).

Limiting the number of industries used for the main study was a carefully considered procedural step. Because absorptive capacity is a relatively new construct in the literature, much remains to be understood about the precise nature of its relationships. Thus, limiting the industry focus for the main study was deemed suitable given that reducing the number of industries will minimize

unnecessary variance from a cross-sectional industry analysis. Having a limited industry context will allow a richer understanding of the phenomenon. Therefore, even though the generalizability is somewhat limited, the nature of the relationships will be clearer in the context of a single industry.

Refinement of survey administration. A limitation of the industry pilot study was that the *full* Dillman Total Design Method technique (simply “Dillman technique”) (1978, 1991) was not used for the administration of the survey. The Dillman technique is based in social exchange theory and recommends the following procedures to enhance the response rate of mail surveys: (1) careful ordering of questions, so that the first questions closely relate to the topic stated in the cover letter, (2) use of graphical design to ease the reading and response of items, (3) printing questionnaire in a booklet format, (4) reduction of regular size font to decrease perception of lengthiness, (5) individually printed and customized letters, (6) cover letter containing information on the importance of the survey, (7) inclusion of a statement affirming privacy of the respondent, (8) description of why the respondent is important in the study, and (9) the use of four individual mailings.

Of the eight primary recommendations offered by Dillman, all were implemented in the pilot study with the exception of the last recommendation related to the use of four individual mailings. Dillman recommends an initial mailing stating the selection of the participant in the survey, followed by a cover letter and questionnaire sent shortly thereafter. Two weeks following, a



replacement questionnaire and cover letter are recommended, and two weeks thereafter, another replacement questionnaire and cover letter are to be sent to follow-up with the respondent. In the current study, one mailing was used that included a cover letter, questionnaire, and pre-paid business reply envelope. Dillman (1991) advises that full implementation of the aforementioned technique produces high response rates for virtually all survey populations (ranging from 50-70%). Thus, the full Dillman technique was implemented for the administration of the main study survey.

Refinement of length. Managers may have been reluctant to complete the survey during the industry pilot study due to its length. Although the survey was carefully constructed to fit to four pages, and it included ample white space to avoid the appearance of being overcrowded, managers may have been discouraged by the 132 items to complete. In the questionnaire, numerous additional constructs related to absorptive capacity were included. Therefore, to minimize this influence in the main dissertation study, the number of items included in the survey was reduced to include only those variables essential to the main study and those immediately related. In all, a total of 86 items were included. Minimizing the number of items is likely to reduce the amount of time needed to complete the survey and increase the likelihood surveys will be returned.

Refinement of incentive offered. Managers will be more inclined to complete the survey if they perceive they will receive a valuable reward in return.

Thus, in the pilot study, a customized report was offered to respondents, which included simple techniques for improving the absorptive capacity of the firm. For example, prior research (e.g., Jansen et al., 2005) finds support for the influence of social integration mechanisms on the absorptive capacity of a firm. Using these suggestions and others, managers had the opportunity to receive a complimentary report of their firm's absorptive capacity that compared the firm to the industry average. This information was advertised to managers in each mailing sent (in the main study) and was marketed as a "unique, one-of-a-kind resource valuable to managers seeking simple solutions to enhance firm innovativeness and competitiveness." Managers convinced of the unique value in a practical, easy-to-use guide are more likely to feel compelled to participate in the study given the use of a valuable incentive.

In addition to the customized report, managers were also encouraged to complete the survey and be registered for a chance to win an airline voucher worth \$200 USD. The airline voucher will be awarded upon completion of the study, and the recipient will be able to redeem the voucher on any preferred airline. This incentive was selected given that most top-level managers engage in some form of air travel frequently, and the respondent will have the flexibility of redeeming the voucher for business or personal use.

Refinement of terminology. Although the incentive of the customize report is valuable, if it is not marketed properly, then the full value of the report is not understood by the manager. Thus, the benefits of the data were reworded to be

more clearly conveyed. Therefore, all references to “absorptive capacity” were removed from the study and cover letter, and synonyms like “adaptation” and “change” were used.

Refinement of format. The preliminary and pilot studies were conducted using hardcopy surveys. Thus, given the quantity of surveys to be distributed for the main study, the questionnaire format was converted from a hardcopy to an online format. This allowed for a more simplified implementation of the full Dillman technique, and the refined procedure supported more direct contact between the survey participant and the researcher in the event of questions from the participants.

#### Data Collection Procedure

Description of sample. As stated in the previous section, one research design enhancement made for the main study was the implementation of a refined sample. Empirical investigations of absorptive capacity are often conducted in the context of high-growth firms (e.g., Liao et al., 2003) given that the need for a firm to remain adaptive to its rapidly changing environment is great. Thus, the presence of absorptive capacity is typically greater in such contexts than in industries plagued with slow growth.

Due to the lack of responses from numerous high-growth industries in the pilot study, the main study focused on the software industry, which is a high growth industry and is often utilized for absorptive capacity studies (e.g., Matusik & Heeley, 2005). The data for this study was collected from top managers of

firms in the software industry. Firms were identified by using a database obtained from Lead411™, an information provider utilized by numerous large firms. The quality of data is maintained by the provider through a two-prong approach consisting of proprietary data-collection software and a team of experts who manually confirm and update data (Lead411, 2011).

The information in the database included, but was not limited to, the following data: name of firm, names of top executives (e.g., chief executive, chief officers, executive and senior vice presidents, directors, senior managers, and other top-level positions), contact information for top executives including email addresses, and contact information for the firm (e.g., full mailing address, telephone and fax numbers, and website address). The database obtained included information on all firms available from the database provider. The full database consisted of 5,085 unique firms (with information for multiple individuals in each firm). Email addresses were obtained for the following individuals from each unique firm when available: chief executive officer, founder, chief strategy officer, chief business officer, partner, president, vice president corporate development, vice president intellectual property, vice president strategy. These positions were selected given that (1) each position is likely to have a unique understanding of how the phenomena represented in the questionnaire are manifested in the firm, and (2) each position represents a level of top responsibility in the firm, and it is likely higher-level individuals have a more

comprehensive understanding of the strategy and macro-level workings of the firm.

Data collection procedure. The data collection procedure was based on Dillman's (1978) total design method, with updated information obtained from Dillman (2007) specific to the design of online surveys. Dillman's (1978, 2007) total design method recommends making four contacts with survey participants through: (1) a brief pre-notice letter, (2) a questionnaire mailing, (3) a thank you note, and (4) a replacement questionnaire. Dillman also suggests an additional "special contact" can be made with the participants following the final contact to improve response rate. Thus, each executive was sent an email message in line with this technique. Furthermore, two special contact notices were also incorporated into the data collection procedure. One special notice was sent to announce the extension of the survey deadline, and the final notice was sent as a thank you message showing appreciation to everyone who participated and those who considered participation. The messages sent to survey participants are presented in Appendix B.

The majority of the electronic communications were sent using the email communication service, Constant Contact™, which is a leader in email marketing. Sending message through this firm allowed more precise data to be obtained on returned email addresses, opened messages, and unsubscribe requests. The service provided also allowed for immediate sending of all messages, whereas sending each message individually would result in a delay.

Dillman recommends email messages to be sent several days apart (given the ability of immediate delivery), thus each message was sent in accordance with this recommendation.

### Data Evaluation

Prior to conducting analyses on the data, the data were first evaluated to ensure suitability for empirical testing. To evaluate the data, three factors were considered: the type of data being analyzed, the pattern of missing data (and how to impute missing values), and the normal distribution of data. Each evaluation process is detailed.

Type of data. Stevens (1946) defines four types of measurements for variables: nominal, ordinal, interval, and ratio. The measurement data obtained through administration of the questionnaire items resulted in the collection of ordinal data given the nature of the Likert-scale used. Structural modeling techniques are able to analyze all four types of data; therefore, the use of ordinal data in structural modeling is determined to be suitable for this type of analysis.

Missing data. Procedures for screening the missing data were conducted in line with Hair, Black, Babin, Anderson, and Tatham (2006) who recommend a four-step process to diagnose and remedy missing data. Thus, the recommended procedure was followed, and the raw data was analyzed to examine patterns of missing data and select a proper data imputation method.

The first step calls for an assessment of the type of missing data. The type of data missing was determined to be missing due to nonresponse by the

respondents. Patterns of missing data indicate that respondents left data incomplete that was likely perceived as confidential or was unknown by the respondent. Overall, there was no common pattern in the data that resulted in clear evidence of inadequate survey design. Thus, it was not likely the missing data was an artifact of the questionnaire.

Second, the extent of missing data was assessed. The percentage of data missing from each case was calculated, and cases with greater than fifty percent missing data were eliminated. Furthermore, the percentage of data missing from each variable measured was calculated, and it was determined that after eliminating cases with greater than fifty percent missing data, no construct contained data with more than fifty percent of the cases missing values.

For the third step of the assessment, an empirical approach was taken to examine whether the missing data were distributed randomly throughout constructs and cases. Two tests were conducted in this step. First, IBM® SPSS software version 19 was used to compare means of cases with and without data for each construct in the study. The objective was to determine if any pattern of significant difference occurred among variables. Through an analysis of variance using t-tests, it was determined that the significant differences present in the data were limited and of minimal concern. Second, an empirical assessment was conducted to determine whether the data were missing completely at random (MCAR). The MCAR test compares the pattern of missing data present in the dataset with a randomly distributed pattern to determine whether the existing

pattern of missing data is random. A non-significant level of significance indicates that the observed pattern is not different from a random pattern. The significance level of Little's MCAR test was 0.11, which indicates that the observed pattern is not significantly different from a random pattern, and the data is considered MCAR.

The fourth step calls for the selection of an imputation method given the type of missing data present. The results of the previous steps indicated that the type of data missing is MCAR. Therefore, according to Hair et al. (2006), two options exist for proceeding with the data: (1) only observations with complete data can be used, or (2) replacement values can be calculated for the missing values through mean substitution, regression methods, or a model-building approach. Given the limited overall size of the sample, the first option was eliminated to preserve the richness of the existing data. Thus, the remaining methods for replacing values were compared to determine the most appropriate method. To compare the methods, a projected summary of estimated means and estimated standard deviations was calculated for each construct using each method. No consistent pattern emerged among the various methods to indicate one method produced a lower estimated mean or standard deviation than another. Due to the general consistency found among the methods, a correlation of all variables was then compared using projected estimates for each method. Overall, the estimated means approach produced slightly lower correlations among variables than did alternate imputation methods. Thus, the estimated



means approach was deemed the most appropriate method for replacing the missing values among the data. Following this determination, the missing values in the raw data were replaced with estimated means

Normality of data. Maximum likelihood estimation is the most common estimation method for structural modeling. Although an assumption of maximum likelihood is the multivariate normality of exogenous variables, it is suggested that reasonable ranges of skewness and kurtosis are acceptable for satisfying the multivariate normality assumption (Kline, 2005; Hair et al., 2006). Prior to assessing multivariate normality, it is recommended to first assess univariate normality. Kline (2005) suggests that standardized absolute values of skewness greater than 3.00 indicate extreme skewness, and standardized kurtosis values greater than 10.00 indicate extreme kurtosis. Upon examination of the data, it was determined that no variables had values that indicated the presence of skewness or kurtosis. Multivariate normality is assessed using the critical ratio value of the multivariate kurtosis index. The critical ratio is recommended to be less than 5.00. The critical ratio value calculated for the multivariate kurtosis index of the data was 19.27, which indicates the data is non-normally distributed across variables. Given that univariate normality was found, yet the data lacks multivariate normality, a solution to remedy the nonnormality is to further examine the data using the bootstrap method (Schumaker & Lomax, 2004). The Bollen-Stine (1992) bootstrap method provides a significance value for the  $\chi^2$  statistic to assess overall model fit and determine the influence of multivariate

non-normal data. The Bollen-Stein (1992) test was conducted and resulted in a non-significant p-value of 0.314. The insignificance of this value indicates that multivariate non-normality is not of concern given that the results are not affected by the non-normal distribution of the data.

#### Final Sample Characteristics

Final sample. The initial sample included 5,085 unique firms. After deleting undeliverable email addresses and unsubscribe requests from firms, a total of 3,926 unique firms were included in the survey. Through the features offered by the email marketing firm, it was tracked that an average of 1,287 participants opened each message sent. Executives who did not receive the information provided in the email are not considered in this study given that they were not exposed to the details of the investigation and, thus, not fully informed of the reasons for selecting to participate or opt-out. Thus, the final population of participants who received the information offered in the email was 1,287. Of that number, 152 respondents participated in the study, which yielded a response rate of approximately 11.8 percent. Similar studies that contained an online survey component and studied similar industries have yielded response rates of approximately 14 percent (e.g., Xiao & Dasgupta, 2009). Furthermore, Holbert and Stephenson (2002) recommend that researchers using structural modeling analysis techniques obtain a sample size above 150. Thus, the response rate obtained is within an anticipated range and the data is further examined for its suitability of analysis.

Non-response bias. A test of non-response bias was conducted using a comparison of demographic (e.g., size of firm) and financial (e.g., revenue) data. The number of employees was used as a measure of the size of the firm, and to measure the revenue, a measure of net profit was used. A *t*-test revealed no significant difference for the measures of number of employees ( $p = 0.13$ ) or for net revenue ( $p = 0.74$ ). Thus, no significant differences among respondents and non-respondents existed. This supports the assumption that respondents are not significantly different from nonrespondents (Armstrong & Overton, 1977).

Characteristics of individual respondents. The targeted respondents for this study were upper level managers of firms in the software industry. Upper-level managers were targeted given that, in most instances, they are most knowledgeable about the learning processes and zero-order capabilities of the firm. Of the respondents who provided data about their position in the firm, 108 identified themselves as top managers (CEO, president, vice-president, etc.) and 6 respondents identified as middle-level managers (e.g., general manager). A graphical representation is presented in Figure 10.

Furthermore, individuals with more tenure in their current firm are more likely to have a greater understanding of the internal nature of the firm. Thus, respondents were asked to identify the number of years of experience with the current firm. Of the respondents who provided data about their current experience, 34 respondents had less than 5 years of experience. Furthermore, 72 respondents had between 6 and 19 years of experience, and 15 respondents

had 20 years or more experience with their current firm. A graphical representation is presented in Figure 11.

Characteristics of firms. Age of the firm is a valuable data point given the nature of the study conducted. Specifically, firms with a greater number of years of experience have more time to grow and refine their (first and zero-order) capabilities. Therefore, respondents were asked to provide the age of the firm. Of the respondents who provided data on firm age, 19 firms were fewer than 5 years old. The majority of firms were between 6 and 19 years old with 8 firms being 30 years or more in age. A more detailed breakdown of firm age is provided in Figure 12.

The size of the firm is also indicative of the resources available to support firm capabilities. For example, smaller firms may have fewer resources to be allocated for capability growth and refinement. Additionally, larger firms are likely to have greater opportunities to engage in the acquisition of knowledge. Thus, respondents were asked to report the number of employees in the firm as a measure of the firm size. A total of 14 firms had fewer than 4 employees, and the majority of firms consisted of fewer than 100 employees. In all, 5 firms had 500 or more employees. A graphical representation is presented in Figure 13.

