What do we do now? The Role of Absorptive Capacity and Consulting Service Firms in the Internalization of New Knowledge Within Organizations

WHAT DO WE DO NOW? THE ROLE OF ABSORPTIVE CAPACITY AND CONSULTING SERVICE FIRMS IN THE INTERNALIZATION OF NEW KNOWLEDGE WITHIN ORGANIZATIONS

A Dissertation Presented

by

SUDHIR NAIR

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Approved as to style and content by:

_____
Bruce C. Skaggs, Chair

_____
William Wooldridge, Member

_____
Lawrence S. Zacharias, Member

_____
Craig S. Wells, Member

_____
D. Anthony Butterfield, Doctoral Programs
Director, Isenberg School of Management

DEDICATION

To my family

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ABSTRACT

WHAT DO WE DO NOW? THE ROLE OF ABSORPTIVE CAPACITY AND CONSULTING SERVICE FIRMS IN THE INTERNALIZATION OF NEW KNOWLEDGE WITHIN ORGANIZATIONS

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SUDHIR NAIR, B.S., WICHITA STATE UNIVERSITY

M.B.A., CASE WESTERN RESERVE UNIVERSITY

Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor Bruce C. Skaggs

The impact of knowledge on firm performance has been seen as one explanation of firm performance heterogeneity, which is a central question in the area of Strategic Management. However, there has been surprisingly limited research into the role of new knowledge internalization within firms. Further, the ubiquitous role of external knowledge providers, especially those that explicitly exist to provide knowledge to firms (Consulting Service Firms) has been negligibly studied.

Specifically this dissertation looked at how firms first understand new knowledge and suggested that firms differ in their ability to discern the impact of this new knowledge based on the absorptive capacity that they already possess. I examine how firms internalize this new knowledge and suggest that they can either use existing internal resources or seek external assistance to achieve this internalization.

This dissertation has empirically examined these linkages. A survey sent to the top management of 2015 Indian firms, yielded 277 usable responses, which have

provided insights into the new knowledge internalization pathways in firms. I use structural equation modeling and hierarchical regressions to test my hypotheses.

I find that firms do differ in their use of internal and external knowledge providers, while attempting to internalize new knowledge and that the quality of the relationship impacts the outcomes of any external engagement. I also find that firms with absorptive capacity benefit both by having better short term financial performance and also by being well situated to increase their stocks of knowledge assets, which can help long term performance.

This dissertation contributes to several streams of literature in the field of strategic management. I add to the knowledge based view literature and more specifically to the absorptive capacity literature by partially opening the black box of organizational routines. This dissertation also contributes to the professional service literature by suggesting that consultants can help firms generate performance, although this is particularly beneficial to firms that already posses high absorptive capacity. Implications of the results from both practice and research perspectives are discussed and areas of future research are suggested.

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CHAPTER 1

INTRODUCTION

Knowledge has been described as a key strategic resource in the management of firms (Grant, 1996; Kogut & Zander, 1992; Liebeskind, 1996). In fact some have described knowledge as the "one sure source of lasting competitive advantage" (Nonaka, 1998:22). Knowledge has been linked to outcomes such as innovation (March, 1991), innovative productivity (Ahuja & Katila, 2001), development of new firm capabilities (Gavetti & Levinthal, 2000), and generation of new assets for the firm (Dierickx & Cool, 1989) among many others.

While knowledge has been recognized as a key resource, scholars have suggested that it is new knowledge that helps keep a firm competitive (e.g., Kruglanski & Webster, 1996). This new knowledge is considered different than 'learning by doing', which is seen as familiar knowledge which helps firms to do better at what they already know. Instead this new knowledge is how firms can learn to do different things, which when seen from a Schumpeterian perspective is the most competitive activity that firms undertake (Kay, 1979). New knowledge sourcing is considered a key mechanism for fostering firm innovation and consequent firm performance (Lane, Koka & Pathak, 2006). Thus we see that new knowledge is important to firms and that they actively seek new knowledge.

Given its importance firms seek new knowledge both from internal and external sources. Internally, firms can generate new knowledge through research and development, innovation of existing products and processes and through increased experience of their employees (Rahmeyer, 2007). Externally, knowledge can be gained

through purchase of knowledge from providers including but not limited to consultants (Ciampi, 2008), R&D providers such as universities (Gunasekhara, 2005), from customers and suppliers (von Hippel, 1986), and also reverse engineering competitors' products and services or even by engaging in cooperative behavior with competitors (Antonelli, 1999; Malerba, 1992). We thus see that new knowledge can be sourced from a variety of sources either from within or outside the firm.

While the sources of new knowledge are important, even more critical is its successful integration in a firm (Grant, 1996). Lichtenthaler, (2009) suggests that firms internalize knowledge by one of three mechanisms: - leveraging existing routines, transforming existing routines or creating new routines. Though he examines the impact of environmental conditions on these processes, the processes by which firms internally absorb this new knowledge are not specifically addressed.

Further, before firms can internalize this new knowledge, they need to understand what the relevance of the new knowledge to the firm is. Scholars suggest that this is achieved by the absorptive capacity the firms possess (Cohen & Levinthal, 1990). Also following extant literature, I suggest that given that absorptive capacity is heterogeneously distributed across firms, they have a differential ability to understand what this new knowledge means to the firm (Cohen & Levinthal, 1990; Lane, Koka & Pathak, 2006; Zahra & George, 2002).

Consequently, to the extent new knowledge is differentially perceived by firms, we can expect they may seek different mechanisms to internalize it. Scholars suggest that new knowledge within firms has been seen as being integrated by the use of systemic codified routines, which can help with the appropriation of knowledge (Morris &

Empson, 1998). Routines have been suggested as being critical to organizational performance as they are the processes by which firms organize and produce the goods and services they deliver to customers (Nelson & Winter, 1982), or as Augier and Teece (2007: 268) simply put it, they represent "the skills of the organization." However while routines have been suggested as the basis of internalizing new knowledge, there has been limited understanding of who helps firms leverage existing routines or generate new routines. Firms choose between leveraging the new knowledge internally (Argote, 1999) and seeking external knowledge providers (Wind & Mahajan, 1997).

While the role of routines to integrate new knowledge has been examined in terms of managerial choice, the role of external knowledge providers in integrating this new knowledge has not been completely understood. Scholars have suggested that knowledge integration remains a "black box" and that the roles of external entities with regard to the various routines that help explicate the processes need to be further investigated (Baker & Sinkula, 2002; Carlile & Rebentisch, 2003; Sirmon, Hitt & Ireland, 2007). External knowledge providers include entities that firms interact with that are beyond the boundaries of the firm such as customers, suppliers and consultants (Wind & Mahajan, 1997). Of these kinds of external knowledge providers, Consulting Service Firms (CSF) are one class of external knowledge providers that exist specifically for their role in knowledge dissemination to firms (Maister, 1993). They are part of a broader classification known as professional service firms (von Nordenflycht, 2010) and their role has become important to firms since they help firms effectively manage the impact of rapid technological change, global competition and increased customer demands (Ganesan, Malter & Rindfleisch, 2005). Furthermore, new knowledge has also been seen

as helping firms become more efficient, which at times this may involve articulating what already exists at an inchoate level within firms (Gande, 2009). This kind of knowledge is what Agrawal (2006: 64) referred to as "latent knowledge", which is "knowledge that is not codified but is codifiable". Thus we also see that while scholars have directed attention to the importance of the role of professional service firms in new knowledge integration, what has been relatively less understood has been *how* they help firms integrate new knowledge.

Accordingly, this dissertation examines the pathways of integrating new knowledge that firms have sourced. In doing so, I address two broad questions within the ambit of this dissertation. First, how do differential levels of existing knowledge lead to different paths to internalize new knowledge? Second, what are the different paths of firms take when seeking to internalize new knowledge and what is the consequent impact on performance?

Having suggested that firms follow different paths for internalizing knowledge based on their levels of existing knowledge, I specifically examine how firms engage with CSFs to co-produce routines that help internalize the new knowledge. Drawing on the services literature, I suggest that knowledge co-production is a key construct that needs understanding when examining how consultants help firms integrate new knowledge (Bettencourt, Ostrom, Brown & Roundtree, 2002; Lengnick-Hall & Sanders, 1997; Skaggs & Huffman, 2003). Second, I examine how these different routines that firms' leverage, create or transform to integrate new knowledge, impact firm performance. This study seeks to make both conceptual and empirical contributions to the extensive knowledge literature. First, it will help deepen our understanding of how

heterogeneity in levels of existing knowledge affects firms' understanding and implementation of new knowledge. Second, it makes clear the different paths by which firms' internalize this new knowledge – firstly by leveraging existing routines and secondly by using consultants to help internalize the new knowledge. Finally, it empirically examines the link between organizational routines and firm performance.

This dissertation is structured as follows. In Chapter 2, I review the theoretical foundations of knowledge and more specifically new knowledge internalization in organizations. Consistent with theory, I link key constructs such as absorptive capacity, organizational routines, and knowledge co-production to the role of CSFs in the internalization of new knowledge by firms. In Chapter 3, I use the theoretical framework developed in Chapter 2 to build a conceptual framework for the specific research planned in this dissertation and present testable hypotheses that allow for examination of the conceptual model. Chapter 4 presents the research methodology that will be used in this dissertation including the research design, the measures for the focal constructs and the data analysis methodology. In Chapter 5, I present the results of the study and finally in Chapter 6, I discuss these results and conclude by examining the implications for practice and research, limitations of the study, and areas of future research.

CHAPTER 2

THEORETICAL FOUNDATIONS

In this chapter I establish the conceptual foundations that support the framework for the research undertaken in this dissertation. I do this in several linked sections. First is a summary of the Knowledge-Based View of the firm as it is understood by management scholars today, since it is the underlying theory for the research being undertaken in this dissertation. This leads to a discussion of the role of new knowledge in firms. The next section describes how a related concept, absorptive capacity, has been understood within the organizational literature and will later be developed further in Chapter 3 to form the basis of how it impacts the theoretical framework as well as the empirical models of this dissertation. Having examined the link between prior knowledge and new knowledge, I then summarize the role of organizational routines in storing and seeking knowledge. Finally the last section summarizes how external knowledge providers have been examined in the knowledge context of firms.

2.1 Knowledge Based View of the Firm

The Knowledge-Based View of the firm suggests that "the boundaries of and governance structure of the firm are determined not only by the considerations of lowering transaction costs, but also by the value to be derived from the deployment of its knowledge resources and capabilities" (Choo & Bontis, 2002: viii). Put another way, managing knowledge effectively and efficiently is the answer to the Coasian question of why firms exist (Kogut & Zander, 1992). This perspective builds on the Resource-Based View of the firm as it sees knowledge as one of the intangible resources that a firm possesses (Eisenhardt & Santos, 2002). To understand this theory of the firm, it then

becomes incumbent to understand knowledge itself and then examine its role within organizations.

Knowledge has been suggested as being the key resource within firms (Grant, 1996; Nonaka, 1998; Quinn, 1992). Prusak (1997: ix) states that "A firm's competitive advantage depends more than anything on its knowledge." This is because it is linked to unique features of firms such as distinctive competencies (Hofer & Schendel, 1978), core competencies (Hamel & Prahalad, 1990), internal capabilities (Barney, 1986), corporate culture (Fiol, 1991) and unique managerial talent (Penrose, 1959). The linkages that knowledge has to the various key aspects of firms makes it a strategic resource as it meets the criteria suggested by Barney (1991) of being valuable to firms, rare among competitors, imperfectly imitable and there are no direct strategic equivalent substitutes for the focal knowledge.

One broad categorization of knowledge has been based on whether it is tacit or explicit. Explicit knowledge is that knowledge in an organization that can be stored in words, formulae, specifications and manuals, in a formal and systematic manner; while tacit knowledge is very hard to formalize since it includes personal aspects such as intuition, subjective insights and the like and is embedded in the individuals own values and emotions (Nonaka, Toyama & Konno, 2000). This stream of literature builds on Polanyi's (1958) work, which suggests that tacit knowledge is disorganized, informal and inaccessible, with actors at times not even being able to articulate what they have knowledge about (Wagner & Sternberg, 1985). On the other end of this articulation spectrum of knowledge is explicit knowledge, which means that it can be codified and if need be transferred within or outside the firm (Nonaka, 1991). However it must be noted

that while knowledge can be codified, it does not mean that it is codified (Gawande, 2009). Further, Agrawal (2006) suggests that there is an intermediate level of knowledge between these two extremes, which he refers to as "intuition building", which helps subsequent explicit articulation of previously tacit knowledge. However, given that I am discussing how new knowledge is understood and then internalized by firms rather than individuals, my focus is on explicit knowledge rather than on tacit knowledge.

The second categorization of knowledge is based on the nature of this explicit knowledge and is made clear by the distinction between declarative and procedural knowledge. Kogut and Zander (1992) suggest that this distinction makes clear the distinction between information and know-how. They suggest that declarative knowledge is similar to information such as describing the state of a focal object (e.g., inventory levels). On the other hand, procedural knowledge is the basis by which processes are described, and they provide the example of knowing how to minimize inventory (Kogut & Zander, 1992: 386 – 387); thus making clear the distinction between what inventory levels are and knowing how to minimize inventory levels.

Having discussed how knowledge has been understood within the knowledge-based view of the firm, I now turn to the role of knowledge within organizations by examining how knowledge is intimately connected with the learning perspective within firms. Based on a review of over 30 articles that defined learning, Bontis, Crossan and Hulland (2002) integrated the literature and suggested the following definitions. At the individual level, learning is seen as the "individual competence, capability, and motivation to undertake the required tasks" (Bontis, Crossan & Hulland, 2002: 443); at the group level it is seen as "group dynamics and the development of shared

understanding" (Bontis, Crossan & Hulland, 2002: 443); while at the organizational level it is defined as the "alignment between non-human storehouses of learning including systems, structure, strategy, procedures and culture, given the competitive environment (Bontis, Crossan & Hulland, 2002: 444). This last aspect of learning is in line with other research that suggests learning helps firms adapt to changes in the environment (Argote, 1999).

This linkage of learning with the environment (Argote, 1999) was based on Penrose's (1959) earlier work on the role of learning in the growth of firms. Cyert and March's (1963) work on organizational routines further explicated learning in organizations by providing an explanation of how learning was stored in organizations. The key leap forward was the evolutionary approach taken by Nelson and Winter (1982) who suggested that knowledge was stored in organizational routines (this construct is more fully developed in a following section) and that individuals react to uncertainty and change in the environment by drawing on these organizational routines.

The second foundational perspective that needs to be understood for a more complete understanding of the Knowledge-Based View is that of the dynamic capabilities linkage to knowledge (Eisenhardt & Santos, 2002). Several scholars examining rapidly changing environments have suggested that it is impossible for firms to build long-run competitive advantages and hence firms must seek successive temporary advantages (Eisenhardt, 1989; Ilinitich, D'Aveni & Lewin, 1996). This focus on the rapidity of change – and the resultant increased focus on the 'dynamic capabilities' of firms to integrate, build and reconfigure internal and external competencies, led scholars to suggest that knowledge was a key component of this theoretical concept (Teece, Pisano

& Shuen, 1997). Further, it is not just existing knowledge that can help firms keep pace with changes in the environment, but more importantly new knowledge that needs to be sourced as well as integrated (Grant, 1996). I thus examine new knowledge in the following section.

2.2 New Knowledge

Grant (1996) states that existing knowledge, even when proprietary, cannot be a source of sustained competitive advantage as it quickly faces obsolescence. He identifies three characteristics that are key to using knowledge as a basis for competitive advantage: efficiency of integration (including sourcing new knowledge), scope of integration (broader applicability of new knowledge is better), and flexibility of integration (to reconfigure old knowledge and integrate with new knowledge).

New knowledge, which may be sourced from external or internal sources, is critical to building competencies for firms (Kruglanski & Webster, 1996). Empirical evidence has supported the assertion that new knowledge from either source has been beneficial to firms. For example, Henderson and Cockburn (1994) found that new knowledge sourcing in the pharmaceutical industry as measured by patents was linked to relationships with external providers such as research universities. Powell, Koput and Smith-Doerr (1996) found that in new technology areas such as biotechnology, new knowledge is critical to innovation and can be found in networks of alliances. Bierly and Chakrabarti (1996) found that firms that chose to seek new knowledge from outside sources (termed innovators and explorers in their typology) were linked to higher profits than those that did not (loners and exploiters). Rosenkopf and Nerkar (2001) found that when firms use both external and internal sources of new knowledge and depending on

the context, either could be efficacious; however they suggest that new knowledge generated outside of the firm boundaries is more effective when using that new knowledge in a given market. Other studies have shown that new knowledge sourcing from within the firm boundaries can help firm performance (Hansen, 1999).

However, scholars caution that for new knowledge to be leveraged by firms they must possess absorptive capacity (Cohen and Levinthal, 1990) - which is the ability to understand and assimilate new knowledge - since without it new knowledge will not be intelligible to firms and hence will not serve any purpose. Given its importance in helping firms leverage new knowledge I now examine the absorptive capacity construct.

2.3 Absorptive Capacity

The absorptive capacity (AC) construct has spawned a vast stream of literature since its initial conceptualization by Cohen and Levinthal (1989, 1990). The initial definition of absorptive capacity as provided by Cohen and Levinthal (1990: 128) is the "ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends." This definition emphasizes the heterogeneity between firms in terms of their ability to first define what new knowledge is, to determine its value, to integrate this new knowledge within the firm and finally to appropriate it for commercial purposes.

There have been several theoretical and empirical studies that have examined and built on the initial work on absorptive capacity. In what follows, I examine both streams of the absorptive capacity literature. I first summarize the theoretical advances in the AC literature and then examine the empirical evidence for this construct and, based on that discussion, I use it as the building block of the model I propose in this dissertation.

2.3.1 Theoretical Refinements to the Absorptive Capacity Construct

Cohen and Levinthal (1990) provided a model that focused on the learning aspects of firms. This was intentional learning that examined external sources and was different from "learning by doing" which helps firms get better at what they do (Lane, Koka & Pathak, 2006). In an earlier paper, Cohen and Levinthal (1989) had laid the ground work for their seminal 1990 article by suggesting that managers' perceptions of incentives for innovating are made based on what they see in the external environment. Further they argued that other factors influenced AC, such as the intellectual property rights regime of the firm's macro-environment, the industry structure in terms of competitiveness as measured by concentration of market share, the ease of learning, the amount of knowledge available (basic versus applied science), and the potential for growth. In their 1990 paper, Cohen and Levinthal investigated more cognitive based models that examined problem solving and then extended AC to the organizational level. The key ingredient in their model however continued to be the knowledge content of the firm (i.e., AC).

The AC construct was widened by the use of other factors that extended it as more of a capability of firms and thus suggested that it is a firm level construct. Rao and Drazin (2002) for example argued that older firms would have larger AC since time-based accumulated knowledge will accrue to them. Mowery, Oxley and Silverman (1996) suggested that larger firms would have higher AC since they have access to increased resources. Van den Bosch, Volberda and De Boer (1999) extended the construct to a process model. Zahra and George (2002: 186) further build on the process model and suggest that AC needs to be redefined as "a set of organizational routines and

processes by which firms acquire, assimilate, transform and exploit knowledge." These four characteristics of AC are building blocks of two general states of AC that they define as Potential Absorptive Capacity (PACAP) and Realized Absorptive Capacity (RACAP). The former refers to the external knowledge that firms could potentially acquire and the latter refers to the actual knowledge that a firm does acquire and utilize.