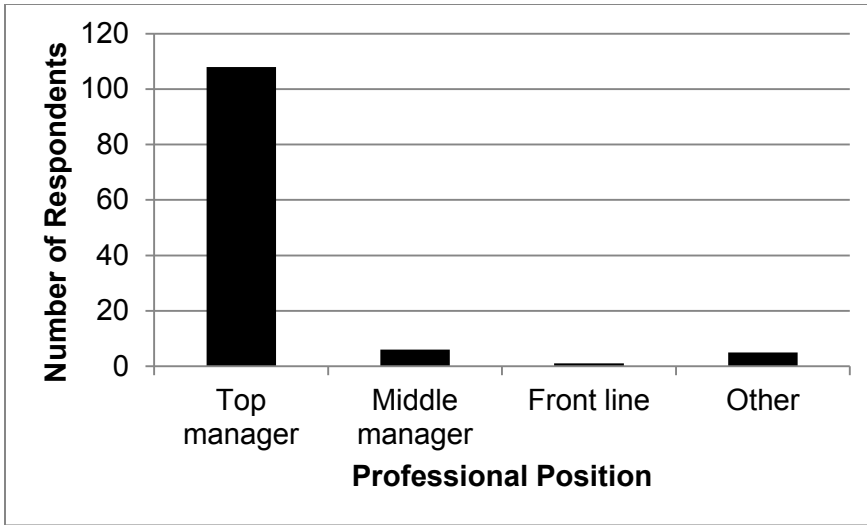


Figure 10. Current Professional Position of Respondents.

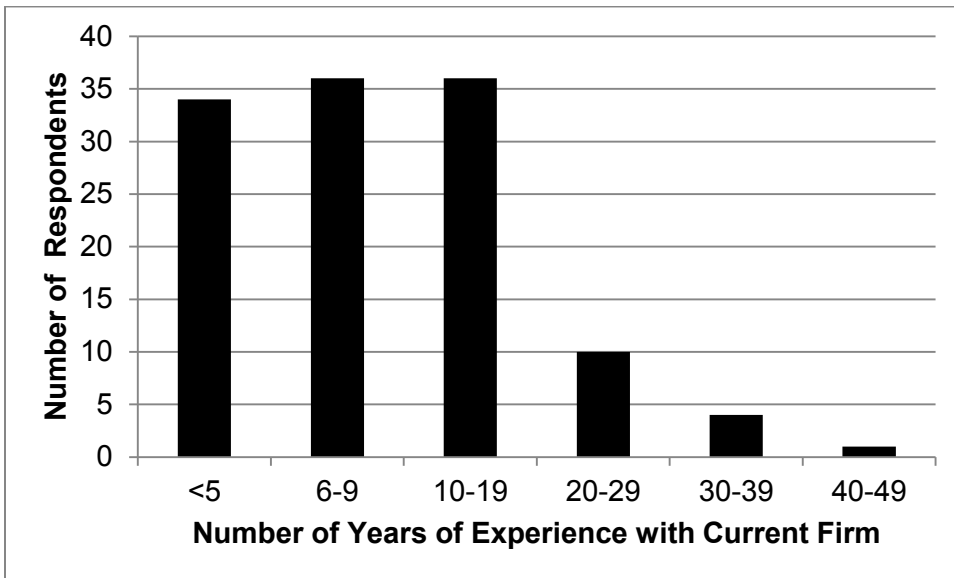


Figure 11. Years of experience of respondents with current firm.

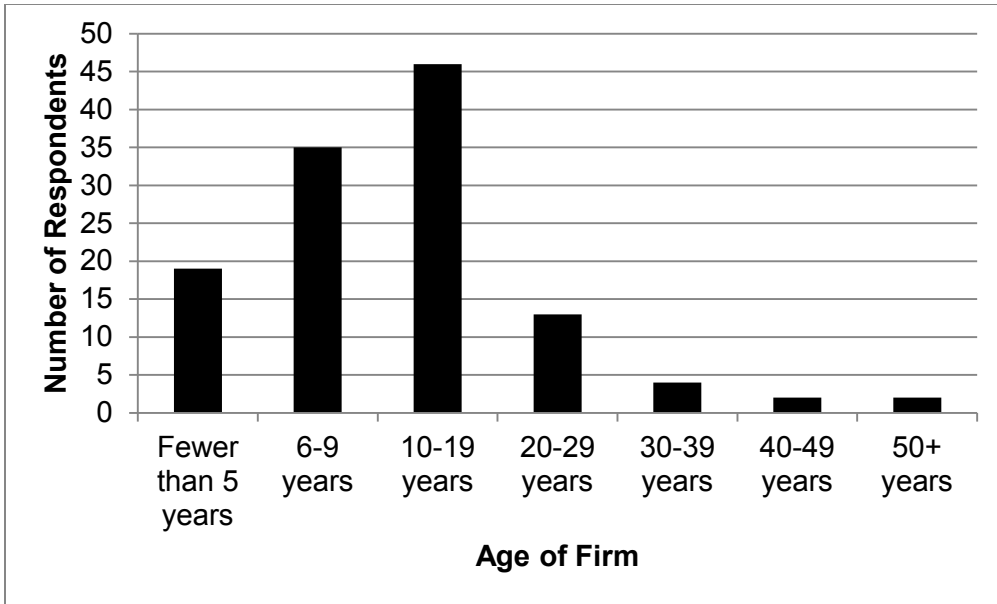


Figure 12. Age of firm.

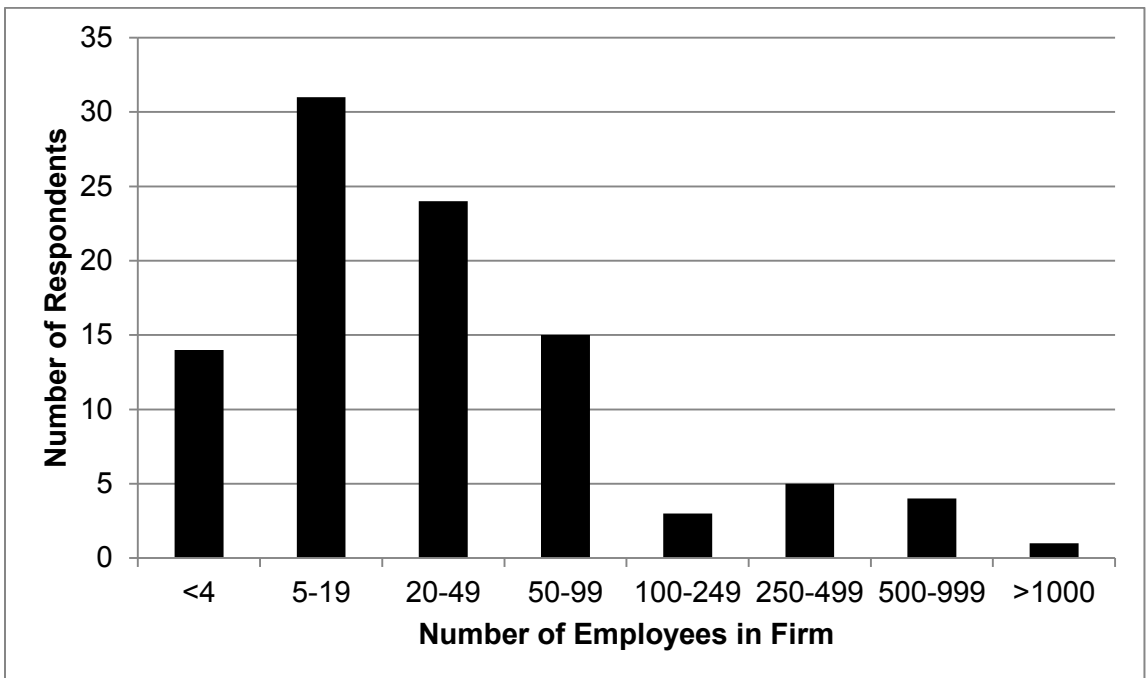


Figure 13. Number of employees in firm.

Overall, this demographic data suggests that the respondents were high level managers with a substantial amount of experience in their respective firms with adequate knowledge about the manifestation of capabilities. Furthermore, the number of employees in the firm signifies that most firms are smaller in nature as expected for high-growth, highly-innovative firms. The majority of firms responding were between 10-19 years old, which is line with the average of 14.3 years found in a related study (Matusik & Heeley, 2005). Thus, given that the demographics of respondents are in line with the expected industry averages, the data are further examined.

### Structural Equation Modeling

In the next chapter, the empirical results are examined using structural equation modeling. The structural equation modeling (SEM) technique is a tool used to perform an analysis of covariance structures and is described as a combination of factor analysis and multiple regression analysis (Kerlinger & Lee, 2000). Numerous statistical tools provide researchers with the ability to examine theoretical questions through the use of data analysis (e.g., multiple regression, factor analysis, multivariate analysis of variance, etc.); however, each tool is limited given its ability to examine only one relationship at a time (Hair et al., 2006). SEM techniques allow the researcher to examine multiple dependence relationships simultaneously, thus testing measurement properties and theoretical relationships in a single model. Given its abilities, SEM has been referred to as the second generation of multivariate analysis (Fornell, 1987).

Due to the multivariate nature of both research questions proposed in this study, SEM techniques were identified as the most appropriate measurement tool for assessment of the hypothesized relationships. SEM techniques allow a simultaneous assessment of the hypothesized relationships, which will provide insight into the appropriate model structures. To examine the hypothesis, the modeling software IBM® SPSS Analysis of Moment Structures (AMOS) version 19 was used. Furthermore, IBM® SPSS version 19 was used to conduct basic data analysis including assessing reliabilities. (It should be noted that the AMOS software is an extension of the SPSS suite software package.)

Structural modeling techniques provide a global assessment of the extent to which the theorized data represents the observed data. To assess the adequacy of the fit between the theorized and observed models, numerous fit indices are used. According to Byrne (2010), CFI and RMSEA are among the most primary indices. Additionally, the  $\chi^2$ , degrees of freedom, and SRMR are also commonly used. Each fit measure is described, and a range for acceptable fit of each measure is offered.

#### Chi-Square ( $\chi^2$ ) and Degrees of Freedom

Chi-square ( $\chi^2$ ) is among the most commonly used fit index for evaluating the degree of fit between the observed and theorized structural model (Hu & Bentler, 1999). In SEM, the research seeks to find no difference between the matrices of the observed and theorized models, thus a low  $\chi^2$  value is ideal, which is indicative of exact or near fit of both models (Hair et al., 2006). One



limitation of the  $\chi^2$  measure is its sensitivity to the sample size in that as the sample size increases, the  $\chi^2$  value also increases notwithstanding an exact fit between the models. Thus, while  $\chi^2$  is a commonly used fit index, it is recommended that other indices be used to assess fit.

Commonly used in conjunction with the  $\chi^2$  measure is a measure of the degrees of freedom of a model. Degrees of freedom (*df*) represent the amount of information available to estimate the model (Hair et al., 2006). A measure of the relative  $\chi^2$  is often used as a supplemental fit index and is calculated as  $\chi^2/df$ . This measure provides an adjustment to the impact of the sample size on the model. A  $\chi^2/df$  value greater than 2 indicates inadequate fit (Byrne, 1998).

#### Comparative Fit Index (CFI)

The comparative fit index (CFI) is a commonly used measure in SEM analyses due to its insensitivity to model complexity (Hair et al., 2006). Values for the CFI range from 0 to 1.00 and are calculated from a comparison of the theorized model to the measured model (Byrne, 2010). A CFI value of 1.00 indicates perfect fit; however, values above 0.90 are generally considered acceptable (Bentler, 1992).

#### Root Mean Square Errors of Approximation (RMSEA)

The root mean square errors of approximation (RMSEA) is a parsimony-adjusted index that accounts for the complexity of the model (Kline, 2005). RMSEA is also a popular fit index used by researchers given that it evaluates the error of approximation, which measures the extent to which the hypothetical

model produces the population covariance matrix (Browne & Cudeck, 1993).

The RMSEA measure is assessed per degrees of freedom, thus it is sensitive to the number of estimated parameters in the model; values less than 0.05 indicate good fit, and values up to 0.08 indicate reasonable fit (Byrne, 2010).

#### Standardized Root Mean Residual (SRMR)

The standardized root mean residual (SRMR) is a representation of the average standardized differences between the predicted and observed covariance matrices (Kline, 2005). If the model is perfectly fit, the SRMR value will be 0; however, the measure ranges from 0 to 1.00, and acceptable values can be as high as 0.08 (Hu & Bentler, 1999). SRMR explains the correlation of the model within an average error of the value obtained by the measure (Hu, Bentler, & Kano, 1992). In the next chapter these measures are employed to conduct a confirmatory factor analysis and empirically examine the hypotheses.

#### Summary

Overall, this chapter described the method used to collect and examine data for hypothesis testing. The chapter began by offering an operationalization of the constructs used in the investigation. The procedure used to conduct the pilot studies was then outlined, and the refinements made to the main study as a result of information garnered from the pilot studies were provided. Following, the data collection procedure for the main study was discussed, and the

preliminary analysis of the data performed to assess the type of data, the extent of missing data, and the normality of the data. A description of structural modeling techniques and the associated fit indices was also offered. In the next chapter, the results of the study are provided beginning with a confirmatory factor analysis and ending with empirical findings for the hypotheses of the investigation.

## CHAPTER IV

### RESULTS

#### Introduction

In this chapter, an empirical examination of the hypotheses is conducted and the results are presented. However, prior to examining the hypotheses, the measurement model is assessed and a confirmatory factor analysis is conducted. Following the confirmatory analysis, the validity and reliability of the measures are assessed. Then, the first research question is empirically examined, and the manner in which the dimensions of absorptive capacity are related is determined. The absorptive capacity model is then assessed as part of the larger, integrated research model, and the effects of absorptive capacity on zero-order capabilities are examined in line with the second research question. The chapter concludes with an examination of hypotheses from which findings and implications are discussed in the following chapter.

#### Measurement Model

An assessment of the measurement model was performed to ensure that the latent constructs are properly specified (Hair et al., 2006). To confirm the measurement model was properly specified, the latent constructs and respective measures were assessed, and the model fit of each was examined.

As theoretically proposed, absorptive capacity is composed of four dimensions. Thus, each dimension was assessed as a component of a higher-

order, latent construct of absorptive capacity. The model warranted removal of two items for the transformation dimension (Items 4 and 5 of the transformation scale) given their low fit with the overall model. All other items were retained. The overall fit measures for the refined model of absorptive capacity were in line with the accepted values of the fit indices, which indicates that the specified model of absorptive capacity was properly fit.

Furthermore, given that innovation capability and customer capability both contained two dimensions (a minimum of three dimensions is needed to assess model fit), the measures were combined to assess the overall fit for each. This is a common practice in modeling techniques used to assess the fit of construct with fewer dimensions. Upon examination of the items for process innovation (a dimension of innovation capability), it was determined that three items warranted removal due to poor fit (process innovation Items 1, 3, and 5 were removed). Additionally, one item was removed from the response speed of customer capability (Item 4) given its low loading with the model. The refined measures of innovation capability and customer capability indicated proper fit.

Operational capability was measured using a four dimension operationalization as previously discussed. One item from the customization dimension of operational capability warranted removal due to poor fit with the overall measure (Item 2). Based on an assessment of the fit indices, the refined model of operational capability demonstrated proper fit.

Performance was measured using two dimensions: organizational health and financial performance. Of the eleven items used to measure organizational health, three warranted removal due to improper fit (Items 1, 4, and 9). Additionally, an assessment of the financial performance dimension indicated that one item (Item 2) warranted removal. The refined measure of performance yielded proper fit. The detailed fit indices for all constructs used in this study are displayed in Table 8.