Building on these theoretical extensions, Lane, Koka and Pathak (2006: 856) suggest that absorptive capacity may be redefined as "a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning." This definition thus allows for the examination of how firms react to new knowledge and then create pathways to internalize this new knowledge, which is the focus of this dissertation. Therefore I use this definition as it synthesizes the considerable work in the AC literature and provides a sequential model that I will use to develop the conceptual model in this dissertation and then the empirical model that will be tested.

2.3.2 Review of empirical research on the Absorptive Capacity construct

Absorptive capacity has been examined in several empirical contexts and below I summarize some of the main findings from the literature. Mowery, Oxley and Silverman (1996) found that technology transfer is associated with AC. Veugelers (1997) found that R&D cooperation in firms resulted in increased internal R&D resource allocations only if the firm had high AC. Thus their findings suggest that AC can be a moderator to crucial

resource allocation decisions. In an entrepreneurial context, Deeds (2001) found that AC is positively associated with entrepreneurial wealth creation as well as technological capability development. Liao, Welsch and Stoica (2003) examined AC in a small to medium-sized context, and found that high AC firms were more likely to respond to environmental changes. Lenox and King (2004) found that AC can be developed within firms through the provision of information across the organization. AC has also been examined in international contexts. Gupta and Govindarajan (2000) found that subsidiary level of AC is relevant to the knowledge flows within multi-national corporations and can impact AC at an organizational level. Lane, Salk and Lyles (2001) found that in international joint ventures, AC allows the joint venture entity to develop its own AC by learning from its parent companies. Minbaeva, Pedersen, Bjorkman, Fey and Park (2003) found that that AC can be developed through specific human resources practices within multi-nationals.

From this limited survey of the empirical work done on absorptive capacity, we can see that it is of deep relevance to firms of all kinds and across industries and, more importantly, is heterogeneously distributed across firms. I now examine the literature on routines and its link to knowledge and absorptive capacity.

2.4 Organizational Routines

Organizational Routines have been studied in several contexts including problem solving (March & Simon, 1958), dynamic capabilities (Teece, Pisano & Shuen, 1997), and evolutionary economics (Nelson & Winter, 1982) to name a few. Within the organizational literature, routines have been defined in several ways. Based on a synthesis of the extant literature, Feldman and Pentland (2003: 96) define it as a

"repetitive, recognizable pattern of interdependent actions, involving multiple actors." They further indicate that formal procedures may be thought as being part of the construct.

In their review of the organizational routine literature, Feldman and Pentland (2003) suggest that there are three broad themes of research that have led to the current understanding of the construct. The first theme is that at the level of the individual, routine is seen as habit. It allows for individuals to react without thinking and helps reduce cognitive costs (Simon, 1957). The next theme is at an organizational level where routines have been seen as being standard procedures, which are more than habits since they require active engagement, albeit of a pre-formulated procedure (Cyert & March, 1963; Gioia & Poole, 1984). The last theme is that of Nelson and Winter (1982) who conceived as routines being akin to genetic material that helps organizations store information and pass it on across time. It is this last theme that provides for change within the organization for routines and the one that has been widely accepted since it provides a link between what happens within an organization and its behaviors in response to environmental stimuli.

Routines are fundamental to evolutionary economic theory (Nelson & Winter, 1982) since they are the founding units of innovation (Winter, 2003) and evolve over time based on learning and experience (Gavetti & Levinthal, 2000). Routines can be simple rules for problemistic search (Cyert & March, 1963) to complex rules on how firms learn to adapt to the external environment (Zollo & Winter, 2002). More broadly, routines have been understood as how things are done and have been referred to as the procedural knowledge of firms (Cohen & Bacdayan, 1994). Within the literature on

learning, routines have taken on the role of organizational memory (Huber, 1991) and scholars have suggested that changes to routines as organizational memory happen due to external stimuli (Feldman & Pentland, 2003). In fact this change in routines is fundamental to how organizations evolve over time, and some have even suggested that the differences in routines may help explain firm heterogeneity (Lewin & Massini, 2003).

This link of routines to performance has limitedly been examined and is an integral part of this dissertation. It also allows for a distinction from individual patterned behavior which may be seen as skills rather than routines, which now is seen as an organizational-level construct (Dosi, Nelson & Winter, 2000). Further, the debate on whether routines drive mindless behavior, or purposeful actions drive routines is to some extent addressed by the fact that most of the empirical work seems to suggest that routines are a basis for firms to compete to improve firm performance (Becker, 2004). Some of the reasons why routines have been associated with improved firm performance include improved coordination within firms (Gersick & Hackman, 1990), simplifying decision making (March & Shapira, 1987), and increasing predictability thus freeing cognitive resources (Baumol, 2002).

We thus see that routines are relevant to firms in many contexts and these routines can be existing or new and generated internally or externally. Some scholars have suggested that firms will seek new routines from external sources as well as internal sources and in times of change, may choose external sources (Zellmer-Bruhn, 2003). This seeking of new routines is the seeking of new knowledge since as Nelson and Winter (1982: 99) suggest, “The routinization of activity constitutes the most important form of storage of the organization’s operational knowledge.”

Further this link between 'routinization' of activity as suggested by Nelson and Winter (1982) and firms' operational knowledge when examined from the prism of new knowledge then needs to be better understood. Hu, Huang, Kuse, Su and Wang (1998) suggest that in case this new knowledge is not consistent with existing knowledge then firms will face deep concerns. This assertion supports other work that suggests that routine consistency is important for firms to build on existing knowledge and be able to improve performance (El Sawy & Majchrzak, 2004).

In summary, I thus suggest that it is important to conceptually and empirically examine the link between routines and performance – whether they are existing routines or new routines; or in other words, we need to further examine the link between existing procedural knowledge and/or new procedural knowledge and performance.

2.5 External Knowledge Providers

In the earlier sections, we have seen that new knowledge is critical to firms. We have also seen that firms differ in their seeking and internalization of knowledge. And we have seen that firms seek new knowledge from external knowledge providers as well as internal sources and that this new knowledge helps keep them competitive (Anand, Glick & Manz, 1993). Internal sources of new knowledge generation include sub-units (Tsai, 2001), existing employees (Argote, 1999), as well as new employees (Cohen & Levinthal, 1990).

We now examine who these external knowledge providers are and their role in firm behavior from a knowledge perspective. A review of the organizational literature suggests that several different kinds of entities, including customers, suppliers, industry associations, alliances and joint ventures and professional service firms have been

conceptualized as being external providers of knowledge to firms. I summarize the research on these firms below.

Customers are increasingly seen as sources of knowledge for firms and the literature has focused special attention on them especially from an innovation perspective (von Hippel, 2009). As customers' needs evolve, they seek more customized products and services from firms and therefore share their private knowledge with the firms who provide them with these products and services (Franke & Shah, 2003; Franke & von Hippel, 2003; Luthje, 2003; von Hippel, 1986). While some customers may go on to form their own companies based on the innovation they generate, most will provide this knowledge to the firm that was the original product/service provider and thus are a key source of new knowledge (Shah & Tripsas, 2007).

Suppliers are another critical source of new knowledge for firms. Empirical work has shown that firms such as Caterpillar and Toyota place strategic importance on this class of knowledge providers and place their own employees within those firms to seek knowledge directly from their practices (Lincoln, Amhadjian & Mason, 1998). The reasons for sourcing knowledge from suppliers range from them having superior technical know-how (Pavitt, 1984) to helping with product improvements (Dyer & Hatch, 2006) to being problem solvers (Takeishi, 2001).

Apart from entities that are a part of a firm's direct value chain (Porter, 1998), other organizations can also provide relevant knowledge to a firm. Some of these entities include universities, industry associations and professional organizations. While these organizations may not have firm specific knowledge, their relationship in many industries leads to critical firm-level outcomes including new products (Cooke, 2005). Universities

typically seek to build deeper relationships in the environment they operate in and also commercialize basic knowledge that they generate and have been extensively studied in various contexts (for example, Gunasekara, 2005). This role of providing knowledge to firms is particularly true of universities termed "entrepreneurial universities", who actively engage with firms to create relevant knowledge (Etzkovitz & Klofsten, 2005).

Industry and professional associations also help foster knowledge transfers to firms and their role in creating "knowledge externalities" or spillovers has been well established (Cooke, 2005; Hakanson, 2005). In fact, for many smaller firms industry associations can sometimes be a key source of knowledge through sharing of best practices within a focal industry (Miles, 2005), and thus have a different role than their more overt role of lobbying for the industry as a whole (Athreye, 2005). This role of industry associations as knowledge providers may organically evolve or could do so as part of government policy (Spencer, Murtha & Lenway, 2005).

In summary, there are a whole host of entities that serve as sources of new knowledge to firms in addition to the firms themselves; however their primary role is not in assisting firms with internalizing this new knowledge. As I have stated earlier, these are all viable sources of new knowledge, but most of them have been reviewed fairly exhaustively by the organizational literature. One set of organizations that explicitly exists for the purpose of helping firms internalize new knowledge, and that has received relatively limited theoretical and empirical focus in the relations they have with their clients, are Professional Service Firms (Maister, 1993). In this dissertation, I plan on furthering our understanding of their role in new knowledge internalization within firms.

2.5.1 Professional Service Firms as External Providers of knowledge

There has been deepening interest in Professional Service Firms (PSFs) in the organizational literature (Greenwood, Suddaby & McDougald, 2006; von Nordenflycht, 2010). This may be since as Sharma (1997: 758) starkly states, "Business as we know it would come to a grinding halt if it were not for this cadre of professional service organizations." Increasingly they are seen as being theoretically distinct from other kinds of firms (von Nordenflycht, 2010) as well as being increasingly important in a knowledge driven world (Anand, Gardner & Morris, 2007; Empson, 2007; Løwendahl, 2005). While this recent focus has been occasioned by the increasing focus of knowledge scholars, it must be noted that PSFs and more broadly 'the professions' have had a long history of theoretical and empirical analysis.

Marshall (1939: 325) presented the classical view of professions as being "suitable for a gentleman" (Marshall, 1939: 325). Given that this gentleman professional was performing his task for the greater good, Marshall was more concerned about how he was to be remunerated at a level that did not leave him susceptible to bring disrepute to his profession, rather than what he did. Hughes (1960) built on this work and suggested that entry into the professions could be made possible by "gaining the education and other qualifications for entry" (Hughes, 1960: 56). We thus see an increasing trend to seeing professionals as being better informed than a lay person, and that this is achieved through education and/or access to professional organizations. This is reflected in part by the current definition of a professional by Løwendahl (2000) who suggested that professionals are part of a vocation that is founded in a body of knowledge that is gained by being exposed to higher academic education.

Abbott (1988) delineated professionals as being based in abstract knowledge and that it is through the negotiation of these abstract spaces that PSFs develop jurisdictions and get imbued with 'expertise', and that these tend to be stable for extended periods of time. We thus see that PSFs are now seen as firms with knowledge in them and that is what is respected by society. Morris and Empson (1998: 613) suggest that this knowledge that PSFs have is "the information which professionals acquire through experience and training, together with the judgment which they develop over time which enables them to deploy that information effectively in order to deliver client service." This takes a view that the professionals' knowledge is relatively superior to that of their clients and hence it is rational for clients to seek this knowledge, given its importance to them.

Freidson (2001:12) writing on the development of PSFs as organized professions states that they can be said to exist when "an organized occupation gains the power to determine who is qualified to perform a defined set off tasks, to prevent all others from performing that task, and to control the criteria by which to evaluate performance." This however does not address issues faced by Management Consultants[1], who are also referred to as Consulting Service Firms (CSFs), as they are not statutorily granted a monopoly by the state (as are lawyers and accountants) to provide services that no one else can (Wood, 2002). This reflects the considerable debate about what a PSF is and how they are to be classified, given the large disparity in the empirical and theoretical work done. As von Nordenflycht (2007) suggested, "Knowledge of professional service

[1] For a complete history of the development of Management Consulting Firms, see United Nations, UNCTAD Report, 1993 "Management Consulting – A Survey of the Industry and Its Largest Firms"

is, however, long on anecdotes and short on rigorous empirical evidence." And this issue of their classification is resolved by von Nordenflycht (2010) himself, who suggests a typology for PSFs to address these theoretical concerns.

Based on the considerable literature on PSFs, von Nordenflycht (2010) suggests that four types of PSFs exist, namely Technology Developers (such as R&D labs), Professional Campuses (such as hospitals), Classic PSFs (such as lawyers, accountants and architects), and Neo PSFs (such as consultants). His taxonomy is based on variation along three distinctive characteristics of PSFs which are knowledge intensity, low capital intensity, and levels of professionalized workforce. This is in line with Greenwood, Suddaby and McDougald (2006) who suggest that the key characteristics of PSFs are that they have intangible outputs, complex knowledge, provide customized services and employ professionals; as well as Løwendahl (2000) who suggests that PSFs employ highly trained people who have a high degree of autonomy and individual judgment, with limited needs for capital intensity.

Further, the "Neo-PSF" moniker for CSFs is based on an increasing trend in the literature to treat consultants as being increasingly perceived as knowledge providers as opposed to being altruistic professionals. Von Nordenflycht (2010) suggests that CSFs have high levels of knowledge intensity as well as relatively low capital intensity, as the knowledge resides in the consultants and that their clients have limited protection, while the consultants themselves have considerable autonomy. Von Nordenflycht's (2010) typology based on empirical and theoretical evidence provides more clarity to the field than earlier attempts, which attempted to impose PSFs into specific pre-determined roles (Reed, 1997). This work in generating typologies provides the necessary impetus to

building and extending theory (McKelvey, 1982), but considerable work in researching PSFs remains to be done.

As many scholars have already suggested, PSFs remain largely under-researched (Lorsch & Tierney, 2002; Malos & Campion, 2000; von Nordenflycht, 2007). While more recent work has examined the role of the structure of PSFs including the archetypal Professional Partnership (P2) form (Greenwood, Hinings & Brown, 1990; Hinings, Brown & Greenwood, 1991; Malos & Campion, 1995), governance of PSFs themselves (Greenwood & Empson, 2003; Sherer & Lee, 2002), the role they play in society (Ernst & Kieser, 2002; Suddaby & Greenwood, 2001) and how society influences them (Suddaby, Cooper & Greenwood, 2007), a key facet of what they do – that of the relationship to clients – has been negligibly studied (Lorsch and Tierney, 2002).

The fact that clients seem to consider CSFs critical can be seen from the fact that they paid consultants globally over $300 billion dollars in fees in 2009 alone and are projected to pay almost $400 billion in fees by 2015(IBIS World Industry Report, 2009). The rapid growth in consulting is being driven by increased globalization, new technologies and the deregulation and intensification of markets (Ernst & Kieser, 2002). This deepening relationship between clients and CSFs has driven some of the theoretical definitions of the latter, with Greenwood, Li, Prakash and Deephouse (2005: 661) defining them as firms "whose primary assets are a highly educated (professional) workforce whose outputs are intangible services encoded with complex knowledge."

These outputs with the encoded knowledge are then provided as reports for their clients, who in turn may use them in multiple ways (Argote, McEvily & Reagans, 2003; Montagna, 1968). In a similar vein, Suddaby, Cooper and Greenwood (2007: 336) have

defined CSFs as "the ensemble of actors and institutions engaged in the production, consumption and interpretation of professional services for the world's largest commercial organizations." Providing a more expansive view of the clients, Lorsch and Tierney (2002) suggested that the entire business community seeks assistance from CSFs. I follow Greiner and Metzger (1983:7) and define Management Consultants as Consulting Service Firms that provide services that "are provided to organizations by specially trained and qualified persons who assist, in an objective and independent manner, the client organization to identify management problems, analyze such problems, recommend solutions to these problems, and help, when requested, in the implementation of solutions." This can be seen as CSFs adopting a "process consultation model" wherein the clients also contribute expertise as opposed to the "doctor-patient" model or the "purchase-of-expertise" model (Schein, 1988).

These knowledge services are provided for clients by CSFs by applying old knowledge to new problems, creating new knowledge, or effectively invoking old knowledge to an existing context (Starbuck, 1992). The knowledge typically is made available to clients in two stages - analysis and implementation (Gadrey and Gallouj, 1998; Hill and Westbrook, 1997; White and Leifer, 1986) - which is in concordance with the definition of CSFs made earlier. In the first stage, the CSF 'diagnoses' the relevant issues that caused the client to seek the engagement in the first place and at the end of this stage, the CSF makes available a report that provides the relevant new knowledge to the firms. However, it is in the second implementation stage that this knowledge is actually internalized by the client firm.

It is central to this dissertation to make explicit that I do not assume that all firms will seek engagement with CSFs in the implementation stage to internalize this new knowledge, since some firms may choose to internalize this new knowledge by leveraging existing internal routines. Further, as discussed earlier, the new knowledge can be generated by any external entity or even by the focal firm itself. Therefore, while the drivers behind seeking engagement with external knowledge providers for generation of new knowledge is one that merits independent attention, this dissertation is focused on the implementation phase of received new knowledge.

Clients may value this knowledge generated by CSFs more than internal knowledge (Menon & Pfeffer, 2003), but there could be considerable issues in internalizing this external knowledge as opposed to knowledge that is generated internally (Darr, Argote & Epple, 1995). This problem is exacerbated when knowledge has to be co-produced by CSFs and clients (Greenwood, Suddaby & McDougald, 2006) as opposed to being generated solely by the firm.

Research in the services literature has clarified that it is the involvement of the client in the service process that makes for services-specific concerns (Lovelock, 1983). The client may play an important part in the creation of the service, the delivery of the service, and also in addressing issues with the delivery of the service. In fact Sampson and Froehle (2006: 331) suggest that at the core of services lies the fact that "the customer provides significant inputs into the production process." This is particularly true for the CSF context, as the client has to actively seek knowledge from a CSF for the latter to provide the same.

Wemmerlov (1990) suggests that there are three kinds of client inputs into the production process: the customer's self, the customer's belongings, and the customer's information. The customer-self as an input addresses those situations wherein customer labor (customer as an employee) is used in the production process as in buffet restaurants. The customer's belongings as an input examines when a service uses tangible possessions of a customer for the service to be delivered – such as a laundry or repair service. The customer-information as an input provides explication of those services that use the knowledge and information of the customer as an input. These include services such as accounting or consulting.

In the context of knowledge co-production, the role of clients is even more pronounced as the services provided by CSFs are unstructured, complex and highly customized (Bettencourt, Ostrom, Brown & Roundtree, 2002). Ciampi (2008) suggests that knowledge co-production by CSFs and their clients can be understood by examining the consulting process. The consulting process is conceived as a diachronic process implying that the client and the CSF have to work together over a period of time and consequently the dynamics of how they work together is important. This temporal process is envisaged to be spread over five broad stages: a) initial contact and contract stipulation; b) problem diagnosis; c) solution discovery and implementation planning; d) solution implementation and e) evaluation and conclusion (Ciampi, 2008: 44).