Table 8

*Fit Indices of the Confirmatory Measurement Models*

| Construct(s)                         | $\chi^2$ | <i>df</i> | $\chi^2/df$ | CFI         | RMSEA       | SRMR        |
|--------------------------------------|----------|-----------|-------------|-------------|-------------|-------------|
| Acceptable Threshold                 |          |           | $\leq 2.00$ | $\geq 0.90$ | $\leq 0.08$ | $\leq 0.08$ |
| ACAP                                 | 210.77   | 150       | 1.41        | 0.92        | 0.05        | 0.08        |
| Innovation and Customer Capabilities | 95.53    | 86        | 1.11        | 0.98        | 0.03        | 0.05        |
| Operational Capability               | 67.98    | 50        | 1.36        | 0.98        | 0.05        | 0.05        |
| Performance                          | 66.99    | 54        | 1.24        | 0.98        | 0.04        | 0.06        |

### Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is a process used to test how well the measured variables represent the latent constructs theorized in the model. In

other words, the purpose of a confirmatory factor analysis is to determine whether a measurement model is valid (Kerlinger & Lee, 2000). An important step prior to analyzing a full structural model is to first test the validity of the measurement model (Byrne, 2010). Validity is defined as the extent to which an instrument measures what it purports to measure (Huck, 2008). Validity can be assessed internally and externally. External validity, or generalizability, is used to determine the extent to which the findings of the investigation are applicable to other firms and/or contexts. Thus, to enhance the external validity, a cross-section of firms from the software industry was used to obtain a broad understanding of the nature of the constructs examined. Furthermore, the internal validity was assessed using the most common measures including face validity, nomological validity, convergent validity, and discriminant validity (Hair, Black, Babin, & Anderson, 2010). Each validity test is described in detail.

#### Face Validity

Face validity is a subjective assessment of measurement items to ensure the selection of scale items is based on more than solely empirical issues (Churchill, 1979). To ensure the current study had face validity, a team of expert panelists was used to review the items. This technique was employed to minimize the likelihood of errors not accounted for by traditional empirical testing. Also, prior to conducting the main study, each item was re-assessed by the researcher and a research partner to ensure each item appropriately measured the phenomenon it was intended to measure. Additionally, given that various

scales were used to create the questionnaire, special attention was given to the items to ensure items measuring phenomena from different scales did not overlap in concept or content. Given these *a priori* efforts, face validity was established for the measures.

#### Nomological Validity

Nomological validity is used to examine the theoretical and empirical relationships between different constructs (Peter, 1981). Nomological is described as the extent to which predictions from theoretical relationships are confirmed (Bagozzi, 1981). To assess nomological validity, the correlational analysis was used to determine if positive correlations exist for relationships that are expected to be positively related. As demonstrated in Table 9, all correlations among variables were positive in nature as expected based on the theoretical rationale provided in Chapter 2. Therefore, it was determined that the constructs exhibit nomological validity.

#### Convergent Validity

Factor loadings. Convergent validity assesses the extent to which differing methods of assessment concur in their measurement of the same concept (Byrne, 1998). The size of the factor loadings is an indicator of convergent validity, and Hair et al. (2006) recommend that all factor loadings should be (1) statistically significant, and (2) should have a value of 0.50 or greater. Thus, each factor loading was examined. It was determined that all factors were statistically significant at the  $p < 0.01$  level. Furthermore, factor



loadings were above the 0.50 recommended value except for two loadings, which possessed values of 0.34 and 0.33. Detailed factor loadings and significance values are presented in Figure 10. Overall, this finding indicates that the factor loadings support proper convergent validity.

Table 9

*Correlation Matrix*

|                        | Acquisition | Assimilation | Transformation | Exploitation | Operational Capability | Customer Capability | Innovation Capability | Performance |
|------------------------|-------------|--------------|----------------|--------------|------------------------|---------------------|-----------------------|-------------|
| Acquisition            | 1           |              |                |              |                        |                     |                       |             |
| Assimilation           | 0.34        | 1            |                |              |                        |                     |                       |             |
| Transformation         | 0.51        | 0.88         | 1              |              |                        |                     |                       |             |
| Exploitation           | 0.23        | 0.81         | 0.99           | 1            |                        |                     |                       |             |
| Operational Capability | 0.32        | 0.69         | 0.77           | 0.79         | 1                      |                     |                       |             |
| Customer Capability    | 0.12        | 0.46         | 0.47           | 0.67         | 0.61                   | 1                   |                       |             |
| Innovation Capability  | 0.45        | 0.74         | 0.73           | 0.89         | 0.86                   | 0.68                | 1                     |             |
| Performance            | 0.40        | 0.55         | 0.66           | 0.67         | 0.64                   | 0.76                | 0.63                  | 1           |

Table 10

*Factor Loadings for Constructs and Items*

| Construct/Item         | Factor Loading | Sig. | Construct/Item | Factor Loading | Sig. |
|------------------------|----------------|------|----------------|----------------|------|
| Assimilation           | 0.34           | ***  | CCEXP1         | 1              |      |
| Transformation         | 0.64           | ***  | CCEXP2         | 1.16           | ***  |
| Exploitation           | 1.02           | ***  | CCEXP3         | 0.88           | ***  |
| Operational Capability | 1.32           | ***  | CCSPD1         | 1              |      |
| Customer Capability    | 0.94           | ***  | CCSPD2         | 0.43           | ***  |
| Innovation Capability  | 1.70           | ***  | CCSPD3         | 0.67           | ***  |
| Performance            | 0.33           | ***  | CCSPD5         | 0.76           | ***  |
| AQ1                    | 1              |      | OCCOOP1        | 1              |      |
| AQ2                    | 1.13           | ***  | OCCOOP2        | 1.03           | ***  |
| AQ3                    | 0.72           | ***  | OCCOOP3        | 0.59           | ***  |
| AQ4                    | 1.02           | ***  | OCCUST1        | 1              |      |
| AQ5                    | 0.67           | ***  | OCCUST3        | 0.99           | ***  |
| AQ6                    | 0.63           | ***  | OCCUST4        | 1.20           | ***  |
| AS1                    | 1              |      | OCRESP1        | 1              |      |
| AS2                    | 0.89           | ***  | OCRESP2        | 1.51           | ***  |
| AS3                    | 1.04           | ***  | OCRESP3        | 1.84           | ***  |
| TR1                    | 1              |      | OCRECON1       | 1              |      |
| TR2                    | 1.02           | ***  | OCRECON2       | 1.39           | ***  |
| TR3                    | 0.72           | ***  | OCRECON3       | 1.27           | ***  |
| TR6                    | 1.06           | ***  | HEALTH2        | 1              |      |
| EX1                    | 1              |      | HEALTH3        | 1.69           | ***  |
| EX2                    | 0.76           | ***  | HEALTH5        | 1.33           | ***  |
| EX3                    | 1.06           | ***  | HEALTH6        | 1.47           | ***  |
| EX4                    | 1.03           | ***  | HEALTH7        | 1.14           | ***  |
| EX5                    | 1.69           | ***  | HEALTH8        | 1.20           | ***  |
| EX6                    | 0.74           | ***  | HEALTH10       | 1.81           | ***  |
| ICPROD1                | 1              |      | HEALTH11       | 1.65           | ***  |
| ICPROD2                | 0.90           | ***  | OPPERF1        | 1              |      |
| ICPROD3                | 0.75           | ***  | OPPERF3        | 1.61           | ***  |
| ICPROD4                | 1.01           | ***  | OPPERF4        | 1.38           | ***  |
| ICPROD5                | 1.00           | ***  | OPPERF5        | 1.77           | ***  |
| ICPROD6                | 0.73           | ***  |                |                |      |
| ICPROC2                | 1              |      |                |                |      |
| ICPROC4                | 1.80           | ***  |                |                |      |

\* =  $p < 0.01$ ; "1" indicates set factor loadings.

Reliability. Another indicator of convergent validity is reliability. Reliability is defined as the “assessment of the degree of consistency between multiple measurements of a variable” (Hair et al., 2010: 125). The most common measure of reliability is internal consistency, which is measured using Cronbach’s (1951) alpha. Nunnally (1978) suggests that Cronbach’s alpha levels above 0.70 are appropriate. Robinson, Shaver, and Wrightsman (1991) provide a range from which to assess reliabilities, which consists of scores greater than or equal to 0.80 reflecting “exemplary” reliability, scores from 0.70 to 0.79 reflecting “extensive” reliability, scores from 0.60 to 0.69 reflecting “moderate” reliability, and scores below 0.60 reflecting “minimal” reliability. The reliabilities of the refined measures in this study were examined using the data collected in the study and are presented in Table 11. Nearly all measures are above Nunnally’s (1978) recommended value of 0.70, and the two constructs with values below are above the 0.60 level, which is considered moderate by Robinson et al. (1991). Overall, the reliability values (Cronbach’s  $\alpha$ ) support the convergent validity of the model.

Table 11

*Reliability Values for Measures*

| Construct           | Dimension             | Cronbach's $\alpha$ |
|---------------------|-----------------------|---------------------|
| Absorptive Capacity | Acquisition           | 0.77                |
|                     | Assimilation          | 0.81                |
|                     | Transformation        | 0.63                |
|                     | Exploitation          | 0.60                |
| Capabilities        | Innovation            | 0.80                |
|                     | Operational           | 0.87                |
|                     | Customer              | 0.76                |
| Performance         | Organizational Health | 0.76                |
|                     | Operating Performance | 0.79                |

Discriminant Validity

Discriminant validity assesses the extent to which differing methods of assessment differ in their measurement of the same concept (Byrne, 1998). In this case, low correlations among the measures indicate the scales are not converging in their measurement of the phenomenon. To examine whether the constructs measured were statistically different, the covariances among

constructs were fixed to 1.00 and the fit indices for the fixed (constrained) model were observed. Subsequently, the covariances among the constructs were freely estimated, and the fit indices of the free model were recorded. The details of the fit indices for both models are presented in Table 10. A  $\chi^2$  difference test was then performed to determine whether the free and constrained model are statistically different. The  $\chi^2$  difference test resulted in a significance value of  $p < 0.00$ , thus indicating that the constrained model is not a better fit. Because the free model is accepted, the presence of discriminant validity is verified due to the observed differences among the constructs.

Table 12

*Test of Discriminant Validity*

|             | Free Model | Constrained Model | Acceptable Threshold |
|-------------|------------|-------------------|----------------------|
| $\chi^2$    | 2303.65    | 2515.41           |                      |
| <i>df</i>   | 1560       | 1587              |                      |
| $\chi^2/df$ | 1.43       | 1.59              | $\leq 2.00$          |
| CFI         | 0.79       | 0.73              | $\geq 0.90$          |
| RMSEA       | 0.06       | 0.06              | $\leq 0.08$          |
| SRMR        | 0.08       | 0.32              | $\leq 0.08$          |

Empirical Assessment of Research Question 1

Following successful completion of the confirmatory factor analysis, all measures were deemed suitable for further testing. Thus, the next step was to empirically test the first research question posed in this investigation: How does absorptive capacity convert knowledge? Prior to examining the influence of

absorptive capacity on zero-order capabilities (the second research question of the study), the relationships among the dimension of absorptive capacity were first tested. To examine the nature of the relationships among the dimensions of absorptive capacity, a structural model was created to model the hypothesized relationships among the dimensions. Using maximum likelihood estimation, the structural model of absorptive capacity was assessed to compare the fit of the hypothesized model to the observed data. The structural model of absorptive capacity is graphically displayed in Figure 14 with the significance of hypothesized relationships identified. Also, it should be noted that for simplification, the error terms and individual items were removed from the figure. While the overall model showed adequate fit ( $\chi^2 = 210.74$ ;  $df = 149$ ;  $\chi^2/df = 1.41$ ; CFI = 0.91; RMSEA = 0.05; SRMR = 0.08), two hypothesis were found to be insignificant. Specifically, Hypothesis 2, which hypothesizes a positive relationship between acquisition and transformation, and Hypothesis 4, which hypothesizes a positive relationship between assimilation and exploitation, were both found to be insignificant ( $p = 0.87$  and  $p = 0.10$ , respectively).

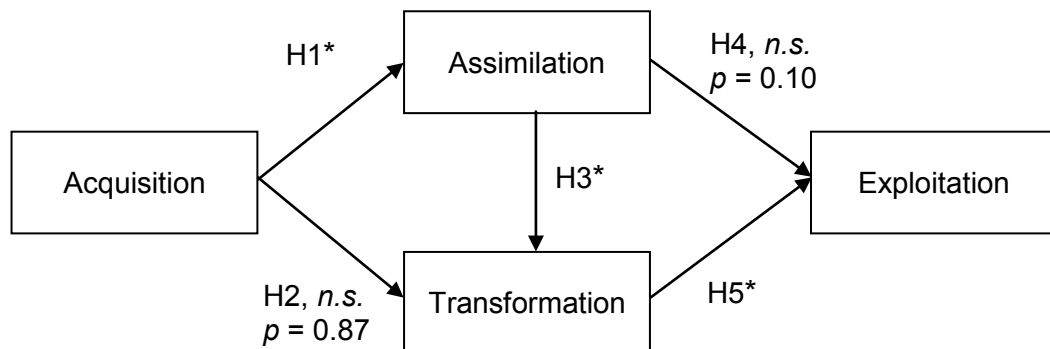


Figure 14. Graphical representation of Research Question 1 results. \* =  $p < 0.001$ ; n.s. = not significant.

Following the finding of the insignificant hypotheses in the proposed structural model, a refined model of absorptive capacity was assessed that included the removal of the two, insignificant hypotheses. The fit for the refined model ( $\chi^2 = 213.99$ ;  $df = 151$ ;  $\chi^2/df = 1.42$ ; CFI = 0.91; RMSEA = 0.05; SRMR = 0.08) was similar to the previous model and indicated proper fit. Also, in the refined model, the remaining three structural relationships were all significant at the  $p < 0.001$  level. The refined model of absorptive capacity is graphically displayed in Figure 15 with the standardized estimate values shown. Furthermore, the error terms and items were removed from the figure for simplification.

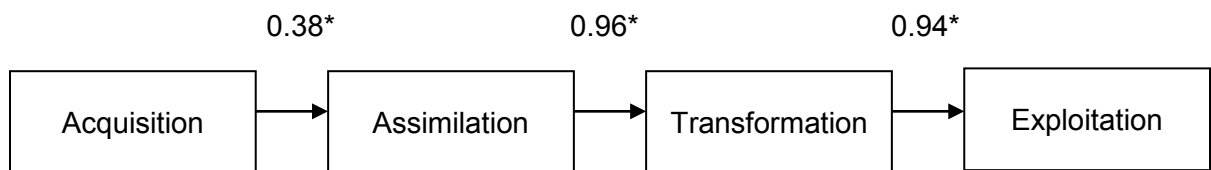


Figure 15. Graphical results of refined model of absorptive capacity. Standardized estimates displayed to indicate strength of relationships. \* =  $p < 0.001$ .

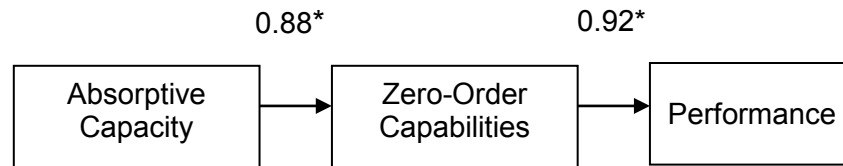
#### Empirical Assessment of Research Question 2

The refined model of absorptive capacity was then incorporated into the overall research model to answer the second research question: How does absorptive capacity influence zero-order capabilities? The first step in

addressing this question was to empirically examine Hypothesis 6, which hypothesizes that absorptive capacity positively influences zero-order capabilities. To conduct this analysis, latent constructs were created representing absorptive capacity and zero-order capabilities. Additionally, since the influence of zero-order capabilities is assumed (given its well-accepted relationship in the literature), a latent construct of performance was also included in the model. The fit indices of the higher-order model were calculated ( $\chi^2 = 2361.38$ ;  $df = 1581$ ;  $\chi^2/df = 1.49$ ; CFI = 0.78; RMSEA = 0.06; SRMR = 0.08), and the CFI measure was found to be below the recommended value of 0.90. Given the complexity of the model, however, a low CFI value can be expected. To ensure the overall fit was adequate (given the presence of a low CFI measure), confirmation was indicated by the relative fit provided by the  $\chi^2/df$ , which produced a value of 1.49 (below the recommended value of 2.00). This measure indicates a proper fit, and overall the model fit was deemed appropriate. An assessment of the Hypothesis 6 concludes that absorptive capacity is significantly related to zero-order capabilities at the  $p < 0.001$  level (standardized estimate of 0.88). Furthermore, zero-order capabilities are significantly related to firm performance ( $p < 0.001$ , standardized estimate = 0.92). Thus, it is concluded that absorptive capacity positively influences zero-order capabilities, and zero-order capabilities positively influence firm performance. This relationship is graphically displayed in Figure 16. It should be noted that the



error terms, measurement items, and dimensions – which are secondary to these relationships – have been removed from the graphical model for simplification.



*Figure 16.* Graphical results of higher-order relationships. Standardized estimates displayed to indicate strength of relationship. \* =  $p < 0.001$ .

Following the examination of Hypothesis 6, hypotheses 6a through 6c were assessed to determine the precise manner in which absorptive capacity influences zero-order capabilities. To assess the influence of absorptive capacity on each dimension of zero-order capabilities, a full structural model was created, which included the dimensional relationships of all constructs: absorptive capacity, zero-order capabilities, and performance. The full structural model is presented in Figure 17, which includes only the primary dimensions tested (error terms, measurement items, control variables, and marker variables were eliminated from this figure for simplification). The fit indices of the model were calculated ( $\chi^2 = 2846.96$ ;  $df = 1854$ ;  $\chi^2/df = 1.53$ ; CFI = 0.75; RMSEA = 0.06; SRMR = 0.08). The CFI measure was found to be below the recommended value of 0.90; however, as noted earlier, the complexity of the model attributed to the low value. However, to ensure the appropriateness of the overall model fit, the  $\chi^2/df$  value was examined, and the result indicated that the value of 1.53 was

below the recommended level of 2.00. Thus, the overall the model fit was deemed appropriate.

Given that the overall model fit was appropriate, the hypotheses were then examined. Hypothesis 6a states that absorptive capacity positively influences operational capabilities. Hypothesis 6a was supported ( $p < 0.001$ , standardized estimate = 0.98). Hypothesis 6b states that absorptive capacity positively influences customer capabilities. Based on the analysis, Hypothesis 6b was supported ( $p < 0.001$ , standardized estimate = 1.06). Last, Hypothesis 6c is examined to determine whether absorptive capacity positively influences innovation capabilities. This hypothesis was also supported ( $p < 0.001$ , standardized estimate = 0.78). From an evaluation of all hypotheses related to the second research question of this investigation, it is determined that absorptive capacity positively influences each dimension of zero-order capabilities. A comparison of the hypothesized model with path estimates and significance values is offered followed by the final, revised model with path estimates and significance values (Figures 17 and 18, respectively). Additionally, the overall fit indices for both models is provided in Table 13, and it is noted that the fit indices remained consistent once the hypothesized model was revised indicating the refinement caused no noticeable alteration to the overall fit of the model.

Table 13

*Fit Indices of Hypothesized and Final Models*

|             | Hypothesized Model | Final Model | Acceptable Threshold |
|-------------|--------------------|-------------|----------------------|
| $\chi^2$    | 2842.56            | 2846.96     |                      |
| <i>df</i>   | 1852               | 1854        |                      |
| $\chi^2/df$ | 1.53               | 1.53        | $\leq 2.00$          |
| CFI         | 0.75               | 0.75        | $\geq 0.90$          |
| RMSEA       | 0.06               | 0.06        | $\leq 0.08$          |
| SRMR        | 0.08               | 0.08        | $\leq 0.08$          |

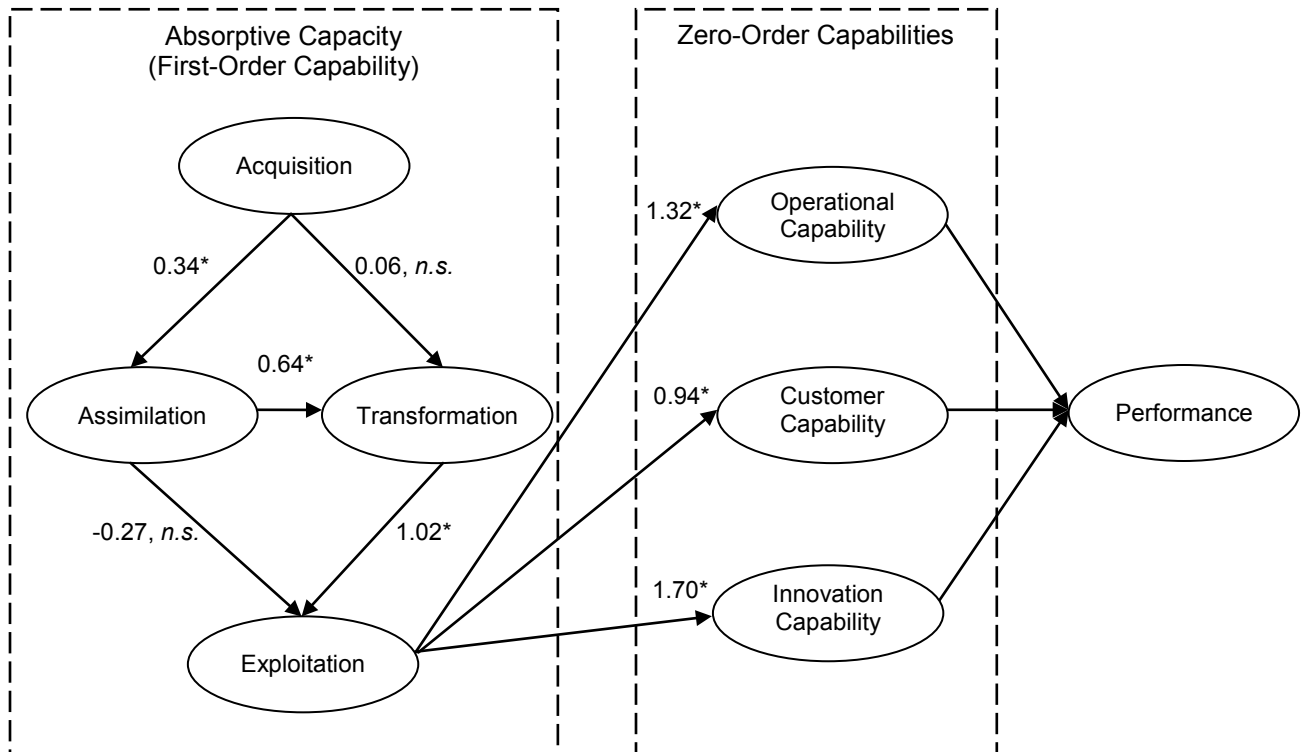


Figure 17. Hypothesized research model. \* =  $p < 0.01$ ; n.s. = not significant.

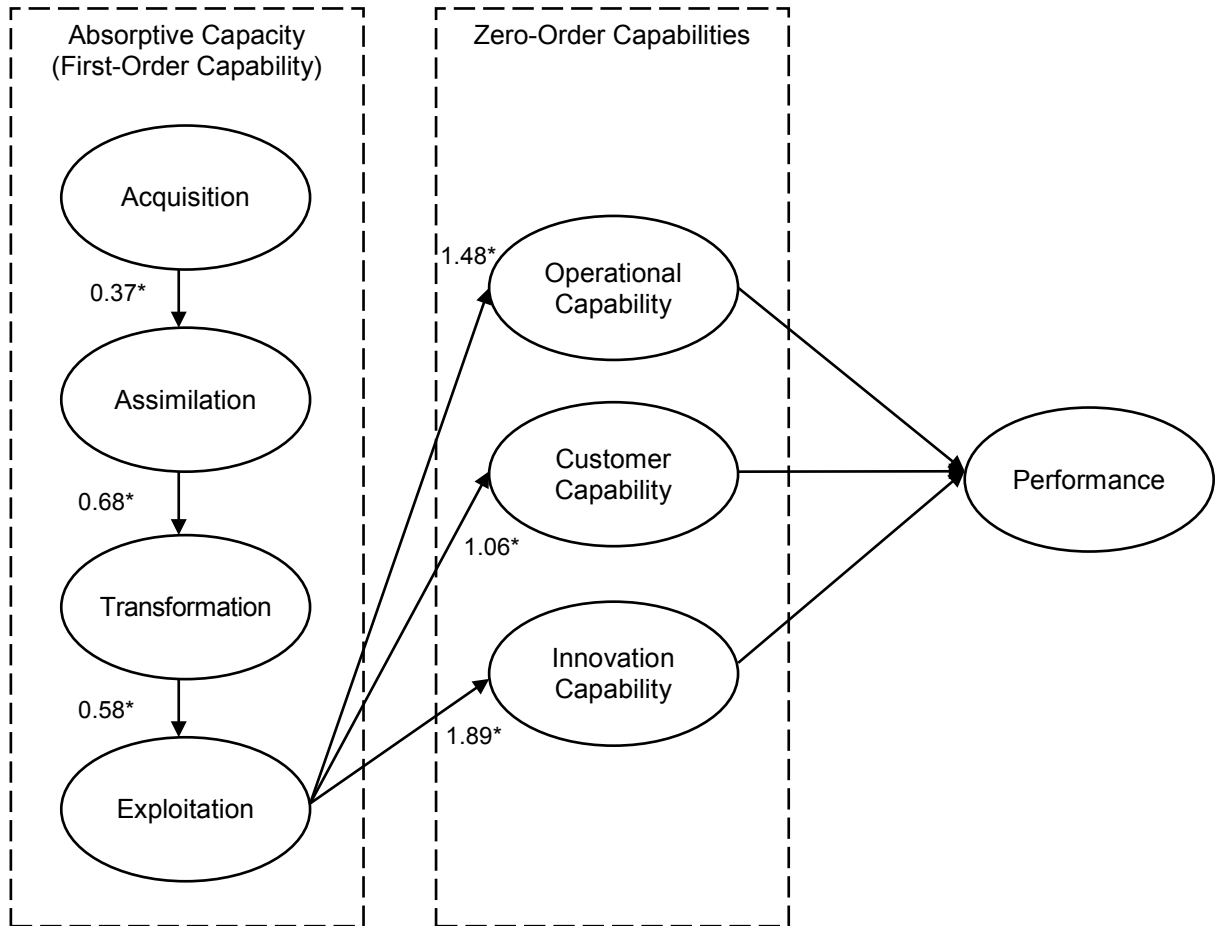


Figure 18. Final model. \* =  $p < 0.01$ .

### Summary

This chapter began with a detailed discussion of structural equation modeling and the primary fit indices used to properly assess the fit of structural models. The confirmatory factor analysis procedures were then discussed, and the steps taken to assess the confirmatory nature of the measurement models were outlined. Once the measurement models were assessed and found suitable for further examination, the main research questions of this investigation

were empirically assessed. The analysis of the first research question resulted in a refined model of absorptive capacity, which varied slightly from the original hypothesized model. Next, the higher-order relationships among absorptive capacity, zero-order capabilities, and performance were tested, and it was determined that absorptive capacity positively influences zero-order capabilities, and zero-order capabilities positively influence performance. Last, the final three hypotheses were examined (hypotheses 6a, 6b, and 6c) to determine the precise influence of absorptive capacity on the dimensions of zero-order capabilities. It was found that absorptive capacity positively and significantly influences each dimension of zero-order capabilities (i.e., operational, customer, and innovation capabilities). In the following chapter, the results from this examination are discussed in detail. Additionally, implications for researchers and managers are offered. Furthermore, limitation of the study and future directions of the work are also discussed.

## CHAPTER V

### DISCUSSION

#### Introduction

The primary objectives of this investigation are to understand (1) how absorptive capacity converts knowledge, and (2) how absorptive capacity influences firm capabilities. To address these research questions, a detailed literature review was conducted, and theoretical models were proposed to examine the nature of the proposed influences. The conceptual model was operationalized, and data were collected and analyzed. In this chapter, the results are discussed in detail, and the implications of the results are discussed for their impact on researchers and managers. Following, the limitations of this investigation are discussed, and recommendations for future research are provided.

#### Results

##### Research Question 1

The first research question focuses on the relationships among the dimensions of absorptive capacity and attempts to discover how the dimensions work together to convert knowledge. Recently, researchers have suggested that absorptive capacity converts knowledge using more complex relationships among dimensions (e.g., Todorova & Durisin, 2007; Lichenthaler, 2009) than earlier conceptualizations (e.g., Cohen & Levinthal, 1990). Thus, given that firms

convert complex knowledge, it was hypothesized that complex relationships exists among the dimensions and five relationships among the four dimensions were hypothesized. Using structural modeling, the five hypothesized relationships were analyzed, and it was determined that two of the five hypotheses were insignificant.

Interestingly, the two insignificant hypotheses were the relationship between acquisition and transformation and the relationship between assimilation and exploitation. Upon refinement of the structural model to remove the insignificant relationships, a more parsimonious model emerged. The removal of the two insignificant hypotheses resulted in a more parsimonious conceptualization and a model with linear relationships among the dimensions of the construct.

Recent studies have offered valuable conceptualizations of absorptive capacity. For example, Todorova and Durisin (2007) propose that absorptive capacity consists of multiple primary dimensions. Previous studies (e.g., Zahra & George, 2002) acknowledged four dimensions of absorptive capacity but conceptualized the dimensions as components of two higher-order dimensions (i.e., potential and realized absorptive capacity). While Todorova and Durisin's (2007) multi-dimensional conceptualization of absorptive capacity is in line with the findings of this study, the relationships among the dimensions that the authors propose warrants re-examination given the findings of the current investigation. This study is among the first to empirically examine the manner in

which the dimensions of absorptive capacity are related, and the findings suggest the relationships are not as complex as those offered by Todorova and Durisin (2007).

The findings of this study suggest that absorptive capacity converts knowledge through a linear process involving direct relationships among acquisition, assimilation, transformation, and exploitation. The relationships among the dimensions are similar to the relationships among the 4-I framework proposed by Crossan et al. (1999): intuiting, interpreting, integrating, and institutionalizing. Additionally, the relationships are linear in nature like the initial conceptual model of absorptive capacity offered by Cohen and Levinthal (1990). The emergence of this linear, process-oriented relationship among the dimensions of absorptive capacity suggests the manner in which knowledge is converted is not as complex as previous scholars suggested. Rather, the knowledge conversion process is more closely aligned with the theoretical roots of absorptive capacity and closely resembles theoretical models of organizational learning (see graphical model presented in Chapter 2). Researchers are no longer required to rely solely on theoretical proposals and are now able to conceptualize the internal dimensions of absorptive capacity with confidence using specific, empirical evidence from this investigation. Given that many conceptualizations of absorptive capacity are theoretical in nature, this investigation provides valuable insight to shape the future direction of absorptive capacity research.