In each of these stages, for the CSF to add any value to the engagement, it is necessary that the client work actively with the CSF by providing inputs as well as firm-specific expertise. The CSF may not be able to define what the problem is if the client is unable to articulate the problem that they are facing (Edvardsson, 1990; Kilmann &

Mitroff, 1979). Once the problem has been understood, the CSF and the client need to continue to work together to jointly develop more than one solution (Kubr, 2002), which can then be winnowed to the appropriate solution (Schein, 1988). The issues of knowledge co-production continue into the implementation of the solution as clients' limited involvement can create concerns for successful transfer and implementation of the solution since clients may feel that it is now the consultant's job to ensure that the implementation happens (Poulfelt, Greiner & Bhambri, 2005). Further, if the solution implementation stages are clearly understood by both entities then the likelihood of a successful engagement increase (Appelbaum & Steed, 2005). We thus see that this stage-wise analysis underscores the need for the client and the CSF to work together. And within the scope of this dissertation, this then implies that the joint role of CSFs and clients in the sourcing, transfer and internalization of new knowledge is important.

In conclusion, the theoretical development in this chapter has suggested that while knowledge is a key strategic resource for firms, it is new knowledge that can help them generate and maintain competitive advantage. However, for this new knowledge to be of relevance firms must have prior absorptive capacity to understand it and then internalize it; and that this capacity is heterogeneously distributed across firms. I have also reviewed how this knowledge is maintained in organizations through the use of organizational routines and how these routines are linked to firm performance. I then examined the role of external knowledge providers in the sourcing of the new knowledge by firms and identified CSFs as being a theoretically distinct form of provider, which lead to specific issues in their relationship with clients (with particular emphasis on the aspect of

knowledge co-production). I now link these concepts in Chapter 3 to examine the internalization of new knowledge by firms.

CHAPTER 3

HYPOTHESES DEVELOPMENT

This chapter synthesizes the work presented earlier on the theoretical connections between a firm's absorptive capacity, new knowledge, organizational routines and firm performance. I first present a conceptual model of what the overall research questions are addressing. I then present testable hypotheses to test empirical models based on this conceptual model. Broadly I examine three sets of relationships in the context of firms internalizing new knowledge that they receive: (1) between Absorptive Capacity and current Organizational Routines; (2) between current routines and development of new routines; and (3) between routines and firm performance.

3.1 General Conceptual Model

Figure 1 presents the overall conceptual model on which the proposed research rests.

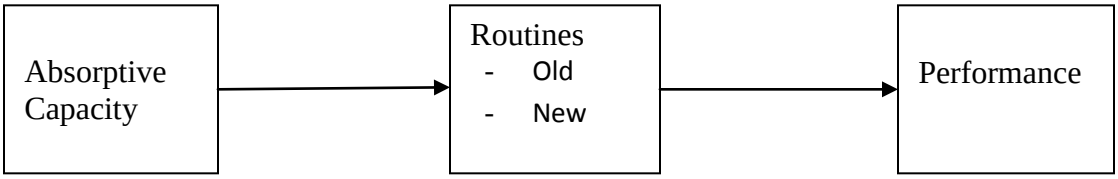

Figure 1: Conceptual Model of New Knowledge Internalization

The conceptual model as schematically shown above links the theoretical constructs discussed earlier. I suggest that absorptive capacity impacts the way a focal firm assimilates new knowledge into existing routines, or if necessary, creates new routines to internalize the new knowledge. It is suggested that this new knowledge then helps the firm to improve performance.

As stated in Chapter 2, this dissertation assumes that some firms will seek to engage with CSFs to internalize new knowledge, while others will seek to leverage existing routines to internalize the new knowledge provided. This caveat is being restated to emphasize the fact that the research undertaken in this dissertation examines the internalization of new knowledge and the differential impact that CSFs can have on that process.

3.2 Hypotheses Regarding Absorptive Capacity and Organizational Routines

As stated in the earlier chapter reviewing the literature, as well as the conceptual model presented above in Figure 1, a key factor in the process of internalization of new knowledge by firms is the absorptive capacity of those firms. In this section, I link absorptive capacity and organizational routines and hypothesize how the stimulus of new knowledge may impact that relationship.

Absorptive capacity (AC) as envisaged in this dissertation and stated earlier, follows Lane, Koka and Pathak's (2006) definition which focuses on AC as being linked to the recognition of valuable new knowledge; assimilating that new knowledge within the firm and if need be new creating new knowledge. This definition implies that firms have a differential ability to examine new knowledge and then decide whether this new knowledge is of any potential commercial use to them. It also suggests that this new knowledge will be differentially internalized within firms.

This aspect of AC as differentially impacting firms' ability to understand and internalize new knowledge is reflected in a large body of the AC Literature. Lane, Salk and Lyles (2001) in a survey of Hungarian firms found that firms do differ in their ability to receive information from external sources, which in this context was from alliances.

They found that the differences in AC may be driven by several micro-factors including management support, training, and goals, as well as macro-factors such as organizational flexibility. Lane and Lubatkin (1998) examined how new external knowledge was understood by firms and suggested that firms can learn passively (from trade journals), actively (through benchmarking against competitors) or interactively (by dealing with other firms). They suggest that it is by this last mechanism that firms tend to realize strategic value from knowledge. Further they state that firms without AC will be less likely to appropriately internalize this new knowledge that may be received interactively, and AC is therefore of critical importance. The aspect of AC that examines the ability to recognize useful new knowledge and its impact on internal routines of the firm was also examined by Jansen, Van Den Bosch & Volberda (2005) who followed Zahra and George's (2002) model of conceptualizing AC as being composed of potential absorptive capacity and realized absorptive capacity. They suggest that several aspects of firms cause heterogeneity in firm potential AC which enables them to differentially understand new knowledge, including coordination mechanisms across units of the firm (Matusik, 2002) and combinative capabilities (Eisenhardt & Martin, 2000).

In summary, the literature suggests that firms are heterogeneously capable of understanding new knowledge, irrespective of whether it is sourced from an external knowledge provider or from internal sources. From the perspective of this dissertation, it must be made clear that this leads to an implication that firms are capable of understanding new knowledge – albeit differentially, with some firms better at understanding the relevance of new knowledge than others. This in turn indicates that

from an empirical perspective, my dissertation will not examine firms that possess no absorptive capacity.

I now examine the relationship of differential understanding of new knowledge with routines. I have already described in Chapter 2 how knowledge in organizations is stored in routines (for example, Nelson & Winter, 1982). Also as stated earlier, to have a more fine grained understanding of routines, I follow Kogut and Zander (1992) and Kogut (2008) and use the broad dichotomous categories of declarative and procedural knowledge. Declarative knowledge is conceptualized as being clearly formulated and documented information as opposed to procedural knowledge which is seen as being the routines where organizational know-how is stored. In the context of this dissertation, the firms' knowledge seeking actions typically result in new declarative knowledge, mostly in the form of a document that makes clear what that new knowledge is. However this knowledge needs to be understood from the perspective of the focal firm itself.

The firm has existing routines (i.e., existing procedural knowledge which I refer to as EPK) and the incremental knowledge gained would be on a continuum that covers the gamut of consistency with the new knowledge being completely inconsistent with existing routines at one end to being completely consistent at the other. I have already discussed in Chapter 2 the importance of the perception of consistency of routines for firms. As suggested earlier, the level of routine consistency can impact performance in firms (Hu et al., 1998; El Sawy & Majchrzak, 2004). I label this continuum – from inconsistent with current routines to completely consistent with current routines – Routine Consistent Knowledge (RCK). Further the new procedural knowledge that is generated is referred to in this proposal as NPK.

While research has emphasized that routine consistency is linked to performance, the level of the consistency has not been examined. Based on the earlier relationship with absorptive capacity I suggest that firms will differ in their perception of how consistent the new knowledge is with existing routines. And further I suggest that with firms with higher AC will be more likely to understand that the new knowledge received is not consistent with existing routines.

Conversely, firms with low AC will look at new knowledge as being more routine consistent. For example, Lavie and Rosenkopf (2006) found in an examination of alliances that firms with low AC tended to seek exploitation of existing routines rather than develop uncertainty-inducing new routines. While that also impacts alliance partner selection by biasing it towards existing partners, in the context of knowledge routines, their research suggests that firms with low absorptive capacity will see the new knowledge as being more consistent with existing routines.

In a similar vein, Gao, Xu and Yang (2008) found in a survey of managers of Chinese firms that lower absorptive capacity firms tended to see new knowledge as being more in line with existing routines as opposed to higher absorptive capacity firms. Mangematin and Nesta (1999) examined R&D activity in France and found that higher AC firms were able to see new knowledge as being different than what they already possessed, as opposed to lower AC firms which saw it as being similar to existing routines. This again suggests that when firms can connect the efficacy of new knowledge to markets in which they compete, they are better able to understand the relevance. Finally, Newman (2000) in a study of firms facing considerable upheaval found that

firms with lower absorptive capacity did not realize that the new knowledge was not in concordance with their existing routines as opposed to higher AC firms.

Thus taken together this suggests that while high AC firms will find that the new knowledge is less consistent with existing routines, low AC firms will find that the new knowledge is more consistent with their existing routines. More formally I hypothesize that:

> Hypothesis 1: There will be a negative relationship between absorptive capacity and the level of routine consistent knowledge firms perceive in any new knowledge they receive.

3.3 Hypotheses Regarding Routines and Continued Engagement with CSFs

I have discussed above how firms differ in their levels of absorptive capacity and that these differences lead to differential understanding of any new knowledge they receive. This differential understanding can then lead to different decisions on whether to seek an engagement with a CSF to implement the new knowledge already received or rely on existing internal routines. As discussed in Chapter 2, it is possible that CSFs may be the source of new knowledge; however I do not distinguish between reengagement with the same CSF that provided the initial report or another CSF that may be more focused on providing implementation services to clients[2]. In the case where the CSF provides the new knowledge, it would be in line with the two-stage model of management consulting suggested in the earlier chapter, wherein CSFs first diagnose a client firm's situation in the analytical stage and then provide implementation services.

[2] My discussions with management consulting firms confirms that several of them take reports generated by more broad strategy consulting firms and help firms implement the recommendations in those reports.

Building on Hypothesis 1, given that firms with low AC will assume that the knowledge they have received is consistent with existing routines, I suggest they will make the decision not to seek the services of a CSF to implement the new knowledge received. And the second implication from Hypothesis 1 is that high AC firms will find less consistency with existing routines and will hence be more likely to seek CSFs to internalize the new knowledge. I now provide evidence for these assertions.

Argyris and Kaplan (1994) in a study examining adoption of new procedures for accounting found that old routines were held on by managers of firms having knowledge concerns. On the other hand, Dimitriades (2005) suggests that firms with higher learning abilities, which are akin to high absorptive capacity firms, are more likely to seek external help in assimilating new knowledge. This reflects similar findings by Zhang, Macpherson and Jones (2006), who found in an examination of British firms that the lower absorptive capacity firms tended to find ways to leverage the new knowledge internally as opposed to higher absorptive capacity firms and stated that they are more likely to have "regular contact with external knowledge providers" (Zhang, Macpherson & Jones, 2006: 308).

Taken together, I suggest that routine consistent knowledge will mediate the relationship between absorptive capacity and the decision to engage a CSF. Formally I state the following:

> Hypothesis 2: Routine consistent knowledge will mediate the relationship between absorptive capacity and the decision to engage a CSF.

This then suggests that the empirical model examining the relationship between existing routines and new routines as well as between routines and firm performance, will be different for firms with high absorptive capacity and low absorptive capacity. This is because their pathways will be different since low AC firms will be less likely to use CSFs as opposed to their counterparts with higher AC.

I present the empirical models as well as the hypotheses related to these models below. I first present the consolidated empirical model that will explicate these relationships in Figure 2 presented below. AC refers to the absorptive capacity of a firm. RCK is the level of routine consistency of new knowledge with the existing routines of the firm. KCP refers to knowledge co-production that can affect how new knowledge is internalized by firms when they engage a Consulting Service Firm (CSF). EPK and NPK refer to existing procedural knowledge and new procedural knowledge in firms. Finally "P" refers to firm performance.

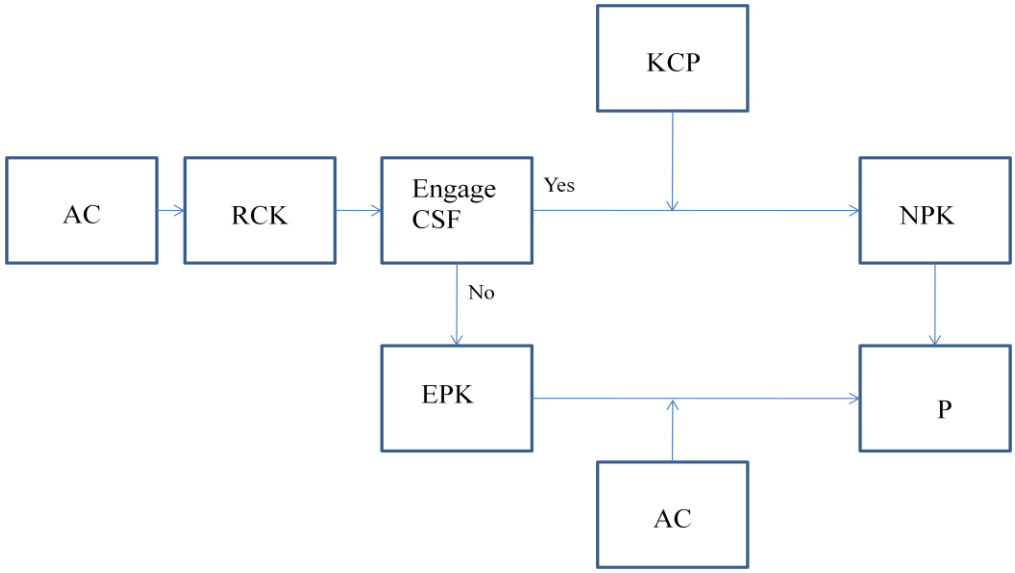

Figure 2: Consolidated Empirical Model Presenting Relationships Among Routines and Performance

3.4 Hypotheses Regarding Existing Routines, New Routines and Performance in High Absorptive Capacity Firms

As stated above in section 3.2, the relationship between existing routines and new routine generation will be dependant on the level of absorptive capacity of the focal firm, since that drives the decision to engage a CSF for implementation services. I first present the model to be tested for high AC firms, who as I have suggested earlier, will engage a CSF to help implement the new knowledge by creating new routines. This model that is specific to High AC firms is presented below in Figure 3 below.

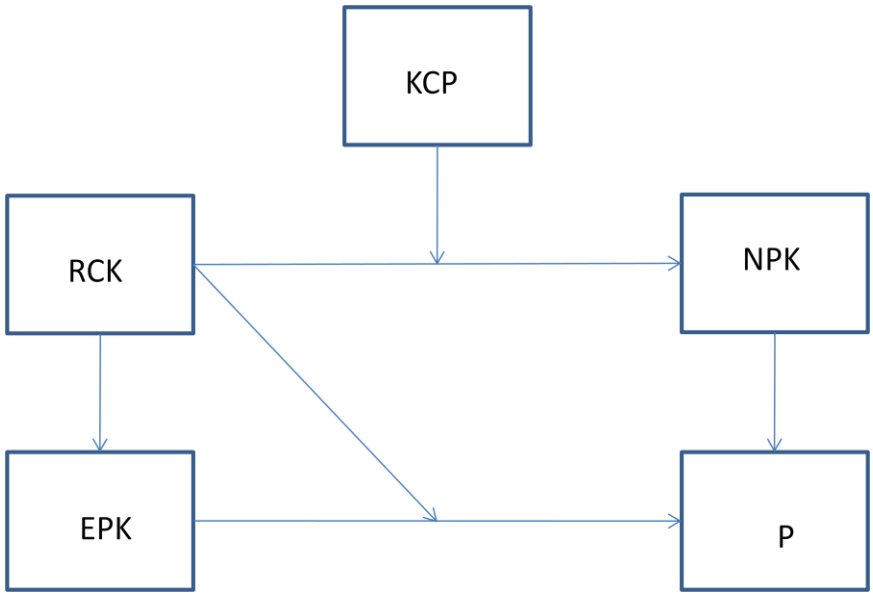

Figure 3: Empirical Model Specifying Relationships Among Routines and Performance for High Absorptive Capacity Firms

In Section 3.2, I have suggested that high absorptive capacity firms will more likely to appropriately understand whether the new knowledge is consistent with their existing routines. Routine consistent knowledge is thus seen as a function of the absorptive capacity of the firm. It is based both on declarative knowledge, such as the

state of a focal object, as well as the procedural knowledge underlying that object (Kogut & Zander, 1992). Thus the diagnosis that new knowledge is routine consistent is crucial to the decision to leverage existing routines to generate firm performance.

Cohen and Levinthal (1994) suggest that firm managers' understanding of the absorptive capacity that they possess can help them leverage their routines by deciding whether to exploit existing routines or explore new ways of internalizing the new knowledge (March, 1991). In fact they go further and emphasize that if the existing routines can help bring a product or technology to market faster, there is a firm-level (as well as societal) cost in not doing so. The literature on exploitation of existing resources (Levinthal and March, 1993; March, 1991) thus makes it abundantly clear that high AC firms could rely on existing routines, or as conceptualized here, existing procedural knowledge (EPK) after an appropriate diagnosis that their existing routines could suffice to leverage the new knowledge.

Moorman and Miner (1998) suggest that routine consistent knowledge can help firms produce coherent action, as the existing routines are already well understood by employees of the firm. They also suggest that increased understanding of existing routines can help firms address temporal concerns. While time-to-market may not have been an issue for all firms, given increasing competition, it is increasingly of interest to all firms. Gattiker (1995) in an empirical examination of Canadian organizations found that focused leveraging of specific knowledge allowed for performance improvements.

Taken together, the literature supports the argument that firms with higher absorptive capacity, on finding new knowledge in concordance with existing knowledge, will leverage existing procedural knowledge to internalize this new knowledge. Further,

by doing this they will be able to realize higher performance, or as the Cohen and Levinthal (1994) article title states "Fortune favors the prepared mind." I therefore formally suggest that

> Hypothesis 3: In high absorptive capacity firms, high levels of routine consistent knowledge will be associated with increased leveraging of existing procedural knowledge.

> Hypothesis 4: In high absorptive capacity firms, levels of routine consistency will moderate the relationship between existing procedural knowledge and performance such that firms that discern higher levels of routine consistency will have better performance.

However, as we have already discussed, other high absorptive capacity firms will define the new knowledge as not being consistent with existing routines. It is suggested that these firms will seek CSFs to help them co-produce new routines to internalize this knowledge. These new routines are expected to yield improved performance.

There has been limited theoretical discussion of the role of existing knowledge and the generation of new procedural knowledge. As Dodgson (1993: 381) states, "the relationship between the two types of knowledge (particularly the processes of creating new procedural knowledge) has not been given sufficient attention." One way that we can begin to examine this link is through Anderson's ACT-R model of knowledge management (Anderson, 1993; Anderson, Bothell, Byrne, Douglass, Lebiere & Qin, 2004) which suggests that when faced with situations of receiving new knowledge and

where prior knowledge is inapplicable, new procedural knowledge is generated. This new procedural knowledge utilizes rules learned from prior knowledge, which in effect are provided by the absorptive capacity in an organizational context. These rules in turn are assumed to be rationally applied to new knowledge to create new routines (i.e., procedural knowledge) that in turn can be used to appropriate organizational ends. This suggests that when organizations perceive reception of new knowledge, they will attempt to create new procedural knowledge. For example, Lovett and Anderson (2005) found that new routines were created by compiling old routines in a new context.

This then suggests that the new procedural knowledge can be seen as double loop learning (Argyris & Schön, 1978) wherein particular attention is paid to how the new routines are applicable in the focal context. The new routines thus add to the organization's knowledge base and do so by building on past knowledge (Zack, 1999; Zack 2003).

That new procedural knowledge will in turn lead to improved performance is well accepted in the literature. Zahra, Ireland and Hitt (2000) found that new procedural knowledge gained by firms during internationalization was positively linked to firm performance. Similarly, Hult, Ketchen and Slater (2004) found a positive link between supply chain performance and the generation of new routines. Katila and Ahuja (2002) found that building on old knowledge to create new routines which were then exploited led to superior performance. Klein (2000) found that new routines were associated with lesser errors committed by municipal bond analysts. In summary, new procedural knowledge will lead to improved performance and consequently firms will seek to generate these new routines.

Further as suggested in Chapter 2, if relevant expertise does not reside within the firms, they will attempt to seek external sources to provide these new routines. This acquisition of knowledge is one of the mechanisms of knowledge generation (Davenport & Prusak, 1998). While there are many avenues for generating procedural knowledge from outside, I focus on the role of CSFs in helping firms generate new routines. Singley and Anderson (1989) suggest that being proficient in one set of skills does not mean that all skills are available to a focal actor. Consequently even firms that have superior routines in one area of their business may not be able to generate similar levels of skill in other areas of their business without assistance. Menon and Pfeffer (2003) suggest that at times managers may value external knowledge more than internally generated knowledge which again would drive the decision to source procedural knowledge from external sources of knowledge.

The need for external expertise is also driven by the fact that existing internal routines may impede novel ways of utilizing the new knowledge. Dougherty (1992) found that strong existing routines made it difficult for product development teams to develop new products. Weick (1996) suggests that over-learnt routines can hinder performance as actors refuse to let go of the learnt routines and that this can lead to disastrous consequences. Both of these were in the context of new knowledge being presented to organizations. Given that this relationship between firms and CSFs is important from a knowledge perspective, we now examine the knowledge co-production aspect of that relationship.

Knowledge co-production by CSFs and their firms has been seen as an important ingredient in the performance of a firm. Bettencourt, Ostrom, Brown and Roundtree

(2002) suggest that this aspect of co-production influences the relationship between existing knowledge and new knowledge. They provide seven different behaviors that firms can adopt during the knowledge production process that can impact the link. These include accommodation of CSF by firm; advocacy of CSF by firm; joint involvement of CSF and client in the governance of the implementation process; open channels of communication between CSF and the firm; shared approach to the process of solving any implementation problems and tolerance for errors on either side. This is line with Lovelock and Young (1979) who suggest that this relationship can impact firm productivity. This body of empirical and conceptual work thus suggests that the working relationship that exists between a client and the consulting firm they engage can directly impact the outcomes of the project itself, and also have consequences for the performance of the focal firm.

Together this suggests that firms will generate new routines based on existing routines and that this relationship will be moderated by the level of knowledge co-production with the CSF and the new procedural knowledge created will lead to improved performance for the focal firm. Formally, the following hypotheses are presented:

> Hypothesis 5: In high absorptive capacity firms that engage CSFs, the relationship between routine consistent knowledge and new procedural knowledge will be moderated by the level of knowledge co-production.

Hypothesis 6: In high absorptive capacity firms that engage CSFs, there will be a positive relationship between new procedural knowledge and performance.

3.5 Hypotheses Regarding Routines and Performance for Low Absorptive Capacity Firms

I have presented hypotheses that link routines and performance for high absorptive capacity firms. However the same relationships are not hypothesized to hold for low absorptive capacity firms, on account of the risk of misdiagnosis of the chosen pathway to internalize the new knowledge. I first present the empirical model below in figure 3.4 and then present the hypotheses with related theoretical development.

Figure 4: Empirical Model Specifying Relationships Among Routines and Performance for Low Absorptive Capacity Firms

The model above suggests that low absorptive capacity firms will seek to internalize existing routines to improve performance. However, as stated in Hypothesis 2 the understanding of these low absorptive capacity firms that the new knowledge received is routine consistent would be a mistaken understanding of the new knowledge.

Kim (1998) suggests that firms with low absorptive capacity will be unable to generate relevant knowledge since they are unaware of the gaps in their knowledge. This he suggests will impair their ability to react to changed situations since they will tend to

continue to leverage existing routines, leading to degraded performance over time. Zhao (2006) finds that low absorptive capacity is linked to regimes that have limited knowledge spillovers. While she does not explicitly examine the generation of new knowledge, the outcomes she finds suggests that low absorptive capacity leads to increased reliance on existing knowledge. At a finer grained sub-unit level, Tsai (2001) found that low absorptive capacity units were less involved in innovation related activities including investments in R&D and tended to rely on existing knowledge bases, and this in turn tended to make them perform at a sub-par level as compared to their high absorptive capacity counterparts. Collectively these studies suggest that low absorptive capacity firms tend to rely on existing routines and that this inappropriate reliance on existing routines can lead to less than optimal performance.

In an examination of British firms, Gray (2006) found that size was an important contextual factor in impacting the role of absorptive capacity on new knowledge creation. However the results regarding the negative relation between reliance on existing knowledge and performance continued to hold. Kumar and Nti (1998) found that low absorptive capacity hindered new knowledge generation by firms even in an alliance explicitly set up to generate new knowledge. Vance and Paik (2005) found that in MNCs, low absorptive capacity led to limited understanding of knowledge within a firm across its units in multiple countries. They further suggest that this then leads to degraded MNC performance at the corporate level. Julien, Andriambeloson and Ramangalahy (2004) found that low absorptive capacity firms tend to employ less people than high absorptive capacity firms in areas of new knowledge creation, which in turn creates a disparity in terms of new knowledge generated. These studies build on the

findings of the earlier paragraph, by suggesting that there could be performance differences between low and high absorptive capacity firms. This could be because the latter are able to generate better performance than their low absorptive capacity counterparts, given that they make better choices of which routines to utilize.

Based on the implications of the studies referred to above, I suggest the following two hypotheses. While the hypothesis is the same as for high absorptive capacity firms, the key difference is that the perception that the new knowledge is routine consistent is inaccurate and will consequently lead to comparatively lower performance and state that:

> Hypothesis 7: In low absorptive capacity firms, higher levels of perceived routine consistent knowledge will lead to increased reliance on existing procedural knowledge.
>
> Hypothesis 8: In comparison to high absorptive capacity firms, firms with low absorptive capacity who leverage existing procedural knowledge will be associated with lower levels of performance.

I have presented the hypotheses that examine the internalization mechanisms of new knowledge by firms, both through leveraging existing procedural knowledge as well as generating new procedural knowledge that they co-create with CSFs. In the following chapter, I present the methodology that I propose to empirically examine these hypotheses.

CHAPTER 4

DATA AND ANALYSIS METHODOLOGY

In this chapter I present the methodology that is used in the design of this empirical study to appropriately examine the overarching research questions and specifically test the hypotheses presented in Chapter 3. I do this in multiple sections. I start by discussing the design of the study, which will then be followed by the data analysis methodology that was used in this dissertation. The final section provides a description of the measures used in the study. The actual items that used in the study are listed in Appendix A.

4.1 Overall design of the study

To discuss the overall design of the study, I follow the multi-stage guidelines as described by Knoke, Marsden and Kalleberg (2002). It must be made explicit at the outset that an organizational survey was used to examine the empirical context of this dissertation. In addition, I assume that respondents of these surveys are informants for their organizations (Cox & Chinappa, 1995).

4.1.1 Research Design Parameters

Since this dissertation is examining the issues surrounding new knowledge internalization of firms, a cross-sectional analysis was considered to be suitable, as the responses provide the necessary insights into the process of new knowledge internalization. The other reason that a cross-sectional survey is appropriate is that I retrospectively ask managers about specific new knowledge internalization situations. Given that new knowledge internalization is of relevance to all firms, irrespective of

location or industry, I use a sample of firms rather than a census approach for the surveys. Finally, given that the issues that I propose seeking information on is of strategic importance, I surveyed only senior managers, which implies that the survey will not be multi-level. The next crucial aspect that needs discussion in a survey design then is the unit of analysis.

4.1.2 Unit of Analysis

Scholars have suggested that it is critical that organizational researchers choose an appropriate unit of analysis while examining their focal questions (Freeman, 1978). Building on that admonishment, and following the argument by other scholars, I examine the hypotheses at an engagement level. Cook and Brown (1999) state that knowledge related phenomena need to be at the practice or engagement level. In a similar vein, Tsang (2002) suggests that knowledge questions need to be understood in the specific context in which they are studied in. Thus all the survey questions aim to be consistent about examining the issues in the context of firms encountering new knowledge. This emphasis on the specific context of new knowledge internalization is made explicit in both the cover letter to the survey, and also in the preamble to each set of questions (please sees Appendix A). It now becomes relevant to contextualize these knowledge internalization aspects from an organizational perspective.

To examine knowledge related aspects, several scholars have suggested that asking questions of respondents who are in situations that are problem solving – whether that be increasing revenues or increasing efficiency – can help reduce the cognitive issues and thus provide clearer insights. For example, Iansiti and Clark (1994) found that new knowledge capability was clearly distinguishable in a problem solving context. This is in

line with other research conducted by Nonaka and Takeuchi (1995) as well as Leonard-Barton (1995). Thus my items address issues that help respondents reduce their cognitive load by focusing their attention on specific engagements; information about these engagements is the used as insight for organizational level behaviors, which can consequently help provide a link to organizational outcomes.

4.1.3 Sampling Frame

Ensuring that appropriate response rates are achieved is a key consideration in any survey design (for example, Skaggs & Huffman, 2003) given that issues of undercoverage may occur (Aldrich, Kalleberg, Marsden & Cassell, 1989). In addition, there are statistical power issues that can occur in the absence of appropriate number of responses. Therefore I use data from Indian companies as I have better access to local networks and received potentially improved response rates for the survey.

I used a list frame approach and sent out surveys based on existing lists of companies. A key qualification for the sampling frame is that only publicly held companies were considered as several key objective data can be independently obtained for these companies. The objective data include items such as the age of company and financial information. Data were obtained from sources such as the "Accord Fintech Database" available from information provider ISI Emerging Markets through the University of Massachusetts Amherst Library resources, as well as independent access to the Prowess Database made available from the Center for Monitoring Indian Economy (CMIE), which has been used by other scholars as a reliable source of information on Indian companies (Bhaduri, 2002; Khanna & Palepu, 2000; Ramaswamy, Li & Velliyath, 2002).

However to ensure that respondents were able to provide the insights into the issues at hand, I confined my sampling frame to companies that have an identifiable dominant business, as signified by at least 70% of revenue being generated by one business (Rumelt, 1974). This is since the new knowledge as conceptualized here will typically be at the business level and hence senior managers need to be able to engage with new knowledge directly to respond to queries on the same. Managers of highly diversified firms may not be able to do the same as they may not necessarily directly come into contact with new knowledge at the business level.

I also applied a minimum size requirement in terms of number of employees being at least 100, since the research question addresses knowledge integration, which may differ in a context of very small organizations. Further using larger firms ensures that requisite resources are available to firms who need them to generate new routines. Finally, very small firms may have no need for organizational routines as conceptualized in this dissertation. The two conditions of dominant business and size yielded a sampling frame of 2015 firms.

4.1.4 Identifying informants

Since I collected organizational data (Miller & Chen, 2004) as opposed to data that is more focused on individual attainments or attitudes (Lincoln & Kalleberg, 1990), I needed to have informants who were knowledgeable about the relevant organizational questions that were put to them in the survey (Huber & Power, 1985). To ensure that these respondents were appropriately knowledgeable, following Simonin (1997), I sought data from senior managers in firms, typically at CXO level (CEO, COO, CMO, CFO level). Once again since these are managers of firms who have an identifiable dominant

business line, they were able to provide relevant insights into the questions being posed of them. Further, given practical considerations of data collection from multiple organizations (Bradburn, 1992), following Aday (1991), I sought responses from only one senior manager per organization.

4.1.5 Instrument Construction

The details of the items are provided in Appendix A; however in this section I discuss the underlying drivers of the survey questions. To avoid potential issues of validity and reliability, I avoided the use of de novo items and relied on adapting previously used items in this proposed survey. Further, to ensure aspects such as fatigue and contextual congruence are addressed, I panel tested the survey with 11 managers (Dippo, Chun & Sander, 1995). I also ensured appropriate Institutional Review Board approval was obtained prior to commencement of field work.

To ensure that appropriate response rates were obtained and that the informants responded to the survey as comprehensively as possible, I adopted the Tailored Design Method suggested by Dillman (2006). This is relevant from an instrument construction perspective, since the questions are to be such that they do not place an undue cognitive load on the respondents.

4.1.6 Data Collection Methodology

As stated above, I followed the Dillman (2006) approach of Tailored Design Method (TDM) for ensuring appropriate response rates as well as completion of items by individual respondents. A key goal of this TDM approach is to reduce errors such as sampling error (number of persons surveyed), coverage error (are all representative

elements of the focal population being surveyed), measurement error (is the survey construction including wording of items appropriate to ensure responses are appropriate for the question being asked), and non-response error (significant number of persons who are relevant to the survey do not respond).

To achieve minimal measurement and non-response errors, Dillman (2006) suggests that survey constructors follow three rules from social exchange including *increasing rewards* by making the survey interesting, *reducing cognitive costs* by making the survey easy to respond to, and *building trust* by making sure that the survey is well structured and asks relevant and important questions. The issue of making sure the survey is interesting was managed by the process of pre-testing the survey with 10-15 managers and ensuring that the survey rewards the respondents with good questions. I addressed the second two issues by offering an online option that allowed for respondents to quickly respond to questions and navigate to question blocks that were appropriate for them (e.g., respondents who do not use a CSF were able to avoid questions on knowledge co-production as those items were irrelevant to them). Of course, for those managers who preferred using paper surveys, those were made available to them.

Our efforts in data collection helped us receive 277 usable surveys, which represents a response rate of 13.75%. While this is lower than what would be ideal, given the restrictions on firms sampled as well as seeking only senior managers to respond, the sample size may be considered acceptable, given similar surveys using similar populations (Skaggs & Huffman, 2003; Skaggs & Youndt, 2004). None of the 11 pilot test survey respondents were included in this final list of respondents. Some broad details of the respondents firms are given below in Table 1. In terms of industries

represented, I received responses from 23 different industries. Details of these industries with the associated number of respondent firms are available below in Table 2**.**

	Mean	Std. Deviation
Assets (Rupees)	4435.702	20239.85
Sales (Rupees)	2010.410	9895.98
Net Income (Rupees)	175.8421	727.23
Age	29.86	18.87
Employee Strength	3582.87	8973.17

(all Rupee figures in Tens of millions – "crores")

Table 1: Descriptive Statistics of firms surveyed

Ind_Dummy	Industry	Number of firms
1	Automobiles	4
2	BFSI	22
3	Cement	8
4	Chemicals	12
5	Construction & Real Estate	7
6	Drugs & Pharma	21
7	Electricity	7
8	Electronics	7
9	Fertilizers	5
10	Food & Beverages	16
11	Glass & Glassware	1
12	Granite	1
13	IT	38
14	Logistics	6
15	Machinery	15
16	Manufacturing	36
17	Metals & Metals products	18
18	Mining	2
19	Non-metalic mining	3
20	Petroleum products	4
21	Services	23
22	Telecom	6
23	Textiles	15

Table 2: Industry distribution of firms in survey

4.2 Data Analysis Methodology

Since the model I am testing is theoretically a priori conceptualized, the appropriate statistical methodology to test it would be a Structural Equation Model that examines both the overall model itself and the paths between the constructs (Kline, 2005). This also helps handle any measurement error concerns since I am using several latent variables in my model (Hair et al., 2010). I am also using hierarchical regression to test those hypotheses that include moderation since there is considerable debate on the use of moderation in structural models.

Following Stevens (1996), who suggests that confirmatory factor analysis is appropriate when a priori theoretical links exist between variables (as is the case in this study), I first perform a Confirmatory Factor Analysis and then examine the validity of the hypothesized relationships. This will check that the expected relationships among the variables load as anticipated and that the individual variables have appropriate validity. The specific hypotheses will be tested using individual path loadings and SEM is particularly useful for Hypothesis 2 since it suggests a mediated model.

Of the 6 basic SEM steps that Kline (2005) suggests need to be completed, the first three – specify model, determine if model is identified, and specify measures – are detailed in this document. The other three steps are to do with data collection and analysis.

The models and the individual hypotheses have been detailed earlier and hence I will not restate them here. I next examine whether the model has been identified. Since there are no reciprocal causation between any of the endogenous variable; there are no

feedback loops, and further there are no relationships between the endogenous variables. Thus I state that the model is identified.

As described in Chapter 3, I split the data and conduct an empirical examination of high absorptive capacity and low absorptive capacity firms separately. Following extant literature, the sample was split on the median of the absorptive capacity values after receipt of the survey responses to avoid causing an imbalance in the number of cases available for the two parts of the analysis (Flynn and Staw, 2004; Salomon and Jin 2010).

I now examine the measures that are used in this dissertation.

4.3 Operationalization of Measures of Variables

Absorptive capacity is treated as an exogenous variable in this model, as the factors that drive it are assumed to occur prior to the data collected for testing this model. This is because AC is a function of past actions taken by the firm regarding knowledge acquisition and the ability to leverage that knowledge. Given that I am not conducting a longitudinal study, I consider it as exogenous. All other constructs – including knowledge co-production, routine consistent knowledge, new procedural knowledge, existing procedural knowledge and performance – are endogenous in the model. It must be noted that the decision of a firm to engage a CSF for new knowledge implementation will create a natural cleaving of the sample and is analyzed independently.

4.3.1 Measures for Independent Variables

4.3.1.1 Absorptive Capacity

As discussed in Chapter 2, following Lane, Koka and Pathak (2006:856), absorptive capacity is defined as "a firm's ability to utilize externally held knowledge through three sequential processes: (1) recognizing and understanding potentially valuable new knowledge outside the firm through exploratory learning, (2) assimilating valuable new knowledge through transformative learning, and (3) using the assimilated knowledge to create new knowledge and commercial outputs through exploitative learning."

Absorptive capacity has been measured in several ways since it was introduced as a relevant construct by Cohen and Levinthal (1990). Some of the key proxy measures include R&D intensity, patent counts, experience and survey instruments, and are briefly reviewed here.

Absorptive capacity was first measured as R&D intensity (ratio of R&D expenses to sales of the focal organization) in the seminal paper by Cohen and Levinthal (1990). Other scholars quickly followed suit and used R&D intensity as an appropriate proxy for absorptive capacity in a variety of contexts. Veugelers (1997) used it to explore how external R&D activities were linked to internal R&D expenditures of firms. Tsai (2001) used it to examine access of a business unit to knowledge based on network position. Sakakibara (2002) used R&D intensity study how R&D cooperation is induced between firms. Youndt, Subramaniam and Snell (2004) used it to examine how human, social and organizational capitals interact with each other to affect the overall intellectual capital of the firm. While the broader literature has moved away from R&D intensity as a measure

for absorptive capacity given the criticism that it is an inappropriate measure (discussed earlier in Chapter 2; also Lane, Koka & Pathak, 2006), some articles that focus on international issues have continued to use it as a measure given cross border issues in data collection (for example, Zhang, Li, Hitt & Cui, 2007; Zahra & Hayton, 2008).