## Research Question 2

The second research question seeks to answer how absorptive capacity influences zero-order capabilities. Prior research establishes that absorptive capacity influences performance; yet, *how* absorptive capacity influences performance remains to be answered. In pursuit of this question, it was hypothesized – based on contributions of Volberda et al. (1999), Zahra et al. (2006), and others – that absorptive capacity influences zero-order capabilities. Given that absorptive capacity is a first-order capability, and first-order capabilities are shown to influence performance, it was hypothesized that absorptive capacity (a first-order capability) influences zero-order capabilities, which thereby influence performance.

To determine the influence of absorptive capacity on zero-order capabilities (as stated in Hypothesis 6), a higher-order structural model was created to assess the relationships among the latent constructs of absorptive capacity, zero-order capabilities, and performance. The fit indices of the structural model indicated proper fit, and the relationships among all constructs were positive and highly significant ( $p < 0.001$ ). Thus, it was determined that absorptive capacity positively influences zero-order capabilities.

This finding empirically supports the theoretical framework proposed by Winter (2000), which suggests that first-order capabilities directly influence zero-order capabilities. The work of Zahra et al. (2006), Helfat et al. (2007), Schreyögg and Kliesch-Eberl (2007), and Volberda et al. (1999) is also

supported given their suggestions of the relationships between higher-order capabilities (e.g., absorptive capacity) and lower-level capabilities. This study is among the first empirical examinations of these constructs, and results confirm the influence of first-order capabilities on zero-order capabilities is in line with the conceptualizations present in the extant literature.

The next step in the investigation was to conduct a more in-depth examination of how absorptive capacity influences zero-order capabilities by moving beyond a higher-level assessment toward a lower-level understanding of the precise dimensional relationships. Understanding the exact nature of the relationship between absorptive capacity and zero-order capabilities will provide insight into how knowledge is used to create value in the firm and will answer the call from Volberda et al. (2010) to extract the full potential of absorptive capacity in strategic management studies. To conduct an examination of the relationship between absorptive capacity and zero-order capabilities, first, the zero-order capabilities construct was proposed to consist of three dimensions (i.e., operational, customer, and innovation capabilities) based on an in-depth synthesis of the capabilities literature. Furthermore, with theoretical justification, it was hypothesized that absorptive capacity positively influences operational capabilities, customer capabilities, and innovation capabilities.

An empirical assessment of these lower-level relationships was conducted using the refined model of absorptive capacity (from the finding of the first research question). The refined absorptive capacity model was included in a full

structural model, and the relationships with each dimension of zero-order capabilities were tested.

Results from the examination of the overall model indicated proper overall model fit, and each of the hypotheses was found to be positive and highly significant ( $p < 0.001$ ) as proposed. These findings suggest absorptive capacity positively influences operational capabilities, customer capabilities, and innovation capabilities. The presence of direct relationships among absorptive capacity and each dimension of zero-order capabilities is in line with the findings of Cepeda and Vera (2007), Chen and Ching (2005), and Liao et al. (2007).

This is among the first studies to theoretically propose and empirically examine the influence of absorptive capacity on zero-order capabilities. In addition to examining the higher-order relationships, this investigation examines the precise lower-level relationships in which absorptive capacity influences each dimension of zero-order capabilities. The supportive findings received from this investigation give rise to abundant potential in the absorptive capacity and capabilities literatures. The multiple contributions of this investigation to research and practice are discussed in detail, and following, the practical implications for managers are offered to ensure that industry benefits from the results of this investigation.

#### Implications for Researchers

This investigation offers valuable implications for researchers. Because of the vast nature of the implications garnered from this study, numerous disciplines

will benefit from the findings. For example, this study reaffirms the need for a balance between theory development and theory testing. Specifically, numerous previous studies have relied on conceptualizations of absorptive capacity that are strictly theoretical. While the contribution of theory to the development of absorptive capacity is indispensable, it is also important for theory testing to occur. Thus, in this investigation, prior conceptualizations were examined, and the findings have the potential to alter the trajectory of absorptive capacity-related research.

Researchers of all disciplines should remain cognizant of the value in maintaining balance between theory development and testing. However, numerous additional contributions can be extracted from this study and applied to a variety of disciplines. Contributions to the disciplines of strategic management, organization theory, organizational behavior/human resources, and public administration are outlined.

**Strategic management.** As stated in the earlier chapters, research related to absorptive capacity sharply increased following the introduction of the phenomenon into strategic management literature by Cohen and Levinthal (1990). Volberda et al. (2010) acknowledge the richness of the construct, yet state that absorptive capacity has not been used to its full potential in the literature. Recently, the amount of research related to absorptive capacity has declined. One likely reason for the decline in the literature and the minimal potential extracted from the construct is the inconsistency with which absorptive

capacity is conceptualized. Specifically, researchers have proposed numerous conceptualizations of how the internal dimensions of absorptive capacity are related, which has led to growing chasms in the literature and ultimately contributed to a decline in overall research.

Van den Bosch et al. (2003) acknowledge the theoretical contributions of absorptive capacity are ahead of related empirical studies. Thus, in an attempt to revive absorptive capacity research and conduct a needed empirical examination, this investigation hypothesized and empirically tested the manner in which the dimensions of absorptive capacity are related. It was determined the dimensions of absorptive capacity are related in a linear, process-like manner, which is a finding that will shape future absorptive capacity studies. By providing future researchers with a theoretically-grounded and empirically supported framework of how the dimensions of absorptive capacity are related, researchers will have a common foundation on which to build future studies. This common ground is likely to minimize the previous inconsistencies in absorptive capacity research and contribute to the unity of the future research program.

In addition to unifying the absorptive capacity literature, this investigation synthesizes the fragmented research of firm capabilities. Numerous terms and definitions are used to describe the concept of capabilities (as demonstrated in Table 2). However, a unified conceptualization and definition of the construct are absent from the literature. Therefore, an additional contribution of this investigation is the review of the capabilities literature and offer of a (1) broad

understanding of capabilities, (2) synthesized definition of capabilities, and (3) dimensional framework of capabilities.

Researchers will benefit from an understanding of the foundation of capabilities and capabilities-based phenomena. The foundation of capabilities (rooted in routines and processes) is offered in Chapter 2, and following the review, the fundamental components of capabilities are identified. Given the vast nature of definitions offered in extant research, a broad understanding of capabilities is intended to ensure researchers have agreement on the foundation of capabilities.

From the common components identified, a synthesized definition of capabilities is offered. Additionally, a survey of the various dimensions of capabilities proposed in the literature was conducted (see Table 4). From an analysis of capability dimensions, a framework was proposed to conceptualize zero-order capabilities as consisting of three dimensions (operational capabilities, customer capabilities, and innovation capabilities). Thus, future investigations will benefit from an enhanced understanding of the foundation, definition, and dimensions of zero-order capabilities, and the capabilities literature will be more unified and have an enhanced trajectory.

Along with the theoretical contributions offered related to zero-order capabilities, an empirical assessment of zero-order capabilities as a multi-dimensional construct was conducted. Dosi et al. (2000) stated that many interpretations of capabilities remain at a high level of abstraction, and thus,

robust empirical research has developed slowly. Furthermore, Kusunoki et al. (1998) stated that few studies empirically examine zero-order capabilities as a multi-dimensional construct. Therefore, in an effort to further advance capabilities research, this study empirically examined how absorptive capacity influences the multi-dimensional zero-order capabilities of the firm.

The empirical examination of the second research question – related to how absorptive capacity influences zero-order capabilities – resulted in a positive influence of absorptive capacity on each dimension of zero-order capabilities (i.e., operational, customer, and innovation capabilities). This model confirms, first, that a multi-dimensional operationalization of zero-order capacity is appropriate (as assessed through the confirmatory factor analysis and the test of the full structural model). Second, these results demonstrate that absorptive capacity positively influences each dimension of zero-order capabilities. This study is among the first to theoretically propose and empirically support the precise influence of absorptive capacity on a multi-faceted conceptualization of zero-order capabilities. Therefore, this study expands the boundary of capabilities related research by offering a synthesized definition of zero-order capabilities, examining zero-order capabilities as a multi-dimensional construct, and using the capability-based perspective to investigate how absorptive capacity influences the firm.

Capabilities-based research has been identified as a prominent field of investigation because capabilities-related questions are central and among the

most complex in strategic management literature (Teece, 2007; Helfat & Peteraf, 2009). By expanding the boundaries of capabilities-related research, strategy theorists will benefit from the findings of this investigation given that a new, synthesized conceptualization of zero-order capabilities is offered. Furthermore, few prior studies have investigated the relationship between first and zero-order capabilities, but from the empirical results of the current study, it is evidenced that a (highly significant) relationship exists between first and zero-order capabilities as proposed in Winter's (2000) hierarchy. Overall, this finding is encouraging for strategy researchers who seek to understand the nature of higher-level influences on lower-level capabilities, and it indicates an exciting opportunity for scholars interested in embarking on a frontier of strategy research.

Organization theory. Organization theorists are concerned with macro-approaches of analyzing the organization (or firm) as a unit (Daft, 2004). Thus, organization theory researchers will benefit from the findings of this study as well. For example, open system theory can be extended to integrate absorptive capacity, and institutional theory can be used to conceptualize the motivations of firms to engage in knowledge conversion.

According to Scott (2003), open systems are self-maintaining systems that convert resources from the environment to remain viable. As a theoretical "descendent" of systems theory, absorptive capacity can be used to describe the manner in which an organization seeks to remain in-sync with its environment as



an open system. Specifically, absorptive capacity offers organization theorists a more precise explanation of how organizations use a systematic approach to acquire, assimilate, transform, and exploit external (knowledge) resources. Most conceptualizations of systems theory include four dimensions: input, process, output, and feedback (e.g., Katz & Kahn, 1966). However, for knowledge-based resources, the process dimension can be expanded to include both knowledge assimilation and transformation given the findings of this study. Future studies could examine whether a similar, more detailed conceptualization of the process dimension would be appropriate for other types of resources (e.g., tangible resources).

Also related to the design of open systems is the influence of inter-organizational relationships on absorptive capacity. Inter-organizational relationships are the transactions, flows, and linkages between two or more organizations (Oliver, 1990). Inter-organizational relationships provide firms with the ability to communicate, assess industry competitiveness, and acquire knowledge. While some firms may be forced to engage in inter-organizational relationships, others may choose to engage for purposes of acquiring knowledge and enhancing performance. Thus, organization theory – and the study of inter-organizational relationships – is complementary to a more precise understanding of how organizations acquire knowledge. For example, are specific types of organizational relationships more worthwhile to firms than others?

On the surface it appears that firms may enhance performance by engaging in numerous inter-organizational relationships. Conversely, resource dependence theory suggests firms seek to minimize their dependence on other organizations for the supply of knowledge and other resources (Pfeffer & Salancik, 1978). Thus, from a resource dependence perspective, an optimal balance of inter-organizational relationships is ideal for firms seeking knowledge. Organization theorists are encouraged to extend the findings of the current study to examine the optimal manifestation of inter-organizational relationships. For example, are specific types of relationships more valuable for knowledge acquisition (e.g., trade associations versus direct contact with competitors)? Also, what is the value of electronic forums to acquire knowledge, and do such means provide knowledge acquisition with minimal dependence on external organizations? These suggestions and others can be pursued to better understand the nature of how absorptive capacity complements the stream of open systems research.

Institutional theory can be useful in describing the antecedents of absorptive capacity and influences on performance. Institutional theory suggests that organizations are similar as a result of isomorphic pressures; specifically, firms are subjected to coercive, mimetic, and normative forces (DiMaggio & Powell, 1983). Therefore, the primary motivation of firms to engage in knowledge acquisition may be to gain legitimacy. While the pursuit of legitimacy may be beneficial to the firm over the long term, short-term performance may

suffer. Given that the motivation of firms to acquire, assimilate, transform, and exploit knowledge may not be purely for performance reasons, scholars of all disciplines should be aware of such adverse influences on the outcome of the firm. Thus, the findings from this study have the potential to contribute to the field of organization theory, and similarly, organization theory can benefit future studies of absorptive capacity and capabilities.

Organizational behavior/human resources. Value from this investigation can also be extracted by researchers of organizational behavior and human resources. While this study investigates phenomena at the organizational level, it provides a framework for researchers to bridge the gap between macro and micro studies of the firm. For example, this investigation can be extended to include individual-level social networks as an antecedent to the acquisition dimension. Scholars have recognized the multi-level approach of knowledge conversion (e.g., Montoni, Miranda, Rocha, & Travassos, 2004); however, by using the framework of absorptive capacity offered in this study, researchers can gain a new perspective into how knowledge conversion begins with the individual (through acquisition) and is then converted for use by the firm.

Further in line with bridging the macro-micro gap, an assessment of individual traits may yield insight into which individuals are best-suited to acquire knowledge on behalf of the firm. Studies using the “Big Five” dimensions of personality have found that extraversion is a valid predictor of success for individuals in managerial and sales positions (e.g., Barrick & Mount, 1991).

Similarly, individuals high in extraversion may also be the ideal employees to engage in knowledge acquisition on behalf of the firm. Thus, micro-level researchers can continue to bridge the macro-micro divide by incorporating micro-level constructs into the macro-level model of absorptive capacity and capabilities.

Public administration. Even though most public organizations do not exist in environments that are as dynamic as the software industry examined in this study, more public organizations are incorporating more business-like approaches. Following a six-month, intensive study of the federal government, the National Performance Review committee, led by then Vice President Al Gore, determined that the government was functionally broken, and the solutions consisted of the organizations enhancing efficiency, putting customers first, and being more entrepreneurial (Gore, 1993). These recommendations encouraged public organizations to become more private-like and gave rise to the study of new public management, which is concerned with the implementation of private industry practices in public organizations (Lane, 2000).

The practice of new public management aims to develop the entrepreneurial nature of public organizations by lessening rigidity and enhancing adaptability to changing external influences. Given that new public management is a relatively recent phenomenon in the public administration literature, the exact manner in which public organizations are to enhance adaptability remains to be

specified. Thus, public administration scholars will benefit from a detailed conceptualization of the absorptive capacity and zero-order capability constructs.

Specifically, researchers can apply absorptive capacity to the discipline of public administration to conceptualize how public organizations convert knowledge. This understanding will allow scholars to compare the differences (if any) between knowledge conversion in public and private organizations, and it will provide insight into how absorptive capacity influences capabilities of public organizations. Furthermore, the conceptualization of zero-order capabilities can be applied to public organizations for a better understanding of how such organizations utilize zero-order capabilities to influence performance. For example, when applied to public organizations, operational capabilities describe the cooperation of departments in the organization and the configuration of day-to-day resources. Similarly, customer capabilities assess the extent to which the organization responds to constituent needs and maintains a reputation of service to constituents. Last, innovation capabilities conceptualize the creation of new processes or services to benefit the constituency served. Overall, the field of public administration – as it incorporates more business-like practices – can benefit from incorporating more detailed assessments of how organizations convert knowledge and how the knowledge can be used to enhance capabilities and influence organizational outcomes.