Researchers such as DeCarolis and Deeds (1999) were among the first to suggest that a better measure of absorptive capacity may be patent data since it provides a tangible measure of what the firm would call its existing knowledge. Dushnitsky and Lenox (2005) used both R&D intensity and patent data to capture the absorptive capacity of a firm. In a similar vein, Song, Almeida and Wu (2003) used patent data with patent citations to capture absorptive capacity and by using the latter suggested that it captures the intent of the firm as well. Sampson (2007) used patent stock data to examine the role of technology diversity and governance in an alliance. Singh (2008) used the patent data to measure knowledge spillovers in a given geographical area and the resultant innovation activity. This measure however has been criticized as being particularly relevant to industries where patent data is important and reduces the understanding of absorptive capacity in firms where patents are neither sought nor are relevant.

Given criticisms of using R&D intensity and patent data as measures of absorptive capacity, some researchers have suggested that experience of a focal firm may be a good proxy for absorptive capacity. These researchers suggest that path dependencies create absorptive capacity for firms which can help them deal with changes in the environment (Gulati, 1999; Newman, 2000). Alvarez and Busenitz (2001) attributed experience as absorptive capacity to create competitive advantage for entrepreneurial firms. Other scholars have suggested that the firm's board members

experience can help measure absorptive capacity of the firm (Beckman, Haunschild & Phillips, 2004). This shows how varied the conceptualization of experience itself is within the absorptive capacity literature and, at times, the limited theoretical link to the construct itself (a concern raised by Lane et al. (2006)).

These criticisms of the various measures used by researchers led to other scholars using survey instruments as a way to measure a firm's absorptive capacity. These scholars felt that simple and easy to find measures such as R&D intensity or patent data were not sufficient to capture an important and complex construct such as absorptive capacity (Lane et al., 2006). Szulanski (1996) used a survey approach in his examination of the role of absorptive capacity in the transfer of knowledge. Lane and Lubatkin (1998) used surveys in the context of how firms learned from each other and explicitly suggested that this is a better measure of absorptive capacity. Laursen and Salter (2006) used surveys to measure absorptive capacity in the context of British firms searching for new ideas with commercial applications.

Building on this stream of literature which uses surveys for measuring absorptive capacity, Flatten, Brettel, Engelen and Greve (2009) developed a more comprehensive set of items that can be used to measure this construct. Based on a literature review (to create a comprehensive list of items), a series of pre-tests (wherein this large pool of items was winnowed) and two large survey based empirical studies (first to test several plausible alternative structures for the construct and the second to replicate the first study) they have generated a scale that is appropriate to be used by researchers. Given the comprehensiveness of the items as well as the sound theoretical basis for generating the items, I use this scale for measuring absorptive capacity (specific items are available

in Appendix A). The items were re-worded to be consistent with the specific research agenda of this dissertation. An elaborate discussion of the absorptive capacity variable was presented since it is the driver of the conceptual and consequent empirical models in this dissertation. The reworded items were used to understand what the firms' managers thought of their ability to seek and use knowledge is, in language that is accessible to them. The items then collectively address the absorptive capacity construct.

I conducted a reliability analysis using Cronbach's alpha for the items used for the AC construct and it was 0.864, which exceeds the minimum target reliability of 0.7 and since it is higher than 0.8, would be considered good reliability (Nunnally, 1978).

4.3.1.2 Routine Consistent Knowledge

The next variable that needs to be understood is Routine Consistent Knowledge. Following literature reviewed in Chapter 2, I define Routine Consistent Knowledge (RCK) as "knowledge that is consistent with the current routines of the firm".

To examine appropriate items for evaluating this construct, it is important to review measures of routines itself that have been used in the literature. Zollo and Winter (2002) present an integration of the theoretical frameworks that have been used by scholars to examine routines. They use both cognitive and behavioral frameworks to develop an understanding of how routines are clearly conceptualized and can then be empirically examined. A key point they make is regarding the role of knowledge codification in organizations as being a way to gain insights into the routines. I therefore use Szulanski's (1996) measures as a way of generating items which make explicit the codification of knowledge in routines. This is consistent with the approach undertaken in this dissertation which assumes that knowledge can be made explicit.

I combine the codification aspect of knowledge in routines by Szulanski (1996) with the work of Howard-Grenville (2005) who in her examination of whether routines tend to be flexible or persistent provides a method of checking consistency with existing routines. Her work is in the context of high-tech manufacturing; however the conclusions are generalizable in that they deal with routine consistency. A six tem measure of routine consistent knowledge is presented in Appendix A. These items tap the perception of managers in terms of how consistent they feel any new knowledge they received is with their existing routines.

I conducted a reliability analysis using Cronbach's alpha for the items used for the RCK construct and it was 0.865 after dropping item 2, which exceeds the minimum target reliability of 0.7 and, since it is higher than 0.8, would be considered good reliability (Nunnally, 1978).

4.3.1.3 Existing and New Procedural Knowledge

I now look at the measures of *existing procedural knowledge* and *new procedural knowledge*. It may be recalled that some firms will exploit existing procedural knowledge to internalize the new knowledge while others will choose to explore the creation of new procedural knowledge to internalize the new knowledge that they receive.

The items for existing procedural knowledge are developed by first examining the contours of the variable itself. I build on Zahra and George (2002) who suggest that while existing procedural knowledge is innately connected with the absorptive capacity of the firm, it must be seen as being distinct since it is fungible and can immediately be leveraged by firms to internalize new knowledge. Thus here I define existing procedural

knowledge as “routines that are already in use by the firm at the focal point in time” and that can be used by the firms to leverage new knowledge once the diagnosis of the routine consistency is made.

This definition then provides the theoretical basis to use items from Wong, Shaw and Sher (1999) who examined how routines in use can be itemized. A six tem measure of existing procedural knowledge is presented in Appendix A. It must be noted that I contextualize these items to inquire about actual routines in practice and this provides the contra-distinction from the earlier routine consistent knowledge since the latter is inquiring about the perceptions of the managers about how consistent the new knowledge is with these routines. These items now examine how managers perceive the routines currently in use in their respective firms.

New procedural knowledge follows a similar conceptual origin but differs from existing procedural knowledge in terms of what is being examined. Following Szulanski (1996) and Schulz (2001) I frame new procedural knowledge from a perspective of what can be done by the new routines. Thus I define new procedural knowledge as “routines that are generated in a focal firm as a result of new knowledge entering the firm”.

Szulanski (1996) sees new procedural knowledge as being reflective of the ‘stickiness’ of knowledge and the consequent concerns during transfer. The empirical examination in his work thus provides a starting point for adapting items to measure this construct. And to contextualize the items for this study I use the items provided by Schulz (2001) since those items allow for theoretical consistency of new procedural knowledge within the context of CSFs helping develop new routines or internal development of the new routines. Further the adapted items allow for examination of the

uncertain impact of new procedures given that some firms may choose to use CSFs to create this new procedural knowledge. A six item measure of new procedural knowledge is presented in Appendix A. These items now examine what managers perceive to be the new routines generated by the strategic project they had recently completed. The preamble to these items requests the respondents to recall a recently completed project while responding to the questions.

I conducted a reliability analysis using Cronbach's alpha for the items used for the EPK and NPK constructs and they were found to be 0.897 and 0.867 (after dropping item 5 for NPK), which exceeds the minimum target reliability of 0.7 and, since it is higher than 0.8, would be considered good reliability (Nunnally, 1978).

4.3.1.4 Knowledge Co-production

In Chapters 2 and 3 we have already examined the role of co-production when two actors are engaged in a focal activity. Building on the conceptual arguments presented in Chapter 2, I define *knowledge co-production* as "the act of focal firms and the CSFs they engage, working together to generate new routines to internalize new knowledge received by the firm."

We have also seen the complexity that such co-production can engender during the process. The items that address co-production thus need to be able to cover this complexity while being parsimonious. Further the items need to be specific to knowledge co-production since the services literature has an abundance of survey items that address co-production in various other contexts, which would be of limited relevance here.

Lengnick-Hall and Sanders (1997) undertake understanding of knowledge co-production in a pedagogical context and develop items that help capture the construct. They provide boundaries of what needs to be examined and suggest that issues such as control, timing and understanding of roles are crucial for understanding this construct. The paper by Bettencourt et al. (2002) examines these issues and allows for both the competing dynamics of examining complexity while being parsimonious. The items generated by this paper have the added advantage of being focused on practitioners of knowledge transfer and hence provides for greater understanding by managers. I use a seven item scale for measuring this construct and it is presented in Appendix A. These items now tap the knowledge co-production items from the perspective of the client firm manager and his/her perception of the project process.

I conducted a reliability analysis using Cronbach's alpha for the items used for the KCP construct and it was 0.835, which exceeds the minimum target reliability of 0.7 and since it is higher than 0.8, would be considered good reliability (Nunnally, 1978).

4.3.2 Measures for Dependent Variable

The dependent variable in this study is *performance* measured from the perspective of the unit-of-analysis, which is the outcome of the new knowledge internalization. These measures include objective data such as increases in sales attributable to this new knowledge and, decreases in costs due to efficiency gains from the new internalized knowledge. These nine items (available in Appendix A) have been developed in line with research done by Lewin, Massini and Peeters (2009). The Cronbach's alpha for the perceptual measures of performance was 0.911.

All the performance related issues are at the new knowledge creation level. It can be seen that these items have a relationship to firm level outcomes and that is occasioned by the fact that this dissertation examines strategic initiatives for new knowledge internalization. The preamble to the survey was the key mechanism to ground respondents to think in these strategic terms. As stated earlier in this chapter, I have ensured that the items were phrased such that the focal new knowledge internalization engagement will be used for the purpose for eliciting insights into firm behavior that is generalizable. Lastly, following Hinkin (1995, 1998), I have consistently used seven-point scales for the responses. A response of 1 on any item translates to "strongly disagree" and a response of 7 translates to "strongly agree".

Since the dependent measure does have the potential for common method bias, I also examine the link to firm-level outcomes since the sampling frame involves only publicly held companies and objective data for the same are consequently available. Following Dess and Robinson (1984), the relevant measures for organizational outcomes will be ROA (as a measure of potentially increased efficiency) and ROS (as a measure of potentially increased sales).

Reliability data for all the perceptual measures is available in Appendix B.

4.3.3 Measures for Control Variables

Several control variables are being considered for this study and are detailed below.

Firm size has been seen to impact key strategic variables in organizations. In the context of new knowledge internalization, larger firms may have internally greater amounts of knowledge as compared to smaller firms. Given the relationship in the

literature between individuals and knowledge, I operationalize *size* as the log of number of employees as has been done in several studies (for example, Waddock & Graves, 1997).

The next variable to consider is *organizational slack*. This construct is being controlled for since firms with increased access to resources may choose to seek external providers of knowledge even when there might be internal routines that could address the needs of the firm. Since the focus is on the discretionary aspect of slack, I follow Wan and Yiu (2009) who used the free cash flows normalized by sales.

Differences in industry can also have serious implications for on performance (Hansen & Wernerfelt, 1989; Rumelt, 1991; Schmalensee, 1985). The implications from a knowledge perspective are also critical since there could be differential impacts of new knowledge internalization due to idiosyncrasies of conditions within specific industries. The two issues from an industry perspective that are of particular importance in the context of this study are munificence and dynamism (complexity is not seen as a relevant variable as it has to do with industry level homogeneity/heterogeneity and concentration, which are not of relevance to this study (Dess & Beard, 1984)). Following Boyd (1990), *munificence* was calculated by regressing sales on time for a five year period and dividing the slope coefficient by the mean sales value for that period. Similarly, *dynamism* was calculated by regressing sales on time for a five year period and using the standard error of the slope.

Studies have indicated that older firms, on account of temporal path dependencies, can benefit from higher absorptive capacity (Rao & Drazin, 2002).

Therefore I control for *firm age* and operationalize it as the year of incorporation of the focal firm.

4.3.4 Common Methods Bias

As stated earlier, this research includes variables that are perceptions of the respondents. Given that some of these variables include dependent variables that are collected at the same time as the independent variables, there is potential for common methods bias impacting the results.

Given this potentially serious concern, I have employed measures to alleviate any impact that this may have on the results of the study. A key measure is the use of multiple sources of data (Kerlinger & Lee, 1999; Schwab, 1999) and therefore I have used objective measures wherever possible. For performance, I have used return on assets and return on sales to examine performance, in addition to the perceptual measures of performance detailed above.

However, when it was not possible to use objective measures for variables, I have followed measures suggested by Podsakoff et al. (2003) for both design and data collection stages. The first step was to carefully avoid any explicit mention of the purpose of the research. While this does not imply any willful misleading of respondents, it did not make the dependent variables explicit. This then helped avoid any percept-percept bias since the respondents were unable to anticipate the relationships under study and consequently alleviated the concern that they may respond in line with their pre-conceptions.

The structuring of the survey in terms of location of questions also helped address this problem. This was done by placing the section of new process knowledge separately

from the section on routine consistency of knowledge. I also included six reverse coded items and used open-ended questions in the survey, to mitigate issues that may occur when respondents continuously answer survey questions (LaHuis & Copeland, 2009).

Other steps taken to address common methods bias included a clear and unambiguous assurance of confidentiality made to the respondents. As suggested by Podsakoff et al. (2003), this can help respondents not feel the need to respond in accordance with any perceived organizational need. I also reduced the cognitive costs for respondents by using items that were clear to understand and in understandable in their context; and also were free of cuing language.

Finally, to statistically test for common methods bias in the survey data, I employed the widely used Harman's single factor test (for example, Aulakh & Gencturk, 2000; Christmann, 2004), which involves loading all the variables into an exploratory factor analysis. On employing this method, I found that no single factor accounted for at least a third of the total variance. This suggests a low likelihood that common method bias exists, since that situation would lead to one general factor accounting for a large part of the variance.

CHAPTER 5

RESULTS

Having discussed the measures and survey in Chapter 4, I now look at the results of the analysis of the hypotheses offered in Chapter 3. There are three sets of hypotheses to consider – the first set examines all firms in the survey; the second set addresses a subset of firms with high absorptive capacity and the third set addresses a subset of firms with low absorptive capacity.

5.1 Hypotheses Regarding AC, Routines and CSF Engagement

I first present the descriptive statistics for the variables used in this analysis. The constructs are factor analyzed to show correlations with other variables of interest. The factor analysis methodology uses principal factor analysis as suggested by Harman (1976). The correlation table is shown in Table 3. For Hypotheses 1 and 2, a CFA with all 277 cases was run and the results indicate acceptable fit – CFI 0.92, IFI 0.902, GFI 0.896 and AGFI 0.832 (the last fit index provides a proxy for the variance in the items explained by the latent construct (Bryant, Yarnold & Grimm, 1996)). However, while RMSEA 0.120 indicates a poor fit, given the number of observed variables and the difficulty of having perfect goodness of fit indices across all categories, for survey data based models, I continue with the analysis of the structural model (Hair, Black, Babin & Anderson, 2010). This measurement model is presented in Figure 5 below.

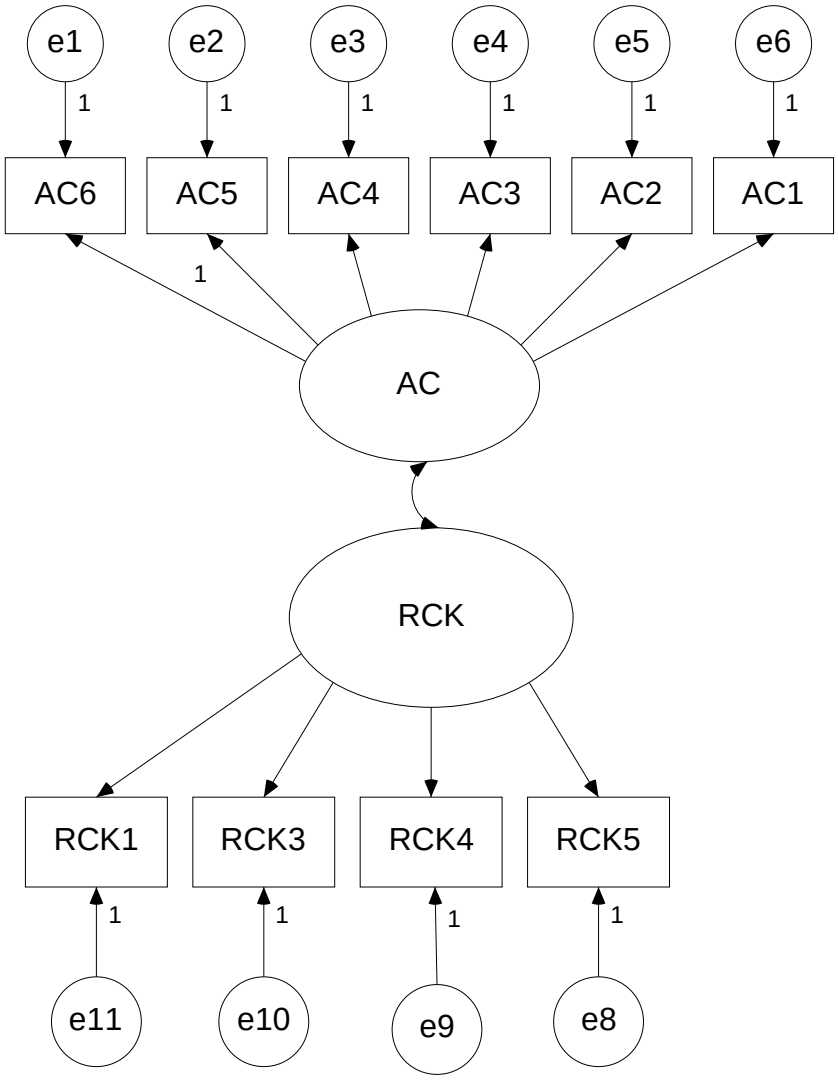

Figure 5: Measurement model for relationship between absorptive capacity and routine consistent knowledge

5.1.1 Hypothesis One – AC and RCK

In Hypothesis 1, I had suggested that the level of absorptive capacity of firms will be negatively associated with routine consistent knowledge. On examining the structural model, I found a positive and significant relationship between the two – thus the hypothesis was not supported. The standardized estimates results indicate for an increase of one standard deviation of AC, RCK goes up by 0.136 standard deviations. Further this result was significant at the 0.05 level ($p = 0.049$, two tailed). The level of significance was calculated by using bootstrapped estimates as suggested by Shrout and Bolger (2002).