## Implications for Managers

In their recent discussion on management research, Briner et al. (2012) examine the gap between management theory and practice. The researchers state that the existence of the theory-practice gap is strongly present. Therefore, in an attempt to minimize the current divide, practical implications for managers are discussed. The implications are organized by practical advice for enhancing absorptive capacity and each dimension of zero-order capabilities (operational, customer, and innovation capabilities).

**Absorptive capacity.** Based on the findings of this study, managers will benefit from an enhanced understanding of absorptive capacity and its influences on the firm. Specifically, managers can engage in numerous practices or incorporate processes to enhance the firm's ability to acquire, assimilate, transform, and exploit knowledge. Several practical suggestions for managers are described including examining job design, enhancing knowledge retention, and supporting knowledge transfer.

Managers interested in enhancing absorptive capacity are encouraged to reexamine existing job designs and knowledge acquisition practices. Job design is defined as the identification of job duties and content organized into a productive unit of work (Mathis & Jackson, 2008). Managers interested in enhancing the absorptive capacity of the firm are encouraged to ensure that job designs in the firm support the knowledge conversion process. When jobs are designed, a duty of each position should include the codification of knowledge

relative to the position. When knowledge is codified, the existing knowledge structures of the firm are enhanced. Storing knowledge in the firm is vital to the successful implementation of the assimilation and transformation dimensions of absorptive capacity. Without well-defined and comprehensive internal knowledge structures, the firm will experience difficulty understanding and combining new and current knowledge.

Nonaka (1994) explains that codified (or explicit) knowledge can be easily transferred among individuals, yet for knowledge to be easily transferred it must first be retained. Codified knowledge is commonly found in employee manuals, process guides, and/or in online knowledge repositories. Thus, to ensure knowledge is retained in the firm, the implementation of practices that support knowledge codification are essential. Managers should be reminded that (tacit) knowledge that is not written or stored in the firm is knowledge that will leave the organization. When knowledge is codified, it is stored in the firm for future use. Thus, even with employee turnover, less codified knowledge leaves the firm when employees depart, and the existing knowledge structures are enhanced. By redesigning current jobs in the firm, managers can ensure the knowledge structures are enhanced and knowledge does not exit the organization with employees.

To further enhance absorptive capacity, managers should focus on the first dimension (i.e., acquisition of knowledge) with special attention to how knowledge is transferred. To enhance acquisition, employees can be

encouraged to interact with peer firms and share knowledge about products, processes, internal operations, and the like. Additionally, based on the work of Granovetter (1973), firms are encouraged to seek information from weak links in their social network. While strong links are peer firms with the closest and most frequent interaction, innovative knowledge is more likely to come from weak links: the firms with which the host firm has indirect or infrequent contact. Therefore, a suggestion for managers seeking to enhance the acquisition of new knowledge is to encourage employees to participate in professional organizations, trade associations, and similar groups where the exchange of information is facilitated. Furthermore, given the virtual resource available to most firms, knowledge acquisition can also be supplemented via online knowledge sharing. Online communities, newsgroups, message boards and similar platforms can be used by firms to enhance overall knowledge acquisition. Once knowledge is acquired – according to the linear model of absorptive capacity supported in the first research question – knowledge is then utilized by the other dimensions of absorptive capacity, which enhances zero-order capabilities and influences performance.

Zero-order capabilities. In this study, a synthesized, multi-dimensional framework was offered to conceptualize zero-order capabilities. Managers, like researchers, will benefit from an enhanced understanding of the multi-dimensionality of the construct. Specifically, by understanding that absorptive capacity positively influences each dimension of zero-order capabilities,



managers are encouraged to invest in each component of the firm's zero order capabilities, namely the operational, customer, and innovative capabilities. By focusing resources in each specific area, the firm will be better able to integrate the knowledge converted via the absorptive capacity process, and the performance of the firm is likely to be enhanced. Detailed recommendations for managers interested in enhancing each component of zero-order capabilities is offered.

*Operational capabilities.* As defined in Chapter 2, operational capabilities are designed to support cooperation among units and properly configure operational resources. Cooperation among units is essential to the firm working together as a unified manner; however, to instill cooperation, managers can focus on the internal team environment of units in the firm.

Research suggests that internal team environment of three dimensions: shared purpose, voice, and social support (Carson, Tesluk, & Marrone, 2007). Thus, managers can focus on these three dimensions to enhance the overall environment and cooperation among units. Specifically, shared purpose exists when members have common goals and work together to achieve goals of the team (Carson et al., 2007). To enhance shared purpose, managers can ensure each unit has stated goals, and the unit's goals are complementary to the goals of the firm. Voice describes the extent to which individuals feel they can contribute to the team by recommending changes (Hirshman, 1970). By listening to suggestions from all individuals and units, managers can instill a sense of

voice. Furthermore, social support is defined as the extent to which an individual or unit feels part of the greater team (Kirmeyer & Lin, 1987; Sarason, Levine, Basham, & Sarason, 1983). Through assigning each unit a key role in a task and recognizing each unit as a team player, managers can build social support among individuals and units.

Properly configuring operational resources is an additional action managers can take to support operational capabilities. Valuable resources (e.g., financial resources) in the firm must be properly allocated to ensure the units of the firm function at optimal levels. However, the process of appropriately allocating such resources can be challenging for managers. Crossan et al. (2009) recommend using careful analytic approaches and data collection processes to determine proper resource allocation. Therefore, by minimizing bounded rationality, managers are able to have enhanced insight into the resource allocation process thereby supporting the operational capabilities of the firm.

*Customer capabilities.* Customer capabilities are developed to respond to changing customer needs and support a valuable reputation with customers. While numerous approaches exist for enhancing customer relationships, Sias (2009) offers an approach consisting of relationship marketing and customer relationship development. In response to the competitive nature of service-oriented industries, Sias (2009) suggests firms engage in relationship marketing, which relates to the retention of customers and cultivation of valuable

relationships. Doyle and Roth (1992: 59) suggest that the goal of relationship marketing is to earn the “position of preferred supplier” by developing trust in customers. In a study of relationship marketing, Morgan and Hunt (1994) found the primary mediators of successful cultivation of relationships are commitment and trust between the firm and customer. Therefore, managers are encouraged to heed this advice and focus on establishing trust and commitment with current customers with the goal of enhancing overall customer capabilities.

Additionally, Sias (2009) recommends the development of new customer relationships. However, the manner in which new customers are developed should not occur haphazardly. Payne and Frow (2005) recommend that the customer development strategy be closely related to the strategy of the firm and integrated into the strategic development process. To assist with targeting strategic customer groups, they recommend managers utilize numerous resources including data repositories, analytical tools, and customer relationship management metrics (Payne & Frow, 2005).

In addition to determining which customer groups to target, managers must also be cognizant of factors that influence the initial development of the customer relationship. For example, the knowledge of the salesperson and the nature of the customer’s relationship with the salesperson were identified as two primary characteristics of salespeople that customers value (Fojt, 1995). Additionally, Martin and Bush (2003) found organizational climates that support employee security, open communication, and decentralized decision making

created stronger customer relationships. Thus, managers interested in developing new customer relationships are encouraged to consider the presence of these factors in the context of the firm.

*Innovation capabilities.* Innovation capabilities support the creation of new, valuable products/services and processes. For an innovation to be successful, the firm must support the development of the innovation. Various unit (team) structures can be used to support the development of an innovation. Wheelwright and Clark (1992) propose four types of team structures that foster innovation: functional, lightweight, heavyweight, and autonomous teams. Functional teams are somewhat isolated in traditional units (marketing, finance, etc.) and specialize in detailed functions of innovation. These types of teams are responsible for creating incremental improvements to a product, service, or process. Lightweight teams are useful when the work of a specialized unit infringes on the work of a closely related unit; thus, there is a level of “light” teamwork across functional units. Lightweight teams are a beneficial structure if interdependencies among functional units are needed to create incremental change. Heavyweight teams consist of members with specialized expertise who come together to create new developments. These forms of teams are useful for larger-scale changes to the architecture of a product, service, or process. Finally, autonomous teams consist of members acting external to their functional department and are assembled for the purpose of innovating in response to a disruptive occurrence.

Managers seeking to enhance innovative capabilities of the firm are encouraged to consider the influence of the team/unit structure employed. The correct team structure should be utilized to match the nature of the innovation needed. Thus, by understanding the forms of teams and the benefit of each structure to the type of innovation, managers will enhance the innovative capabilities of the firm.

#### Limitations

Notwithstanding the contributions made by this study, limitations of the investigation exist and should be considered with the interpretations of the findings. First, the generalizability of the results should be considered. Although numerous studies have examined absorptive capacity and related dynamic capabilities phenomena in similar contexts (e.g., Matusik & Heeley, 2005), the results of this study should be interpreted in the context in which they were examined (i.e., the software industry). Future researchers are encouraged to replicate and extend the current study to determine whether similar results are obtained in other industries (using various growth rates). With a multiple industry sample, researchers will be able to compare capability-related phenomena across industries.

Also related to the issue of generalizability, is the type of firms surveyed. Although all efforts were made to obtain a representative cross sample of firms in the software industry, based on an analysis of respondent firm characteristics, the majority of firms that participated in the study were firms with fewer than 100

employees and less than 20 years old. Although similar studies have found the average age of firms in the software industry is approximately 14.3 years (Matusik & Heeley, 2005), the type of firm surveyed should be considered when attempting to generalize findings of this study beyond the context surveyed. Older and larger firms may have varying manifestations of absorptive capacity and capability-related phenomena; thus, broad generalizations of findings are cautioned.

The type of knowledge converted by the firm is also a limiting factor. This study assumes that the type of knowledge converted by the firm via absorptive capacity is complex in nature. Todorova and Durisin (2007) propose a more detailed model of absorptive capacity with the assumption that various processes may be used to convert knowledge depending on the complexity of the knowledge acquired. The result of the first research question of this study suggests the knowledge conversion process is not as complex as suggested in previous literature; rather, it is a linear process. Future studies are encouraged to include a control variable to assess the complexity of knowledge assessed. By having a reference of the complexity of knowledge considered when using a self-reported measure of the knowledge conversion process, the researcher will have a more precise understanding of the type of knowledge converted. Assessing the complexity of knowledge converted as a control variable will benefit future studies of absorptive capacity in that it will allow for comparisons of complex versus less complex knowledge.

Additionally, the internal reliabilities – measured using Cronbach's  $\alpha$  – for two dimensions were below the 0.70 level recommended by Nunnally (1978). Although Nunnally (1978) recommends 0.70 as a minimum level of reliability, other scholars have suggested that reliabilities in the range of 0.60 to 0.69 represent moderate reliability (Robinson et al., 1991). The transformation and exploitation dimensions of absorptive capacity were both in the moderate range as suggested by Robinson et al. (1999). Therefore, even though due diligence was performed with rigorous pre-testing of the instrument, future studies are encouraged to further refine these measures to enhance the internal consistency of the items.

The response rate is a minimal limitation of the study. Although the response rate satisfied the minimum requirement for testing the data using structural modeling techniques (minimum sample size of 150 as recommended by Holbert & Stephenson, 2002), a larger sample would provide an even richer insight into the phenomena examined. To increase the response rate in the current study, respondents were offered a free, customized report of the learning capabilities of their firm and a chance to win an airline voucher for an airline of choice. Future studies should consider similar incentives, and if additional research resources are available, the researcher should consider enhancing the incentives offered. Being that the sampled population (top managers of firms in a high-growth industry) has strict time restraints, worthwhile incentives are likely to enhance the response rates of similar studies.

Last, while the scope of this research was specific to examining capability-related phenomena, it is likely that other constructs influence the proposed model. Therefore, the current model is likely underspecified. Much research has been conducted on external influences on the absorptive capacity construct. For example, Fosfuri and Tribo (2008) propose that activation triggers (i.e., actions that propel a firm to engage) act as an antecedent to absorptive capacity. Jansen et al. (2005) examined the influence of socialization (measured as connectedness and tactics) on absorptive capacity. Additionally, regimes of appropriability and power relationships are yet other constructs that have been proposed to influence the absorptive capacity of the firm (Cohen & Levinthal, 1990; Todorova & Durisin, 2007). Thus, future researchers are encouraged to extend the conceptual model used in this study to determine the influence of the aforementioned constructs and others to develop a more comprehensive model.

#### Recommendations for Future Research

Given the nature of this research and the findings of this investigation, scholarship on absorptive capacity has few reasons to not continue in an onward and upward direction. Being that this investigation has offered numerous valuable insights into absorptive capacity and its relationships with lower-level capabilities, researchers are encouraged to continue this stream of research and further pursue what is called the “Holy Grail” of strategic management research (Helfat & Peteraf, 2009).



This investigation confirmed that absorptive capacity is positively related to zero-order capabilities. Future researchers are encouraged to extend this study to assess whether zero-order capabilities fully or partially mediate the absorptive capacity-performance relationship. In other words, is there a direct link between absorptive capacity and performance that exists simultaneously with the influence of absorptive capacity on zero-order capabilities? Also, do other factors exist in the firm that absorptive capacity influences to alter performance? While the capabilities-based perspective was selected for its relevance in the current study, other theoretical perspectives can be applied (simultaneously) to determine the manner in which absorptive capacity affects firm performance.

The first research question of this study was to examine the manner in which the dimensions of absorptive capacity are related. Although it was beyond the scope of the current study, future research can examine the manner in which the dimensions of zero-order capabilities are related. Through the course of this examination, a synthesis of the capabilities literature was conducted to propose a unified framework representative of dimensions of zero-order capabilities. Next, future researchers can extend this conceptualization by theorizing and empirically testing the manner in which the operational, customer, and innovation capabilities are related.

Furthermore, future studies may consider further investigating whether the linear relationships of the absorptive capacity dimensions hold when converting complex and less complex knowledge. The insight garnered from such a study

would provide a rich contribution to absorptive capacity literature. With data on the type of knowledge converted and the type of industry in which the firm exists, a matrix of absorptive capacity typologies may be constructed if differences emerge among the dimensional relationships. An absorptive capacity typology would be beneficial to researchers to provide a comprehensive understanding of how the internal dimensions of the construct work to convert knowledge in various types of industries and with various types of knowledge. The categorization of various types of absorptive capacity (assuming such variations exist) would provide insight for researchers on the proper form of absorptive capacity to be used in a given context. If no difference is found to exist among the various contexts and types of firms, then confirmation will be achieved that a linear model of absorptive capacity is broadly descriptive of the knowledge conversion process.

This study examined zero and first-order capabilities. Future researchers are encouraged to extend this study and examine the influence of second-order capabilities on lower-order capabilities. For example, dominant logic may be a type of second-order capability; however, the manner in which dominant logic influences first and zero-order capabilities is unclear. Based on Winter's (2000) hierarchical framework, theoretical support exists for a direct relationship between dominant logic (second-order capability) and absorptive capacity (first-order capability). Thus, it is assumed that higher level schemas of the organization (specifically of the top management team) influence the manner in

which knowledge is acquired, assimilated, transformed, and exploited. However, do higher-level capabilities influence the first dimension of this process (i.e., acquisition), or does the dominant logic influence each dimension of absorptive capacity uniquely? By answering this question, researchers and managers will be better able to understand the influence of the highest-order capabilities on lower-level capabilities and performance.