	AC	RCK	EPK	NPK	KCP	Slack	Age	Size	Ind_Mun	Ind_Dyn	ROA	ROS	P_PRCP
AC	1	.360**	.750**	.441**	.427**	-.140*	.054	.064	-.011	.033	-.017	-.023	.413**
RCK	.360**	1	.439**	.472**	.125	-.076	-.021	.084	-.060	.088	.194**	.080	.389**
EPK	.750**	.439**	1	.530**	.425**	-.147*	.044	.071	.023	-.054	.056	.031	.480**
NPK	.441**	.472**	.530**	1	.560**	-.090	-.066	.130*	-.033	-.016	.064	.005	.622**
KCP	.427**	.125	.425**	.560**	1	.086	-.137	.237**	.024	.083	-.006	-.037	.366**
Slack	-.140*	-.076	-.147*	-.090	.086	1	.054	-.002	.081	-.033	-.030	-.010	.026
Age	.054	-.021	.044	-.066	-.137	.054	1	-.311**	.061	-.075	-.156**	-.267**	-.016
Size	.064	.084	.071	.130*	.237**	-.002	-.311**	1	.078	-.035	.088	.067	.077
Ind_Mun	-.011	-.060	.023	-.033	.024	.081	.061	.078	1	.279**	-.125*	-.096	-.057
Ind_Dyn	.033	.088	-.054	-.016	.083	-.033	-.075	-.035	.279**	1	.039	.018	.001
ROA	-.017	.194**	.056	.064	-.006	-.030	-.156**	.088	-.125*	.039	1	.517**	.021
ROS	-.023	.080	.031	.005	-.037	-.010	-.267**	.067	-.096	.018	.517**	1	.016
P_PRCP	.413**	.389**	.480**	.622**	.366**	.026	-.016	.077	-.057	.001	.021	.016	1

**. Correlation is significant at the 0.01 level (2-tailed)

**. Correlation is significant at the 0.05 level (2-tailed)

Table 3: Correlation table for all firms in survey

5.1.2 Hypothesis Two – RCK Mediates Relationship Between AC and CSF hiring

For Hypothesis 2, I had stated that routine consistent knowledge will mediate the relationship between the level of absorptive capacity of a firm and the decision to hire a consulting service firm. The same structural model that was tested for hypothesis one was also used for testing this hypothesis. The results support the hypothesis and the standardized results indicate that the mediated (indirect) effect of AC on CSF hiring is such that when AC goes up by one standard deviation, CSF hiring goes up by 0.135 standard deviations. This result is significant at the 0.05 level ($p = 0.046$, two tailed). This significance was obtained by a bootstrapped approximation constructed by two-sided bias-corrected confidence intervals. I used the bootstrapped estimates since scholars now suggest that bootstrapping estimates is a more conservative test of mediation than the Sobel test, which has been widely used (Preacher & Hayes, 2004; Shrout & Bolger, 2002). Controls used included age, size and organizational slack as each of these can differentially impact the decision to engage a CSF.

5.2 Hypotheses regarding High AC firms

As explained in Chapter 3 and 4, to test the hypotheses for those firms that have high absorptive capacity, I have used a median split of the complete sample of 277 firms (Flynn and Staw, 2004; Salomon and Jin 2010). This yielded 142 firms that had high AC, which implies their AC value was 5.33 or higher. The analysis methodology used

for these cases is hierarchical regression, as several of the hypotheses relating to high AC firms, include moderation.

I am again detailing the correlations in Table 4 for the variables in this section to make explicit the relationships of variables for this sub-sample of the study.

	EPK	RCK	KCP	NPK	P_PRCP	Slack	Age	Size	Ind_Mun	Ind_Dyn	ROA	ROS
EPK	1	.437**	.205	.396**	.394**	.044	-.089	.166*	-.081	-.101	.184*	.097
RCK	.437**	1	.086	.456**	.314**	.036	-.016	.114	-.130	.059	.338**	.112
KCP	.205	.086	1	.639**	.225	.062	-.141	.273*	-.006	-.031	.018	.009
NPK	.396**	.456**	.639**	1	.541**	.058	-.097	.155	-.022	.048	.066	-.013
P_PRCP	.394**	.314**	.225	.541**	1	.040	-.063	.135	-.106	.034	.005	.035
Slack	.044	.036	.062	.058	.040	1	.077	.005	.073	-.027	-.061	-.040
Age	-.089	-.016	-.141	-.097	-.063	.077	1	-.333**	.041	-.110	-.191*	-.360**
Size	.166*	.114	.273*	.155	.135	.005	-.333**	1	.079	-.042	.109	.083
Ind_Mun	-.081	-.130	-.006	-.022	-.106	.073	.041	.079	1	.232**	-.114	-.143
Ind_Dyn	-.101	.059	-.031	.048	.034	-.027	-.110	-.042	.232**	1	.070	.026
ROA	.184*	.338**	.018	.066	.005	-.061	-.191*	.109	-.114	.070	1	.555**
ROS	.097	.112	.009	-.013	.035	-.040	-.360**	.083	-.143	.026	.555**	1

**. Correlation is significant at the 0.01 level (2-tailed)

**. Correlation is significant at the 0.05 level (2-tailed)

Table 4: Correlation table for high absorptive capacity firms

5.2.1 Hypothesis Three – RCK and EPK

In Hypothesis 3, I suggest that those high absorptive capacity firms that discern high levels of routine consistent knowledge will be associated with high levels of reliance on existing procedural knowledge. This hypothesis was supported at the 0.01 level and the results are presented below in Table 5**.**

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	19.877	1	19.877	33.046	.000[a]
	Residual	84.210	140	.601		
	Total	104.087	141			

a. Predictors: (Constant), RCK

b. Dependent Variable: EPK

Coefficients[a]

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	-1.799E-16	.065		.000	1.000
	RCK	.400	.070	.437	5.749	.000

a. Dependent Variable: EPK

Table 5: Regression results for high AC firms' routine consistent knowledge and reliance on existing procedural knowledge

The variance explained is 0.191. The regression results suggest that for every one standard deviation increase in routine consistent knowledge, the associated increase in reliance of existing procedural knowledge is 0.437. It must be noted that the control

variables are not used at this juncture as they are conceptualized as impacting performance.

5.2.2 Hypothesis Four – RCK Moderates Relationship of EPK and Performance

Building on hypothesis 3, I suggest that those high absorptive capacity firms that determine that the new knowledge they have received is in concordance with existing routines (RCK), will leverage existing routines (EPK) to generate improved performance (P). I further hypothesize that this relationship will be moderated by the level of routine consistency – such that at higher levels of RCK, firms will generate higher levels of performance. As stated earlier, I have three different measures of performance – perceptual (9-item construct), ROA and ROS. The control variables, as explained in Chapter 4, included organizational slack, size of firm, age of firm, industry munificence and dynamism.

Using ROA as a performance variable, this hypothesis was supported at the 0.001 level. The model with the interaction was significant ($F_{8,141} = 8.127$ and $p < 0.001$). The amount of variance explained by the interaction term was significant ($\beta = -0.123$ and $p < 0.001$) was 17%. The effect size (f – square) was 0.489 with an observed power of 0.738. Although there are no universally accepted standards for effect size for interactions, following Cohen (1988), we could classify this as a large effect, as the suggested cutoff is at least 15% of incremental variance to be explained by this variable.

However, when using the perceptual measures of performance, the results are insignificant. The interaction term only contributes 0.1% of variance. While the power to estimate this effect is fairly large (0.778), the lack of increased contribution is interesting.

This is similar to the result obtained by using ROS as the performance measure. In comparison to the perceptual measures the interaction explains more variance (0.6%); however this is still insignificant. What is different when ROA or ROS is used as opposed to perceptual measures for performance is that for the latter, immaterial of whether the routine consistency is high or low, respondents believed the performance was improved (as opposed for the objective measures which suggest that when consistency is high then performance is high and when consistency is low, the performance of the firm deteriorates).

The results are available in Table 6 below and I have graphed the interactions for performance as measured by ROA, ROS and perceptual below in Figures 6, 7 and 8. Following Aiken and West (1991) for plotting the interaction, high and low values of the moderator (RCK) were taken at +/- one standard deviation and the independent variable and the moderator were centered.

	ROA			**ROS**			**PRCPT**		
	β	**SE**	**p**	**β**	**SE**	**p**	**β**	**SE**	**p**
Constant	0.065	0.018	0.001	0.109	0.155	0.483	-0.015	0.082	0.852
Control									
Ind_Dyn	2.148	2.195	0.329	2.542	18.471	0.891	0.032	0.087	0.715
Ind_Mun	-0.375	0.446	0.402	-4.962	3.755	0.189	0.000	0.004	0.994
Size	0.000	0.000	0.173	-0.032	0.008	0.000	0.000	0.000	0.420
Age	-0.001	0.001	0.165	-0.018	0.164	0.912	-2.151	1.983	0.280
Slack	-0.016	0.020	0.412	0.000	0.000	0.770	9.469	9.751	0.333
Independent									
EPK	0.042	0.023	0.069	0.106	0.193	0.585	0.343	0.102	0.001
RCK	0.037	0.022	0.085	0.100	0.181	0.583	0.168	0.096	0.082
Interaction									
EPKxRCK	-0.123	0.021	0.000	-0.187	0.179	0.299	0.044	0.095	0.645

Table 6: Regression results for high AC firms moderation test regarding existing procedural knowledge and routine consistent knowledge

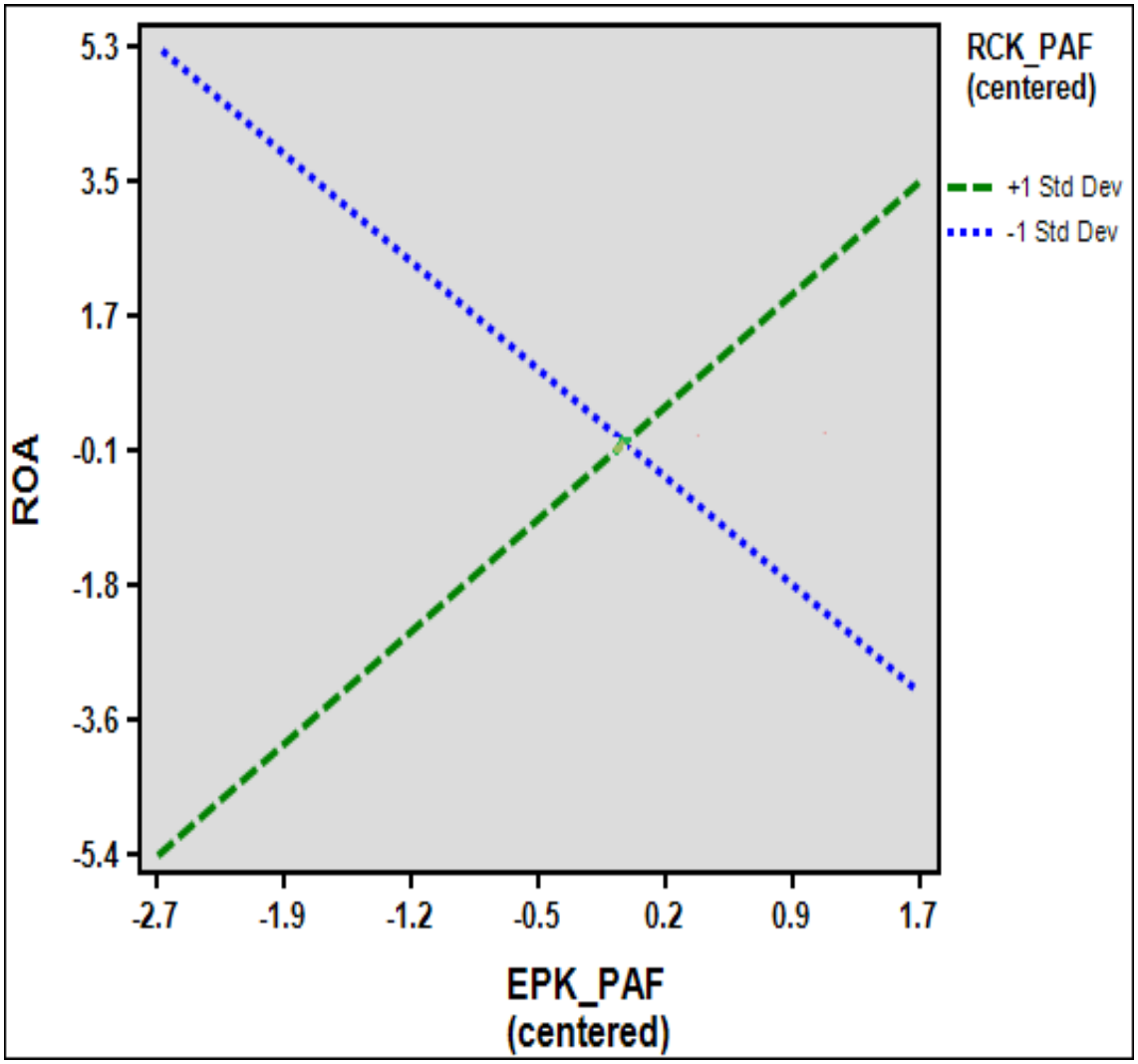

Figure 6: Interaction plot of existing procedural knowledge and routine consistent knowledge with ROA as dependent variable

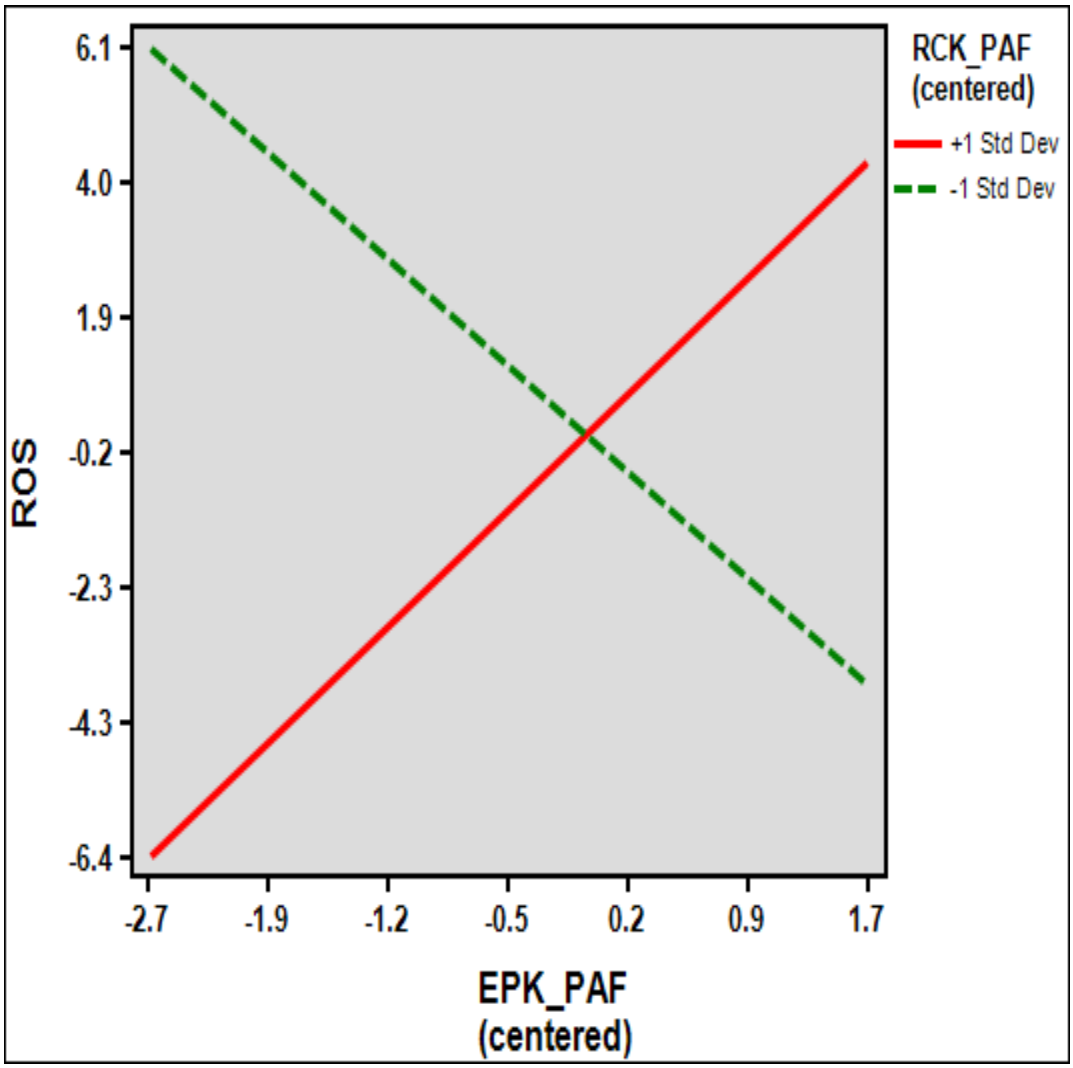

Figure 7: Interaction plot of existing procedural knowledge and routine consistent knowledge with ROS as dependent variable

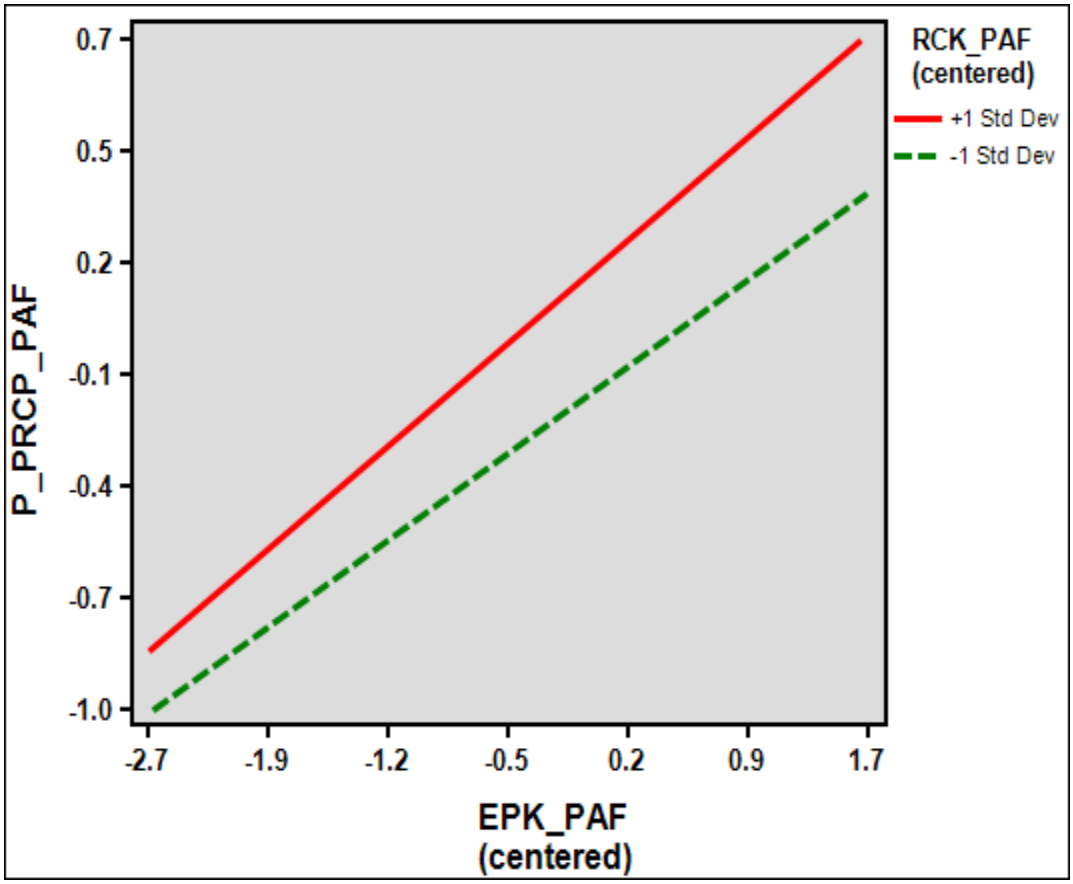

Figure 8: Interaction plot of existing procedural knowledge and routine consistent knowledge with perceptual performance as dependent variable

5.2.3 Hypothesis Five – KCP Moderates Relationship of RCK and NPK

In Hypothesis 5, I suggest that some high absorptive capacity firms may determine that the focal new knowledge they have received is not in concordance with existing routines (RCK). They may then choose to engage a consulting service firm to help them generate new routines to internalize this new knowledge. I further hypothesize that this relationship between the firm and the CSF it hires will impact the production of

new procedural knowledge (NPK), such that at higher levels of knowledge co-production (KCP) with their CSFs, firms will generate higher levels of NPK.