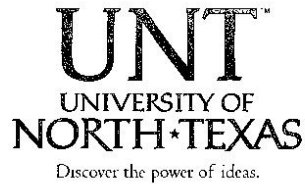
While there are numerous future directions for related research that result from this investigation, a final future recommendation is for the theory-practice partnership to be strengthened across the board. To strengthen this divide, researchers and managers are encouraged to find means to share scholarship and experience. For example, researchers are aware that if managers desire to enhance firm outcomes, an understanding of how firm outcomes are influenced must exist. Researchers are trained to develop and extend theories to explain such phenomena, yet only through close partnerships between managers and researchers can the proper balance of theory development and theory testing exist. Therefore, managers and researchers are encouraged to work in close proximity to develop theory, test the phenomenon in the field, and ultimately incorporate the findings into practice. Without the existence of this mutually beneficial relationship, the benefit of both researchers and managers is diminished.

## Conclusion

In an effort to advance absorptive capacity research, this study has answered two primary questions related to (1) how absorptive capacity converts knowledge, and (2) how absorptive capacity influences firm capabilities. Despite developments in the recent literature, findings from this study indicate that the dimensions of absorptive capacity are related in a linear manner, and the knowledge conversion process is not as complex as previously assumed. Additionally, for scholars and practitioners interested in understanding how absorptive capacity enhances firm performance, this study confirms that zero-order capabilities are a means through which absorptive capacity affects firm outcomes.

Overall, organizational learning has been a relevant topic in strategic management literature for decades. With the findings from the current study, researchers and managers will benefit from an enhanced perspective of how organizational learning manifests through the phenomenon of absorptive capacity, and how the phenomenon creates value for the organization. Much remains to be understood about the manner in which knowledge is used in firms; however, given the recent theoretical developments and empirical findings, researchers and managers are well-positioned to further explore knowledge-based value creation approaches and continue developing this frontier of strategic management research.

APPENDIX A  
INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL



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OFFICE OF THE VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT  
Research Services

May 26, 2011

Dr. Derrick D'Souza  
Department of Management  
University of North Texas  
RE: Human Subjects Application No. 11-257

Dear Dr. D'Souza:

In accordance with 45 CFR Part 46 Section 46.101, your study titled "The Influence of Absorptive Capacity on Firm Capabilities" has been determined to qualify for an exemption from further review by the UNT Institutional Review Board (IRB).

Enclosed is the consent document with stamped IRB approval. Please copy and **use this form only** for your study subjects.

No changes may be made to your study's procedures or forms without prior written approval from the UNT IRB. Please contact Jordan Harmon, Research Compliance Analyst, ext. 3940, if you wish to make any such changes. Any changes to your procedures or forms after 3 years will require completion of a new IRB application.

We wish you success with your study.

Sincerely,

Patricia L. Kaminski, Ph.D.  
Associate Professor  
Chair, Institutional Review Board

PK;jh

## University of North Texas Institutional Review Board

### Informed Consent Form

Before agreeing to participate in this research study, it is important that you read and understand the following explanation of the purpose, benefits and risks of the study and how it will be conducted.

**Title of Study:** The Influence of Absorptive Capacity on Firm Capabilities.

**Principal Investigator:** Dr. Derrick D'Souza, University of North Texas (UNT) Department of Management.

**Key Personnel:** Josh Daspit, University of North Texas (UNT) Department of Management.

**Purpose of the Study:** You are being asked to participate in a research study, which involves assessing the influence of a firm's absorptive capacity on capabilities.

**Study Procedures:** You will be asked to complete the attached questionnaire (survey) that will take about 15 minutes of your time.

**Foreseeable Risks:** No foreseeable risks are involved in this study.

**Benefits to the Subjects or Others:** The study may yield implications that will be beneficial for firms seeking to enhance knowledge-related and firm-level capabilities.

**Compensation for Participants:** For completing the survey, you will receive a customized report in return. The report will assess your firm's knowledge-related capabilities (i.e., absorptive capacity) and your firm's operational, customer, and innovation capabilities. The individual report will be customized for each firm that participates in the study and will be sent following the completion of the investigation.

**Procedures for Maintaining Confidentiality of Research Records:** You are assured complete confidentiality. All responses will be housed in a locked and secured location with access only by the principal investigator and key personnel. The confidentiality of your individual information will be maintained in any publications or presentations regarding this study.

**Questions about the Study:** If you have any questions about the study, you may contact Dr. Derrick D'Souza at (940) 565-3168.

**Review for the Protection of Participants:** This research study has been reviewed and approved by the UNT Institutional Review Board (IRB). The UNT IRB can be contacted at (940) 565-3940 with any questions regarding the rights of research subjects.

Office of Research Services  
University of North Texas  
Last Updated: August 9, 2007

Page 1 of 2

**Research Participants' Rights:**

Your signature below indicates that you have read or have had read to you all of the above and that you confirm all of the following:

- You have been told the possible benefits and the potential risks and/or discomforts of the study.
- You understand that you do not have to take part in this study, and your refusal to participate or your decision to withdraw will involve no penalty or loss of rights or benefits. The study personnel may choose to stop your participation at any time.
- You understand why the study is being conducted and how it will be performed.
- You understand your rights as a research participant and you voluntarily consent to participate in this study.
- You may retain this form for your records.

\_\_\_\_\_  
Printed Name of Participant

\_\_\_\_\_  
Signature of Participant

\_\_\_\_\_  
Date

**For the Principal Investigator or Designee:**

I certify that I have reviewed the contents of this form with the subject signing above. I have explained the possible benefits and the potential risks and/or discomforts of the study. It is my opinion that the participant understood the explanation.

\_\_\_\_\_  
Signature of Principal Investigator or Designee

\_\_\_\_\_  
Date

Office of Research Services  
University of North Texas  
Last Updated: August 9, 2007

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**APPROVED BY THE UNT IRB**

**DATE:** 5-26-11  
OJS



APPENDIX B  
EMAIL MESSAGES SENT TO PARTICIPANTS

## Email Message #1

Subject: Advance Notice - Innovative Study on Firms: Participate and Receive Free Assessment of Firm Capabilities

Dear (First Name of Recipient),

Your firm has been identified as a successful business in your industry. Congratulations.

We would like to learn how your firm achieved its current status and use the results to support future success for your firm. Therefore, we invite you to participate in an innovative study that investigates how firms adapt to changing environments.

In a few days, you will receive an electronic survey. For a small investment of your time, we will provide you with a report containing valuable information for your firm.

Specifically, we will create a *free, customized report* of your firm's ability to remain competitive. The report will be unique to your firm and include a comparison of your firm's capabilities with industry benchmarks.

We look forward to working with you on this groundbreaking study. Further information on the study is provided below. However, if you have additional questions, you may contact Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

Best regards,

[Josh Daspit](#), M. B. A.  
University of North Texas

[Derrick D'Souza](#), Ph. D.  
University of North Texas

### Details about study:

Your firm was selected because it has competed successfully in what is identified as a high-growth industry by the United States Department of Labor.

In a few days, you will receive a survey that includes questions about your firm's operations. Additionally, this survey will allow us to assess your firm's capability ranking relative to your competitors. This analysis will provide insight into your firm's expertise and will offer a customized output that suggests areas of improvement. Also, specific recommendations to help improve your firm's adaptive capabilities will be included. (Given the recent nature of research on such capabilities, few managers currently have access to such data.)

## Email Message #2

Subject: Innovative Study on Firms: Participate and Receive Free Assessment of Firm Capabilities

Dear (First Name of Recipient),

You recently received a request to participate in the innovative study we are conducting regarding how firms successfully adapt to changing environments.

For a small investment of your time, we will provide you with a report containing valuable information for your firm. Specifically, we will create a free, customized report of your firm's ability to remain adaptive and compete. The report will be customized to your firm and include a comparison of your firm's adaptive capabilities with industry benchmarks. (See further details at end of message.)

Please complete the survey before Tuesday, November 15. The survey is expected to take approximately 20 minutes and is accessible online by visiting: [http://untbusiness.qualtrics.com/SE/?SID=SV\\_41j4qxlG0VtzSPq](http://untbusiness.qualtrics.com/SE/?SID=SV_41j4qxlG0VtzSPq).

We look forward to working with you on this groundbreaking study. Further information on the study is provided below. However, if you have additional questions, you may contact Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

Best regards,

[Josh Daspit](#), M. B. A.  
University of North Texas

[Derrick D'Souza](#), Ph. D.  
University of North Texas

### Details about study:

This survey is designed to assess the various capabilities of your firm including its ability to adapt to changing environments. In appreciation for your time completing the survey, we will create a customized report of your firm's current capabilities with a comparison to industry benchmarks. This analysis will provide insight into your firm's expertise and will offer a customized output that suggests areas of improvement. Also, specific recommendations to help improve your firm's adaptive capabilities will be included. Given the recent nature of research on such capabilities, few managers currently have access to such data.

### Email Message #3

Subject: REMINDER -- Innovative Study on Firms: Participate and Receive Free Assessment of Your Firm

Dear (First Name of Recipient),

We contacted you earlier this week regarding your participation in our innovative study. This is a friendly reminder regarding the upcoming deadline.

For a small investment of your time, we will create a *free, customized report* of your firm's ability to remain competitive. The report will be customized to your firm and include a comparison of your firm's adaptive capabilities with industry benchmarks. Specific recommendations to help improve your firm's adaptive capabilities will also be included. Few managers currently have access to such data.

Please complete the survey before Tuesday, November 15. The survey is expected to take approximately 20 minutes and is accessible online by visiting: [http://untbusiness.qualtrics.com/SE/?SID=SV\\_41j4qxlG0VtzSPq](http://untbusiness.qualtrics.com/SE/?SID=SV_41j4qxlG0VtzSPq)

We look forward to working with you on this groundbreaking study. Further information on the study is provided below. However, if you have additional questions, you may contact Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

Best regards,

[Josh Daspit](#), M.B.A., and [Derrick D'Souza](#), Ph. D.  
University of North Texas

#### Details about study:

This survey is designed to assess the various capabilities of your firm including its ability to adapt to changing environments. In appreciation for your time completing the survey, we will create a customized report of your firm's current capabilities with a comparison to industry benchmarks. This analysis will provide insight into your firm's expertise and will offer a customized output that suggests areas of improvement. Also, specific recommendations to help improve your firm's adaptive capabilities will be included. Given the recent nature of research on such capabilities, few managers currently have access to such data.

## Email Message #4

Subject: ATTENTION: Survey Deadline Extended - Receive Chance for \*Free Air Travel\* and Free Customized Firm Analysis for Participation

Dear (First Name of Recipient),

We previously contacted you regarding your participation in our innovative study on firm competitiveness. We want to provide you an additional opportunity to respond. Therefore, we are extending the deadline.

The survey will close this Friday, November 18, at 8:00 p.m. CST and is accessible online by visiting:

[http://untbusiness.qualtrics.com/SE/?SID=SV\\_41j4qxlG0VtzSPq](http://untbusiness.qualtrics.com/SE/?SID=SV_41j4qxlG0VtzSPq) .

For participating, you will receive enhanced incentives:

- Chance to win a \$200 airline voucher
- Free, customized report of your firm's competitive ability (Report includes: valuable information for managers on firm's adaptive capabilities, a comparison of your firm's capabilities with industry averages, and practical tips for enhancement.)

We look forward to working with you on this groundbreaking study. Further information on the study is provided below. However, if you have additional questions, you may contact Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

Best regards,

[Josh Daspit](#), M.B.A., and [Derrick D'Souza](#), Ph.D.  
University of North Texas

Further details about study:

This survey is designed to assess the various capabilities of your firm including its ability to adapt to changing environments. In appreciation for your time completing the survey, we will create a customized report of your firm's current capabilities with a comparison to industry benchmarks. This analysis will provide insight into your firm's expertise and will offer a customized output that suggests areas of improvement. Also, specific recommendations to help improve your firm's adaptive capabilities will be included. Given the recent nature of research on such capabilities, *few managers currently have access to such data.*

Furthermore, if you complete the survey in full, you will be entered into a drawing for an airline voucher valued at \$200. Individuals who have already participated are eligible for the voucher drawing.

## Email Message #5

Subject: LAST CALL: Survey Deadline Extended - Receive Chance for \*Free Air Travel\* and Free Customized Firm Analysis for Participation

Dear (First Name of Recipient),

We previously contacted you regarding your participation in our innovative study on firm competitiveness. Given that your opinion is valuable, we want to provide you a final opportunity to respond.

The survey will close this Friday, November 18, at 8:00 p.m. CST and is accessible online at

[http://untbusiness.qualtrics.com/SE/?SID=SV\\_41j4qxIG0VtzSPg](http://untbusiness.qualtrics.com/SE/?SID=SV_41j4qxIG0VtzSPg) .

For participating, you will receive:

- Chance to win a \$200 airline voucher
- Free, customized report of your firm's competitive ability (Detailed report includes: valuable information for managers on firm's adaptive capabilities, a comparison of your firm's capabilities with industry averages, and practical tips for enhancement.)

We look forward to working with you on this groundbreaking study. Further information on the study is provided below. However, if you have additional questions, you may contact Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

Thank you for your participation.

Best regards,

[Josh Daspit](#), M.B.A., and [Derrick D'Souza](#), Ph.D.  
University of North Texas

### Further details about study:

This survey is designed to assess the various capabilities of your firm including its ability to adapt to changing environments. In appreciation for your time completing the survey (approximately 20 minutes), we will create a customized report of your firm's current capabilities with a comparison to industry benchmarks. This analysis will provide insight into your firm's expertise and will offer a customized output that suggests areas of improvement. Also, specific

recommendations to help improve your firm's adaptive capabilities will be included. Given the recent nature of research on such capabilities, *few managers currently have access to such data.*

Furthermore, if you complete the survey in full, you will be entered into a drawing for an airline voucher valued at \$200. Individuals who have already participated are eligible for the voucher drawing.

Email Message #6

Subject: LAST CALL: Survey Deadline Extended - Receive Chance for \*Free Air Travel\* and Free Customized Firm Analysis for Participation

Dear (First Name of Recipient),

We want to thank you for your participation in and/or consideration of our recent study.

As you will recall, we sent you a few notices regarding our study, and we want to take a moment to share with you our appreciation for the success of the research project.

If you participated, we will send you the free, customized report (as promised) as soon as the data analysis is complete. We will also be notifying the winner of the \$200 airline voucher in the near future.

Again, we appreciate your time. We wish you and your family a *safe and happy Thanksgiving*.

Thank you.

[Josh Daspit](#), M.B.A., and [Derrick D'Souza](#), Ph.D.  
University of North Texas

The study will remain open until this Friday if you still wish to participate. At that time the survey will be closed, and the data analysis will begin. The survey can be accessed at [http://untbusiness.qualtrics.com/SE/?SID=SV\\_41j4qxlG0VtzSPq](http://untbusiness.qualtrics.com/SE/?SID=SV_41j4qxlG0VtzSPq)



APPENDIX C  
QUESTIONNAIRE

### Absorptive Capacity: Acquisition

*The following questions address your firm's adaptive abilities:*

- AQ1 Our firm has frequent interactions with other firms to acquire new knowledge.
- AQ2 Our employees regularly visit other firms in the industry.
- AQ3 We collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners).
- AQ4 (R) Our employees rarely meet with employees from peer firms.
- AQ5 Our firm periodically meets with customers or third parties to acquire new knowledge.
- AQ6 Our employees regularly approach third parties such as accountants, consultants, or tax consultants.