This hypothesis was supported at the 0.01 level. The model with the interaction was significant ($F_{8,61}$= 8.173 and $p < 0.001$). The amount of variance explained by the interaction term was significant (β = -0.326 and $p < 0.01$) was 8.8%. The effect size (f – square) was 0.489 with an observed power of 0.738. The control variables, as explained in Chapter 4, included organizational slack, size of firm, age of firm, and industry munificence and dynamism, none of which are significant. Results of the regression are made available below in Table 7 and the interaction is plotted in Figure 9 below that. Again, following Aiken and West (1991) for plotting the interaction, high and low values of the moderator (RCK) were taken at +/- one standard deviation and the independent variable and the moderator were centered.

	β	**SE**	**p**
Constant	0.122	0.071	0.090
Control			
Ind_Mun	0.268	2.239	0.905
Ind_Dyn	-0.099	8.320	0.991
Slack	0.070	0.132	0.598
Age	-0.002	0.005	0.731
Size	0.000	0.000	0.800
Independent			
RCK	0.221	0.085	0.012
KCP	0.651	0.092	0.000
Interaction			
RCKxKCP	-0.326	0.101	0.002

Table 7: Regression results for high absorptive capacity firms moderation test of consistency of knowledge and knowledge co-production

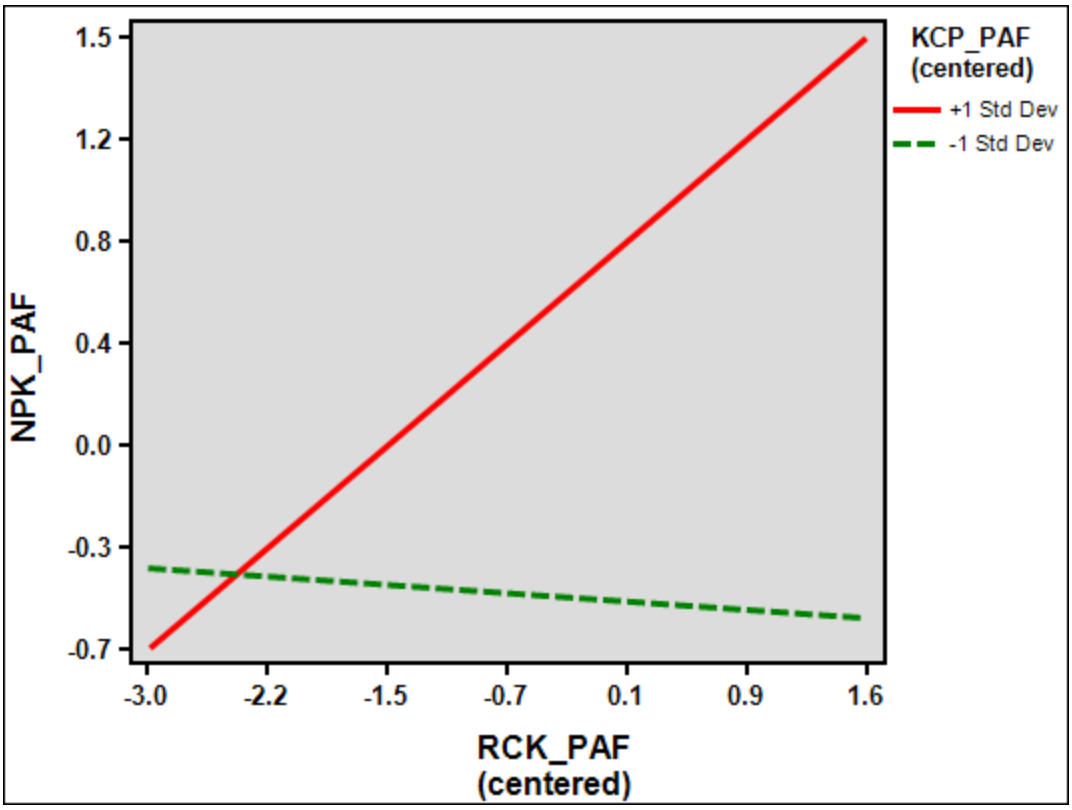

Figure 9: Interaction plot of routine consistent knowledge and knowledge co-production with generation of new procedural knowledge as dependent variable

5.2.4 Hypothesis Six –NPK to Performance

In hypothesis 6, I suggest that those high absorptive firms that have worked with consulting service firms to generate new routines will be able to then realize improved performance. Control variables employed again were industry munificence, dynamism, organizational slack, age and size.

The regression results are equivocal and indicate that the perceptual measure of performance as the dependent variable is significant as hypothesized; however the objective measures (ROA and ROS) are not. The variance explained for the significant result is 27.6%, which again is a large effect size as per Cohen (1988). The results of the

regression analyses with the three different performance variables (perceptual, ROA and ROS) are shown below in Tables 8, 9 and 10.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	.198[a]	.039	.004	.96096286	.039	1.109	5	136	.359
2	.554[b]	.307	.276	.81904856	.268	52.212	1	135	.000

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.768	8.870		.087	.931
	Slack	.057	.094	.051	.606	.545
	Age	.000	.004	-.004	-.042	.967
	Size	1.437E-5	.000	.147	1.634	.105
	Ind_Mun	-3.328	2.112	-.138	-1.576	.117
	Ind_Dyn	8.617	10.366	.073	.831	.407
2	(Constant)	-1.559	7.567		-.206	.837
	Slack	.018	.080	.016	.224	.823
	Age	.001	.004	.020	.255	.799
	Size	6.854E-6	.000	.070	.906	.367
	Ind_Mun	-2.671	1.803	-.111	-1.482	.141
	Ind_Dyn	4.686	8.852	.040	.529	.597
	NPK	.540	.075	.527	7.226	.000

a. Dependent Variable: P_prcpt

Table 8: Regression results for high absorptive capacity firms performance (perceptual) implications of new procedural knowledge

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	3.706	2.161		1.715	.089
	Slack	-.010	.023	-.038	-.451	.653
	Age	-.002	.001	-.149	-1.660	.099
	Size	1.765E-6	.000	.074	.824	.411
	Ind_Mun	-.775	.515	-.130	-1.506	.134
	Ind_Dyn	2.499	2.525	.086	.990	.324
2	(Constant)	3.666	2.169		1.690	.093
	Slack	-.011	.023	-.040	-.478	.634
	Age	-.002	.001	-.147	-1.635	.104
	Size	1.638E-6	.000	.068	.755	.452
	Ind_Mun	-.764	.517	-.128	-1.478	.142
	Ind_Dyn	2.432	2.538	.084	.959	.339
	NPK	.009	.021	.036	.429	.669

a. Dependent Variable: ROA

Table 9: Regression results for high absorptive capacity firms performance (ROA) implications of new procedural knowledge

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	66.786	15.517		4.304	.000
	Slack	-.005	.164	-.002	-.031	.975
	Age	-.033	.008	-.362	-4.238	.000
	Size	-4.732E-6	.000	-.026	-.308	.759
	Ind_Mun	-5.812	3.695	-.130	-1.573	.118
	Ind_Dyn	3.274	18.134	.015	.181	.857
2	(Constant)	67.190	15.567		4.316	.000
	Slack	.002	.164	.001	.010	.992
	Age	-.033	.008	-.364	-4.250	.000
	Size	-3.426E-6	.000	-.019	-.220	.826
	Ind_Mun	-5.927	3.708	-.132	-1.598	.112
	Ind_Dyn	3.958	18.210	.018	.217	.828
	NPK	-.094	.154	-.049	-.610	.543

a. Dependent Variable: ROS

Table 10: Regression results for high absorptive capacity firms performance (ROS) implications of new procedural knowledge

5.3 Hypotheses regarding Low AC firms

As explained above, to test the hypotheses for those firms that have low absorptive capacity, I have used a median split of the complete sample of 277 firms (Flynn and Staw, 2004; Salomon and Jin 2010). This yielded 135 firms that had low AC, which implies their AC value was lower than 5.33. The analysis methodology used for these cases is structural equation modeling. I am again detailing the correlations in Table

11 for the variables in this section, to make explicit the relationships among the variables for this sub-sample of the study.

The CFA of the structural model, run in AMOS, yields the following: CFI 0.894, IFI 0.895, GFI 0.857 and AGFI 0.769; the last fit index provides a proxy for the variance in the items explained by the latent construct (Bryant, Yarnold & Grimm, 1996). While these indices do not reflect a perfect fit, given the number of observed variables and the difficulty of having perfect goodness-of-fit indices across all categories, for survey data based models, these are considered acceptable values (e.g., Collins & Smith, 2006).

	EPK	RCK	P_PRCPT	Slack	Age	Size	Ind_Mun	Ind_Dyn	ROA	ROS
EPK	1	.371**	.448**	-.217*	.046	.022	.041	-.038	.021	-.023
RCK	.371**	1	.338**	-.145	-.087	.072	-.002	.125	.017	.016
P_PRCPT	.448**	.338**	1	.030	-.039	.016	-.036	-.012	-.063	-.093
Slack	-.217*	-.145	.030	1	.046	-.007	.089	-.036	-.010	.084
Age	.046	-.087	-.039	.046	1	-.289**	.078	-.049	-.086	-.042
Size	.022	.072	.016	-.007	-.289**	1	.078	-.031	.030	.022
Ind_Mun	.041	-.002	-.036	.089	.078	.078	1	.316**	-.137	.020
Ind_Dyn	-.038	.125	-.012	-.036	-.049	-.031	.316**	1	-.026	.033
ROA	.021	.017	-.063	-.010	-.086	.030	-.137	-.026	1	.526**
ROS	-.023	.016	-.093	.084	-.042	.022	.020	.033	.526**	1

**. Correlation is significant at the 0.01 level (2-tailed)

**. Correlation is significant at the 0.05 level (2-tailed)

Table 11: Correlation table for low absorptive capacity firms

5.3.1 Hypothesis Seven – RCK and EPK

In Hypothesis 7, I suggest that low absorptive capacity firms will tend to perceive new knowledge as being consistent with existing routines. Consequently there will be a higher reliance on existing routines (i.e., existing procedural knowledge (EPK)) to internalize this new knowledge.

The structural model on analysis shows a positive and significant relationship between the two. The estimates results indicate for an increase of one unit of RCK, EPK goes up by 0.874 units. Further this result was significant at the 0.001 level.

5.3.2 Hypothesis Eight – EPK and Performance

In Hypothesis 8, I build on Hypothesis 7 and suggest that since low absorptive capacity firms will tend to have a higher reliance on existing routines to internalize new knowledge – even when it may not be appropriate to do so – their performance when using EPK will be relatively less than their high absorptive capacity counterparts.

The control variables used are the same as for the high absorptive capacity firms cases and include organizational slack, age, size, industry munificence and industry dynamism. The structural model with the perceptual measure of performance (significant relationship) is presented in Figure 11**.**

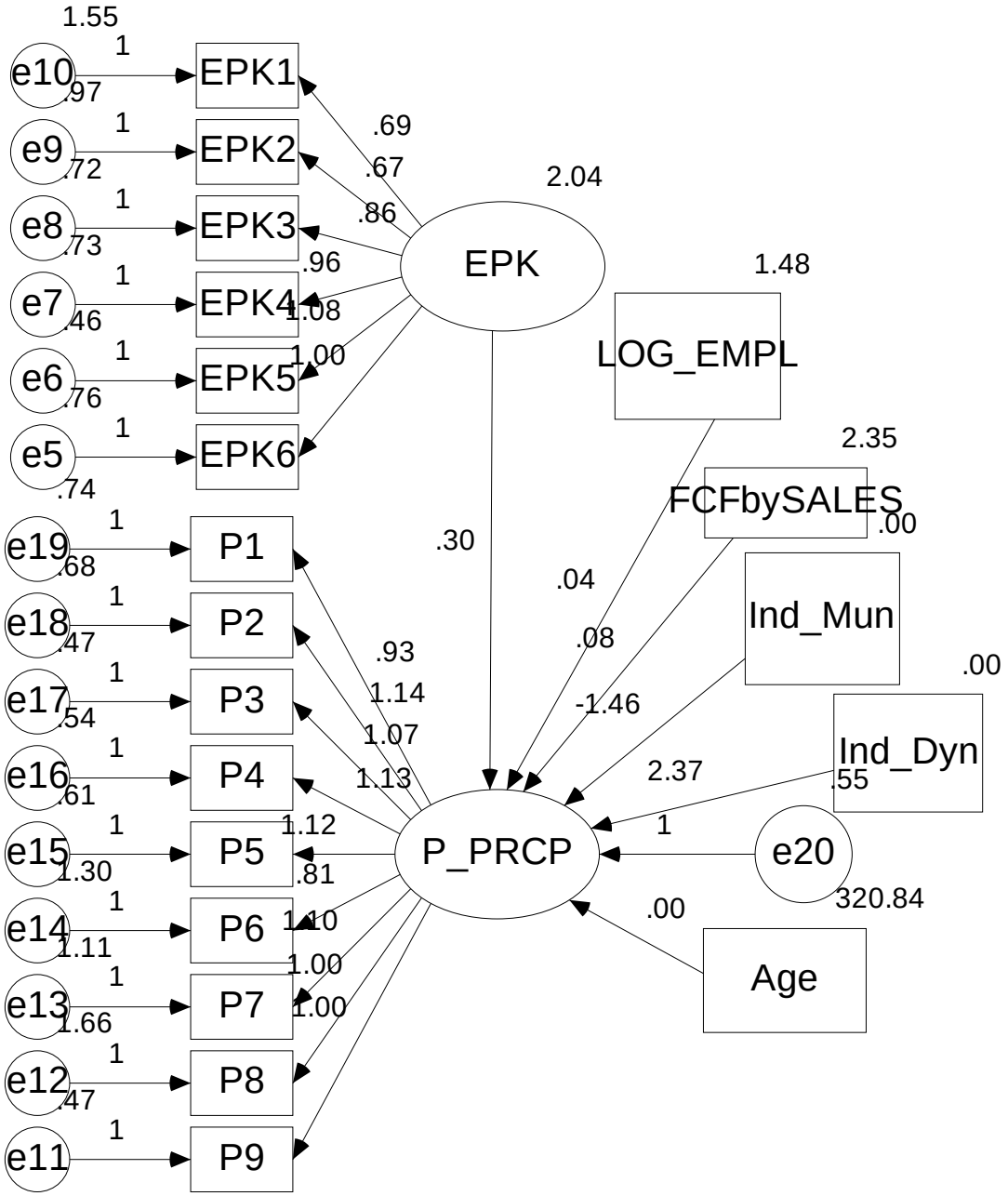

Figure 10: Structural model for performance implications of use of existing procedural knowledge by low absorptive capacity firms

The structural model on analysis shows a positive and significant relationship between the EPK and performance when measured with perceptual indicators. The estimates results indicate for an increase of one unit of EPK, performance (perceptual) goes up by 0.300 units. Further this result was significant at the 0.001 level. None of the control variables were significantly related to the performance variable. However, when objective measures of performance (ROA and ROS) were used, I found no significant relationship between EPK and performance. The control variables were also not significant.

Given potential percept-percept measure bias, I will rely on the performance variables as measured by objective indicators. Consequently, this then suggests that low AC firms who leverage EPK will not be able to leverage improved performance. Since Hypothesis 8 suggests that high AC firms will be better able to leverage EPK to improve performance, I state that hypothesis eight is supported.

A summary of the results is provided below in Table 12.

Hypothesis 1	Not supported (results significant in opposite direction)
Hypothesis 2	Supported
Hypothesis 3	Supported
Hypothesis 4	Supported (for ROA)
Hypothesis 5	Supported
Hypothesis 6	Supported (for perceptual measure)
Hypothesis 7	Supported
Hypothesis 8	Supported (when objective measures used)

Table 12: Summary of results of hypothesis tests

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1 Discussion

Having presented the results from the tests of the hypotheses, I now discuss and interpret these results. The two broad research questions that I set out to examine in this dissertation were first, how do differential levels of existing knowledge lead to different paths to internalize new knowledge; second, what are the different paths of firms take when seeking to internalize new knowledge and what is the consequent impact on performance? I find that the absorptive capacity of a firm impacts that firm's choices of how it chooses to internalize new knowledge that it receives. High absorptive capacity firms seem to be more accurate in their diagnosis of the choice of how to internalize that new knowledge, which they do so by either leveraging relevant existing routines or by generating when needed, new organizational routines, by seeking external sources such as consulting service firms. Low absorptive capacity firms, on the other hand, find it relatively more difficult to understand how they can internalize the new knowledge they receive and consequently may not be able to optimally leverage the value of the focal new knowledge that they receive.

The ensuing detailed discussion section is presented in three parts. The first discusses hypotheses that relate to all the firms and the decision to hire a consulting service firm. The second addresses only the high absorptive capacity firms that choose to work with consulting service firms. Finally, the third part speaks to the low absorptive

capacity firms and the performance issues from the internalization of new knowledge that they face.

6.1.1 Discussion of results about relationship between AC and engagement of CSFs

In Hypotheses 1 and 2, I suggested that the absorptive capacity levels of a firm will impact them in two ways: firstly, in their perception of any new knowledge that they receive as being consistent with existing knowledge (Hypothesis 1) and secondly, in how this perception will impact the decision to engage a consulting service firm to help internalize this new knowledge.

The rationale for Hypothesis 1, which suggested a negative relationship between absorptive capacity and level of consistency with existing routines, was that firms with higher absorptive capacity would be expected to more accurately diagnose the ramifications of any new knowledge. This would then help them understand why even seemingly marginally different new knowledge would need appropriate amounts of changes in existing routines to internalize the new knowledge. However, the results were significant and positive. This was surprising given the large amount of theoretical and empirical work that justified the hypothesis.

One possible explanation for this positive relationship between level of absorptive capacity and the consistency of the new knowledge and existing routines could be the context of Indian firms being used to test the hypotheses. Indian firms have entered the world markets only in the last two decades and have been allowed a lot of government support for enabling growth. One instance of government support for growth of Indian firms is that in the Indian information technology industry, firms have been given particularly favorable tax and utility incentives. This then may allow Indian firms to

substitute necessary knowledge about their routines with these additional resources. The cost for Indian firms of being unaware of relevant knowledge may be paid for external resources that may not necessarily be equally available to firms from other countries. Consequently, they would not be incentivized to properly diagnose the new consistency of the new knowledge.

A second possible impact of the context of Indian firms is that they are relatively new in global markets and previously only contested in government controlled markets. This youthfulness of Indian firms may also contribute to their lack of nuanced knowledge about their own firms' capabilities as well as understanding the nuances of any new knowledge they receive. Competing in a global market may help firms learn more about the market and about the firms themselves; and two decades may not be sufficient for firms to improve upon their knowledge bases. The absorptive capacity of these firms may well increase over time, since many have suggested it is a dynamic capability, and hence could help firms better understand their own abilities better and thus realize the gaps that may exist in their knowledge stocks, which could then lead to support for the argument set forth in Hypothesis 1. This may indicate that future research could look at temporally driven propositions regarding when firms change in their perception of new knowledge that they receive.