### Absorptive Capacity: Assimilation

*The following questions address your firm's adaptive abilities:*

- AS1 We are quick to recognize shifts in our market (e.g. competition, regulation, demography).
- AS2 New opportunities to serve our customers are quickly understood.
- AS3 We quickly analyze and interpret changing market demands.

### Absorptive Capacity: Transformation

*The following questions address your firm's adaptive abilities:*

- TR1 Our firm considers the consequences of changing market demands in terms of new products and services.
- TR2 Our employees record and store newly acquired knowledge for future reference.
- TR3 Our firm recognizes the usefulness of new external knowledge to existing knowledge.
- TR4 (R)\* Our employees rarely share practical experiences.
- TR5 (R)\* It is difficult for our firm to grasp opportunities from new external knowledge.
- TR6 Our firm periodically meets to discuss consequences of market trends.

### Absorptive Capacity: Exploitation

*The following questions address your firm's adaptive abilities:*

- EX1 We know how activities within our firm should be performed.
- EX2 (R) Customer complaints are ignored in our firm.
- EX3 Our firm has a clear division of job duties.
- EX4 We often seek to exploit new knowledge acquired by the firm.
- EX5 (R) Our firm has difficulty introducing new products and services.
- EX6 Our employees have a common language regarding our products and services.

### Innovation Capability: Product Innovation

*The following questions address your firm's innovation abilities:*

- ICPROD1 Our firm often develops new products/services that are well accepted by the market.
- ICPROD2 A majority of our firm's profits are generated by new products/services.
- ICPROD3 The new products/services developed by our firm arouse imitation from competitors.
- ICPROD4 Our firm can launch new products/services faster than our competitors.
- ICPROD5 Our firm has better R&D capabilities for new products/services compared to our competitors.
- ICPROD6 Our firm can develop novel skills for transforming old products/services into new products/services.

### Innovation Capability: Process Innovation

*The following questions address your firm's innovation abilities:*

- ICPROC1\* We often try different procedures to speed up the realization of firm's goals.
- ICPROC2 Our firm can acquire new skills or equipment to improve operations or processes.
- ICPROC3\* Our firm can develop more efficient operations or process procedures.
- ICPROC4 Our firm has the flexibility to meet the changing demands of customers.
- ICPROC5\* New process/service procedures employed by our firm arouse imitation from competitors.

### Customer Capability: Response Speed

*The following questions address your firm's customer abilities:*

- CCSPD1 When we identify a new customer need, we are quick to respond to it.
- CCSPD2 Customer complaints are not quickly responded to in our firm.
- (R)
- CCSPD3 We take corrective action immediately when we find that customers are unhappy with our product/service.
- CCSPD4\* We believe in being proactive to shape market demand rather than being reactive.
- CCSPD5 When we find that customers would like us to modify a product/service, the departments involved make concerted efforts to do so.

### Customer Capability: Response Expertise

*The following questions address your firm's customer abilities:*

- CCEXP1 We can easily satisfy new needs of customers.
- CCEXP2 We can satisfy needs of our customers better than our competitors can.
- CCEXP3 We have a reputation for effectively meeting the demands of our customers.

### Operational Capability: Cooperation

*The following questions address your firm's operational abilities:*

- OCCOOP1 Our information system facilitates cooperation across departments.
- OCCOOP2 Our formal procedures facilitate teamwork across departments.
- OCCOOP3 Our employees are skilled at maintaining healthy relationships with each other to solve problems.

### Operational Capability: Customization

*The following questions address your firm's operational abilities:*

- OCCUST1 Our resources are used in ways that differentiate us from our competitors.
- OCCUST2\* Our operations capabilities are modified to better serve customer needs.
- OCCUST3 Our planning system has been modified to better serve the needs of our customers.
- OCCUST4 Our operations process has been modified to gain unique positions in the market.

### Operational Capability: Responsiveness

*The following questions address your firm's operational abilities:*

- OCRESP1 We can reduce uncertainty of resource availability by changing the operational processes.
- OCRESP2 We can adjust operational processes for unexpected variations in inputs.
- OCRESP3 We can adjust operational processes for unexpected variations in labor requirements.

### Operational Capability: Reconfiguration

*The following questions address your firm's operational abilities:*

- OCRECON1 We can adopt new and better practices to respond to market changes.
- OCRECON2 We can reconfigure resources to respond to market changes.
- OCRECON3 We can develop new operational competencies to respond to market changes.

### Performance: Financial Performance

*How does your firm compare to other firms in your industry in terms of:*

- OPPERF1 ROA (return on assets)
- OPPERF2\* Net profit (as a percentage of sales)
- OPPERF3 Sales growth
- OPPERF4 Market share
- OPPERF5 Overall firm performance

### Performance: Organizational Health

*How does your firm compare to other firms in your industry in terms of:*

|          |   |
|----------|---|
| HEALTH1* | Employment growth                       |
| HEALTH2  | Employee compensation                   |
| HEALTH3  | Employee morale                         |
| HEALTH4* | Employee job satisfaction               |
| HEALTH5  | Employee turnover                       |
| HEALTH6  | Customer relationships                  |
| HEALTH7  | Supplier relationships                  |
| HEALTH8  | Ability to predict customer preferences |
| HEALTH9* | Ability to predict competitor actions   |
| HEALTH10 | Firm reputation                         |
| HEALTH11 | Product/Service quality                 |

### Firm Information

*The following questions relate to firm financials and descriptives. Please insert the appropriate number in the corresponding box. (Note: Respondents asked to report for years 2010 and 2005.)*

What was your firm's revenue in millions? (e.g., 5.0 million)  
What was your firm's net profit in millions? (e.g., 5.0 million)  
What was the number of firm employees?

*(The following three items were open-ended.)*

What percentage of sales arises from your primary business unit?  
What is the current age of your firm?  
What is the name of your firm?

### Demographic Information (classifications provided for respondent to choose)

Which best describes your current position?  
How many years of professional experience do you have with your current firm?

### Affective Assessment

*(Note: Used as marker variable to assess common method variance.)*

|         |   |
|---------|---|
| AFFECT1 | Minor setbacks tend to irritate me substantially. |
| AFFECT2 | Often I get irritated at minor annoyances.        |
| AFFECT3 | There are days when I am "on-edge" all the time.  |

*Note: All items measured using a 5-point Likert scale unless otherwise noted.*

*\* Indicates item removed following confirmatory analysis.*

*Absorptive capacity items adapted from Jansen et al. (2005) and used with permission from Academy of Management.*

*Innovation capability items adapted from Liao et al. (2007) and used with permission from Sage Publications.*

*Customer capability items adapted from Jayachandran et al. (2004) and used with permission from Springer.*

*Operational capability items adapted from Wu et al. (2010) and used with permission from John Wiley and Sons.*

APPENDIX D  
ONLINE QUESTIONNAIRE

**Informed Consent Notice**

The following survey is related to your firm's experience adapting to changing environments.

Please complete all questions before submitting your responses. Answering the questions in this survey involves no foreseeable risks, and each section must be answered before proceeding to the next section.

If you have any questions regarding this study, please contact the following study investigator:

Josh Daspit at [josh.daspit@unt.edu](mailto:josh.daspit@unt.edu).

By clicking below to proceed, you confirm that you understand the information presented and that you are at least 18 years of age. Furthermore, you are providing consent to participate in this study, and you understand the participation is voluntary and you may withdraw at any time.

If you choose to receive the incentive offered, you will be asked to provide your name and contact information at the end of the survey. This information will not be linked with the responses from your survey.



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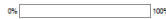
**Welcome!**

Thank you for participating in this innovative study of firm adaptability in changing environments.

As compensation for your time, we will create a **free, customized report** of your firm's ability to adapt to a changing environment. The report is specific to your firm (based on your responses) and will include a comparison of your firm's capabilities with the industry average. Recommendations for improving your firm's adaptation capabilities and performance will also be included.

We ask that you please complete all questions to the best of your knowledge. The survey is designed to take approximately 20 minutes of your time.

Begin by clicking the arrow below.



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**Current experiences**

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| The current economic recession has presented challenges for our firm                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm would benefit from learning about new ways to enhance its competitive advantage | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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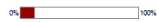
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**The following questions address your firm's adaptive abilities:**

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| We are quick to recognize shifts in our market (e.g. competition, regulation, demography).            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| New opportunities to serve our customers are quickly understood.                                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We quickly analyze and interpret changing market demands.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm considers the consequences of changing market demands in terms of new products and services. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees record and store newly acquired knowledge for future reference.                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

**The following questions address your firm's adaptive abilities:**

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our firm recognizes the usefulness of new external knowledge to existing knowledge. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees rarely share practical experiences.                                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| It is difficult for our firm to grasp opportunities from new external knowledge.    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm periodically meets to discuss consequences of market trends.               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm has frequent interactions with other firms to acquire new knowledge.       | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



The following questions address your firm's adaptive abilities:

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our employees regularly visit other firms in the industry.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We collect industry information through informal means (e.g. lunch with industry friends, talks with trade partners). | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees rarely meet with employees from peer firms.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm periodically meets with customers or third parties to acquire new knowledge.                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees regularly approach third parties such as accountants, consultants, or tax consultants.                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

The following questions address your firm's adaptive abilities:

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| We know how activities within our firm should be performed.               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Customer complaints are ignored in our firm.                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm has a clear division of job duties.                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We often seek to exploit new knowledge acquired by the firm.              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm has difficulty introducing new products and services.            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees have a common language regarding our products and services. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



The following questions address your firm's innovation abilities:

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our firm often develops new products/services that are well accepted by the market.         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| A majority of our firm's profits are generated by new products/services.                    | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| The new products/services developed by our firm arouse imitation from competitors.          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm can launch new products/services faster than our competitors.                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm has better R&D capabilities for new products/services compared to our competitors. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

The following questions address your firm's innovation abilities:

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our firm can develop novel skills for transforming old products/services into new products/services. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We often try different procedures to speed up the realization of the firm's goals.                   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm can acquire new skills or equipment to improve operations or processes.                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm can develop more efficient operations or process procedures.                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our firm has the flexibility to meet the changing demands of customers.                              | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| New process/service procedures employed by our firm arouse imitation from competitors.               | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



The following questions address your firm's operational abilities:

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our information system facilitates cooperation across departments.                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our formal procedures facilitate teamwork across departments.                                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our employees are skilled at maintaining healthy relationships with each other to solve problems. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our resources are used in ways that differentiate us from our competitors.                        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our operations capabilities are superior to those of our customer needs.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our existing system has been modified to better serve the needs of our customers.                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Our operations process has been modified to gain unique positions in the market.                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

The following questions address your firm's operational abilities:

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| We can reduce uncertainty or resource availability by changing the operational processes. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can adjust operational processes for unexpected variations in inputs.                  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can adjust operational processes for unexpected variations in labor requirements.      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can adjust new and better practices to respond to market changes.                      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can reconfigure resources to respond to market changes.                                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can develop new operational competencies to respond to market changes.                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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The following questions address your firm's customer abilities:

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| When we identify a new customer need, we are quick to respond to it.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Customer complaints are not quickly responded to in our firm.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We take corrective action immediately when we find that customers are unhappy with our products/service.                         | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We believe in being proactive to shape market demand rather than being reactive.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| When we find that customers would like us to modify a product/service, the departments involved make concerted efforts to do so. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can easily satisfy new needs of customers.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We can satisfy needs of our customers better than our competitors can.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| We have a reputation for effectively meeting the demands of our customers.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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The following questions address the characteristics of your firm's top management team:

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Members of the top management team share leadership responsibilities                                 | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team share in establishing the goals for our firm.                     | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team help to frame the vision for our firm.                            | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team share in deciding on the best response when faced with a problem. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team are accountable to all other members of the leadership team.      | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team collaborate with one another in strategic decision making.        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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The following questions address the characteristics of your firm's top management team:

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Each top management team member has a say in deciding how resources are allocated concerning the top management team's priorities. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team help to resolve the problems that face this team.   | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team chip in to insure the team fulfills its obligations.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| The opinion of each member of the top management team counts.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Members of the top management team share information with others on the team.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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**How does your firm compare to other firms in your industry in terms of:**

|   | Much worse than industry average | Worse than industry average | Same as industry average | Better than industry average | Much better than industry average |
|---|----------------------------------|-----------------------------|--------------------------|------------------------------|-----------------------------------|
| Employment growth                       | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Employee compensation                   | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Employee morale                         | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Employee job satisfaction               | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Employee turnover                       | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Customer relationships                  | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Supplier relationships                  | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Ability to predict customer preferences | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Ability to predict competitor actions   | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Firm reputation                         | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Product/Service quality                 | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |

**How does your firm compare to other firms in your industry in terms of:**

|                                       | Much worse than industry average | Worse than industry average | Same as industry average | Better than industry average | Much better than industry average |
|---------------------------------------|----------------------------------|-----------------------------|--------------------------|------------------------------|-----------------------------------|
| ROA (return on assets)                | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Net profit (as a percentage of sales) | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Sales growth                          | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Market share                          | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |
| Overall firm performance              | <input type="radio"/>            | <input type="radio"/>       | <input type="radio"/>    | <input type="radio"/>        | <input type="radio"/>             |



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**The following questions address the competitive nature of your industry:**

|  | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|--|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Our customers tend to look for new products/services all the time. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Competition in our industry is cutthroat.                          | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| The technology in our industry is rapidly changing.                | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |



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The following questions relate to firm financials and descriptives. Please insert the appropriate number in the corresponding box.

|  | In 2010              | In 2005              |
|--|----------------------|----------------------|
| What was your firm's revenue in millions? (e.g., 5.0 million)    | <input type="text"/> | <input type="text"/> |
| What was your firm's net profit in millions? (e.g., 5.0 million) | <input type="text"/> | <input type="text"/> |
| What was the number of firm employees?                           | <input type="text"/> | <input type="text"/> |

What percentage of sales arise from your primary business unit?

What is the current age of your firm?

- Fewer than 5 years
- 6-9 years
- 10-19 years
- 20-29 years
- 30-39 years
- 40-49 years
- 50+ years

What is the name of your firm?

0%  100%



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Which best describes your current position?

- Top manager (e.g., CEO, President, Vice-president)
- Middle manager (e.g., General manager)
- Front line manager (e.g., Shift supervisor)
- Other (please specify):

How many years of professional experience do you have with your current firm?

- Fewer than 5 years
- 6-9 years
- 10-19 years
- 20-29 years
- 30-39 years
- 40-49 years
- 50+ years

The following questions address your personal beliefs (included to assist with data analysis):

|   | Strongly Disagree     | Disagree              | Neither Agree nor Disagree | Agree                 | Strongly Agree        |
|---|-----------------------|-----------------------|----------------------------|-----------------------|-----------------------|
| Minor setbacks tend to irritate me substantially. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| Often I get irritated at minor annoyances.        | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |
| There are days when I am 'on-edge' all the time.  | <input type="radio"/> | <input type="radio"/> | <input type="radio"/>      | <input type="radio"/> | <input type="radio"/> |

0%  100%



Survey Powered By Qualtrics



This concludes the survey. Thank you for your time.

If you would like to received the free report of your firm's ability to adapt to a changing environment, please complete the information below.

First Name

Last Name

Your E-mail Address

Name of Firm

Please note the customized report will be sent to you electronically upon completion of the main study. All data must be complete to be eligible for the complimentary report.



Survey Powered By [Qualtrics](#)



We thank you for your time spent taking this survey  
Your response has been recorded.



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