Another possible explanation of this surprising result derives from Matusik and Heely (2005). They suggest that absorptive capacity is driven by three aspects of a firm: a) its organizational boundary porosity b) the collective dimension (structures and routines for knowledge transfer) and c) the individual dimension (the individual employees' absorptive abilities). In this dissertation I have examined the impact of

absorptive capacity from a primarily collective aspect. However, one possible reason I find that firms with high absorptive capacity are seeing consistency with existing routines may be the high individual ability levels of the employees in these firms. If a firms' high absorptive capacity derives from its employees abilities then even if they do not have high porosity they will see consistency. This line of thinking is consistent with other work that suggests that low absorptive capacity firms may also only seek new knowledge that they already have some expertise in (Wegner, 1987). However my findings extend this line of work by suggesting that even high absorptive capacity firms may in cases where they have high individual ability see consistency of any new knowledge received with existing routines.

In Hypothesis 2, I suggested that consistency of the new knowledge will mediate the relationship between the levels of absorptive capacity and consulting service firm engagement, such that firms with higher levels of absorptive capacity will be more likely to engage a consulting service firm. This hypothesis was supported and was significant ($p < 0.05$) and the structural model suggested that the hypothesis was strongly supported since it met the full mediation test. This was accomplished by means of a bootstrapped sample that helped me construct a bias-corrected confidence interval.

The result supports the idea that the level of absorptive capacity will drive the decision to engage a consulting service firm. Further this result is in line with existing organizational learning literature that suggests that firms with higher learning abilities will seek external resources to build knowledge assets. More specifically, in this context the use of consulting service firms by high absorptive capacity firms suggests that the logic of those who already know more are the ones who will seek additional help.

This line of empirical work demands further investigation as the extant literature has suggested that firms with gaps in existing knowledge (i.e., low absorptive capacity) would be more likely to engage consulting service firms as opposed to firms with higher absorptive capacity. The extant logic is that firms seek to address knowledge asset imbalances by seeking additional external resources in case they cannot find it internally.

However, what this study is suggesting is that the converse may be occurring, which is that firms with higher knowledge assets will be able to leverage those assets to seek particular assistance where they feel a need. This finding is also interesting since it adds to the literature on external knowledge providers since it bases the choice of seeking external knowledge providers on the absorptive capacity of the firm as opposed to industry ties (Powell, Koput & Smith-Doerr, 1996) or centrality of the firm in its organizational field network (Goes & Park, 1997). Consequently this result, which is in line with the hypothesis suggested in Chapter 3, implies a rethinking of the drivers of engagement of professional service firms by clients. This result indicates that at times firms may not be knowledgeable enough to realize that they need to engage consulting service firms to internalize relevant new knowledge.

6.1.2 Discussion of results about high absorptive capacity firms

In Hypotheses 3, 4, 5 and 6, I examine the impact of new knowledge and its internalization processes in high absorptive capacity firms. As discussed in the results chapter, given the use of moderators in this set of hypotheses, I have used hierarchical regression models to test these hypotheses.

Hypothesis 3 suggested that high absorptive capacity firms on receiving new knowledge will more accurately diagnose the consistency of this new knowledge with

existing routines. When they find that this new knowledge is consistent with existing knowledge, I hypothesized that they will tend to leverage existing routines to internalize this new knowledge with existing routines, rather than create new routines to internalize this new knowledge. This hypothesis was supported ($p < 0.01$).

The results of this hypothesis suggest that high absorptive capacity firms seem to be better equipped to not only discern the potential utility of any new knowledge, but also understand how best to leverage it. Generating new routines is a costly exercise, and efficiency needs of firms dictate the need to conserve capital by leveraging existing resources when possible. This economic efficiency rationale thus finds support.

Building on this hypothesis, I suggested that those firms that do rely on existing routines to leverage new knowledge, after having reliably diagnosed that these existing routines will suffice to leverage new knowledge, will consequently be able to benefit from improved performance. I further suggested in Hypothesis 4, that the closeness of the new knowledge to existing routines will influence the resultant performance. This is based on the premise that firms that have to make less adjustments to their existing routines to accommodate new knowledge will be able to more economically and more quickly be able to internalize the new knowledge. This then would lead to better performance.

Given that other mechanisms may drive performance, I control for these additional variables. These control variables include organizational slack, firm size, age of firm, and industry characteristics.

I also use different measures of performance – both objective and perceptual. This will help provide a more granular perspective of the firm's performance – from the

senior managers' perspective as well as from the financials. For the perceptual measure of performance I use a 9 item construct, and for the objective measures, I use return on assets (ROA) and return on sales (ROS).

On examining the moderated regression results, I found that performance, as measured by ROA, significantly ($p < 0.001$) improved when adding the interaction term of consistency of routine (RCK) and the use of existing routines (EPK). However significant results were not obtained when using ROS or the perceptual performance measure.

This then suggests that high absorptive capacity firms that appropriately decide to use existing routines to leverage knowledge will be associated with improved performance, and this will be particularly true of firms that do so when this new knowledge is relatively consistent with existing knowledge as opposed to being relatively disparate from the existing routines of the firm. While this aspect of high absorptive capacity firms accurately understanding when to leverage existing routines has already been discussed earlier, we must delve deeper to better understand the implications of the interaction of the use of existing routines and consistency of knowledge.

The basic driver of this interaction has to be the stock of routines that a firm already possesses. Thus firms that have a large repertoire of routines will be better situated to benefit from new knowledge – since there will be aspects of this larger set of routines that will increase the likelihood of consistency of new knowledge with these routines. This in turn ought to lead to improved performance for firms.

The add-on effect of a large repertoire of routines would be the linkage between absorptive capacity and routines. While there can be expected to be a high correlation

between being able to leverage knowledge assets when firms have high absorptive capacity, what is less understood is how the differences in relative quantities of routines would impact absorptive capacity – more simply, are firms that do one thing well (and potentially having high absorptive capacity) going to be better at leveraging new knowledge than firms that do several things (and also potentially having high absorptive capacity)? Meschi (2004) speculates that the former would be more useful for firms seeking to leverage new knowledge rather than what he calls "stock of organizational routines" (Meschi, 2004: 598). While my study indicates that there is a likelihood that this hypothesis holds true, given that I specifically did not test for this, does not allow me to plausibly make this claim. This would be an interesting conceptual and empirical question to consider in future research.

A final aspect to consider is the relevance of the ROA measure having significant results and not the ROS or perceptual measures. ROA which is a ratio of net income to assets distinguishes the capital intensity of firms. This implies that the asset base of a firm may be related to the interaction of the use of existing set of routines and the consistency of the new knowledge. However ROS – the ratio of net income to sales – emphasizes sales efficiency through understanding the profit per dollar of sales generated. This was not found to be significantly related to the interaction suggested before, nor was the managers' own perception of their respective firm's performance.

This lack of congruence between the different objective measures is intriguing since the ROA measure would suggest that utilization of capital resources may be more deeply tied to leveraging new knowledge with existing routines, than the use of sales efficiency. This implication is in line with previous research that organizational routines

are more focused on how to leverage internal resources to improve performance rather than getting more efficient at generating additional sales (Benner & Tushman, 2003; Gupta, Smith & Shalley, 2006). These results then suggest that efficiency rather than effectiveness may be the mechanism through which absorptive capacity helps firms generate improved performance.

In Hypotheses 5 and 6 I examine the situation wherein high absorptive capacity firms decide that the new knowledge that they have encountered cannot be internalized by means of leveraging internal resources. They then may choose to interact with external solution providers such as consulting service firms, to help generate new routines (i.e., new procedural knowledge) to internalize the new knowledge. Hypothesis 5 examines the impact of the quality of the relationship between the focal firm and the consulting service firm on the creation of new knowledge. Hypothesis 6 then examines the consequent impact on firm performance from the internalization of new knowledge by means of the new routines jointly created by the focal firm working with the consulting service firm.

Hypothesis 5 suggested a moderated relationship by which the level of new knowledge generated by working with a consulting service firm is impacted by the quality of the relationship to produce the new knowledge. This hypothesis was supported ($p < 0.01$). The implication of this result is that it confirms findings in the services literature that when actors (firms or individuals and combinations thereof) work together to co-create new ways of doing business, the quality of their interaction is a key determinant of the success of achieving the stated goal (Doucet, 2004; Liao & Chuang, 2004).

In this case the stated goal for the focal firms is that they need new routines to internalize new knowledge. From Figure 9, we can see that when they do work well with the consulting service firm, the new knowledge generated is substantial. However when the quality of the interaction is not good, there is not a sharp decline in the new knowledge created. This in turn implies that while the benefits of working well with a consulting service firm that a focal firm hires are substantial, there is limited downside in case the relationship does not work well.

The limited downside risk demands further investigation and I suggest this may be caused by more than one reason. Firstly, focal firms who have high absorptive capacity have substantial knowledge assets already. Therefore while working with a consulting service firm, they only need more nuanced and better defined help (which is along the lines of my interviews with consulting firms done prior to the survey). These firms may thus already possess several of the needed resources and capabilities to generate the new routines and the lack of a good interaction will not necessarily degrade their ability to create routines to internalize the new knowledge.

Secondly, as we have seen earlier, firms with higher absorptive capacity are more likely to hire consulting service firms. This may then entail situations where they may hire consulting service firms even if they may not necessarily be needed. This aspect of hiring by focal firms was referred to by the consultants that I spoke with as "heavy lifting" – the focal client firms could do the work that they engage consultants for internally. However, they may feel that it might be faster and marginally better to hire a consulting service firm for that engagement. Therefore, in a situation where the relationship with the consulting service firm does not work out, they would find it

relatively easy to redeploy internal resources to generate the required new procedural knowledge.

This reasoning is partially in line with earlier work that suggests that good cooperative behavior can be seen as "relationship capital", which can lead to actualized collaborative economic rents (Sarkar, Echambadi, Cavusgil & Aulakh, 2004: 359). However what makes this study interesting is that in the context of contracted knowledge seeking the downside of engaging with an external knowledge provider may be limited as opposed to other contexts such as alliances where poor relationship quality may lead to degraded performance. This aspect of relationship capital can lead to richer conceptual understanding of the construct.

In Hypothesis 6, I look at the impact of this new procedural knowledge on the firm's performance. Once again I use the control variables described earlier – organizational slack, age of firm, size of firm and industry (munificence and dynamism). The performance variables used are also again ROA, ROS and a perceptual (9-item) measure.

The results of the hypothesis test when using the perceptual measure (P-prcpt) are significant while no significance was obtained when using ROA and ROS as the measures of firm performance. None of the control variables were found to be significantly related to the perceptual measure or ROA. However, when using ROS as the dependent variable, age was found to be significantly ($p < 0.001$) and negatively related to performance.

This result then suggests that new procedural knowledge does help firms to improve performance. Further the use of consulting service firms can be beneficial from

a firm performance perspective. This is in line with prior research that suggests that consultants can help firms improve performance (Bracker & Pearson, 1985) but that consultant integrity can impact this result (McLachlin, 1999). My findings suggest that while consultant integrity is important, the quality of the relationship can help generate improved performance also.

The equivocal results, based on which performance indicator is used, indicates that this improvement in performance may be sensed by managers before the impact on the firm's financial results may be seen. This could be caused by the fact that while the survey asked respondents to keep a completed strategic project in mind while responding and the time frame suggested by me to take into consideration for completion was three years.

Since the survey asked for projects completed in the last three years, this may have caused cognitive issues of recollection for respondents, when considering projects which are not more recent. The responses could therefore be of projects that were completed in the more recent past and therefore the impact of the completion of these projects would not be felt on the firm's financials immediately. It would be interesting to look at continuing financial data for these firms at a later stage, and see if the objective measures are, after a larger lag, significantly related to the creation of new procedural knowledge. There could also be methodological improvements to extant literature by better understanding the appropriate lag on knowledge projects on firm financial performance (Bharadwaj, Bharadwaj & Konsynski, 1999).

The divergence of results based on the dependent variable used is interesting, since for the perceptual measures, managers are self-reporting performance. Survey

methodology researchers have suggested that scholars must be cautious when interpreting perceptual measures, given the potential for common method bias. This problem may be exacerbated when objective measures are available for comparison of the analyses. However, given that I have used both design and analytical mechanisms (as reviewed in Chapter 4) to check for potential common method bias, this is less of a concern in this specific empirical setting.

6.1.3 Discussion of results about low absorptive capacity firms

After having examined the impact of new knowledge on high absorptive capacity firms, I now examine the two hypotheses that relate to low absorptive capacity firms. These hypotheses examine the use of existing routines and the consequent impact on firm performance.

Hypothesis 7 suggests low absorptive capacity firms are more likely than their high absorptive capacity counterparts, to inaccurately diagnose new knowledge, as being consistent with their existing routines. Consequently, I suggested that low absorptive capacity firms are more likely to leverage existing procedural knowledge to internalize new knowledge received.

This hypothesis was supported ($p < 0.001$). The result thus supports the assertion that low absorptive capacity firms are more likely to rely on existing routines. This is driven by their comparably limited understanding of deciphering what relevant new knowledge may be, what the impact of new knowledge (once received) is and how to internalize it. Given the scope of this dissertation, I am not addressing the first aspect of

new knowledge that relates to how firms recognize that a focal new knowledge asset may be relevant to the firm.

On the other hand, this dissertation does help buttress the argument that sometimes firms that do not know enough, are unaware of what they do not know (the equivalent of the famous comment by past US defense Secretary Donald Rumsfeld on "unknown unknowns" (U.S. Department of Defense transcript, 2002)). This is where the issue of having low absorptive capacity becomes particularly acute. The lack of knowledge can impair how firms understand and deal with new knowledge. This is line with extant literature that has examined the impact of low absorptive capacity and the problem of misdiagnosis (Zhao, 2006).

The divergence between firms who can use knowledge to further increase their absorptive capacity – and thus in turn further increase their ability to use new knowledge – and those who cannot will further increase. Absorptive capacity could thus help firms build a virtuous cycle of seeking, internalizing and leveraging knowledge.

The second implication of the use of existing routines to internalize any new knowledge received is that these existing routines may be inappropriate to use in the given context of any new knowledge received (Tsai, 2001). For example, using routines developed to sell products in a domestic market may not be necessarily the best to use in a foreign market. While the process of selling may be relatively similar, there could be institutional differences between countries that could hinder the use of the same routines in all settings. This may be particularly apt in the case of Indian firms, who are starting to increase their exposure to global markets.

Hypothesis 8, which built on the arguments in Hypothesis 7, suggested that given the relatively limited way relevant new knowledge is leveraged by low absorptive capacity firms, the consequent impact on firm performance would be relatively different than that of their higher absorptive capacity counterparts. The positioning of this hypothesis as a contrast was based on the premise that even if low absorptive capacity firms cannot appropriately leverage the value of new knowledge, their performance can still be improved by the use of the focal new knowledge. However, this may not reach the optimal level that a high absorptive capacity firm is more likely to achieve even if the latter used existing routines.

The first part of testing this hypothesis involved examining the structural model of the low absorptive capacity firms in terms of the performance data. The same control variables used in the high absorptive capacity case (organizational slack, age of firm, size of firm, and industry munificence and dynamism) were used. Further the same performance measures were used – ROA, ROS and perceptual measures. The perceptual measure of firm performance was significantly ($p < 0.001$) and positively related to the use of existing routines to internalize new knowledge. However the use of objective measures of performance did not yield significant results.

These results have the same equivocal nature as seen in the situation where high absorptive capacity firms used new procedural knowledge to leverage performance. However, in the case of the use of existing procedural knowledge by high absorptive capacity firms, the objective measures had significance while the perceptual measure did not. Many scholars suggest that one must rely more heavily on objective measures of dependant variables when possible, and from that vantage point, my hypothesis finds

support. However others have suggested that common method bias may be more of an urban legend (Spector, 2006) and may not be as important a crisis, as some scholars have suggested. Given the unclear status of the methodological concerns here, I therefore use a conservative approach and suggest that this hypothesis is conditionally supported, when considering objective measures of performance.

The primary implication of this result is that low absorptive capacity firms are less able to use relevant new knowledge to improve their firms' financial performance, when compared to their higher absorptive capacity counterparts. This, as suggested earlier, is related to their lack of ability to meaningfully understand the relevance of the new knowledge they received. The result also suggests that low absorptive capacity firms are less likely to be able to optimally utilize the routines they do have to generate performance from the new knowledge that they receive.

The first part has already been discussed earlier, so I restrict my discussion to the second part regarding the differential ability of low absorptive capacity firms to use routines to leverage performance. It is well accepted that firms' capabilities differ in terms of utilizing the resources they do possess and this has been suggested as a reason why firms' financial performance differs – a central question in the area of strategic management. This dissertation provides additional support for that thesis, while suggesting that a lens to understand this differential performance may be the use of knowledge assets. If firms are seen to have lower levels of absorptive capacity, they have a more limited ability to even understand their own routines, as compared to firms with higher absorptive capacity. Thus it is not just in terms of degraded abilities of perception

of external stimuli that firms with low absorptive capacity suffer, but also in terms of internal understanding of the firm itself (Tsai, 2001).

This less than perfect understanding of internal features of the firm may include resources in addition to the routines that utilize these resources to conduct the firm's business. These resources may include both operational resources such as infrastructure and capital as well as human capital resources. The lack of understanding of the use of technology can be driven by a lack of organizational capital, as well as the human capital to leverage the organizational capital. An important avenue of empirical research could be the link between intellectual capital (an umbrella term referring to a firm's human capital, organizational capital and social capital) and the absorptive capacity of the firm (Subramaniam & Youndt, 2005). It is conceivable that the relatively degraded performance of low absorptive capacity firms may be driven by both a lack of possessing and understanding of these facets of intellectual capital.

6.2 Conclusion

This dissertation attempted to extend our understanding of new knowledge internalization by firms. I examined this important but relatively understudied area of strategic management in the context of firms choosing one of two mechanisms to internalize new knowledge – by doing it internally, or choosing to use an external resource. The external resource that I suggested was the use of consulting service firms – more commonly known simply as consultants.

The results suggest that a key element of the knowledge processes in firms is the absorptive capacity that they already possess. The absorptive capacity of firms not only

defines how firms perceive any new knowledge in terms of the consistency of this focal new knowledge with existing routines, but also whether and how they leverage existing routines to internalize new knowledge. It also explains when firms seek consulting services and, if they do, the impact that has on performance. This study then has significant implications for practice and research. I discuss both aspects of this study and conclude by discussing the limitations of this study, as well as areas of future research.

6.2.1 Implications for practice

This dissertation has several key implications for managers. Knowledge management has become ubiquitous for managers of firms given the centrality of knowledge in the "new economy." Consequently, the focus of this study on the processes of internalization of new knowledge could be of particular interest. The first takeaway from a practice perspective is that investment in knowledge processes is important – and the building of knowledge management skills is important – not just to do better what you are already been doing, but also to recognize new knowledge that the firm could come across. Scholars in entrepreneurship have already stated that opportunity recognition is a key element of the "entrepreneurial firm;" however this dissertation suggests that there are several efficiency benefits as well from improved ability to recognize new knowledge.

This study also suggests that using consultants can be beneficial to firms; a key caveat however is that substantial investment needs to be made in the relationship with the consulting service firm. Another implication is that firms cannot simply seek turnkey projects and expect superlative results from consulting service firms. They must stay

engaged with the project to ensure that communication channels as well as the clarity of project management processes (such as clear areas of responsibility, deadlines, and persons in authority over the project teams).

6.2.2 Implications for research

The role of new knowledge internalization in firms has several implications for research in the area of strategic management. The extant literature on knowledge in the field of strategic management has suggested that knowledge is important for firms and that utilizing knowledge will bestow performance benefits to firms. This dissertation opens, albeit limitedly, the black box of knowledge internalization in firms and discusses some possible mechanisms for the same, and the consequent impact on firms' performance.

The study used the dichotomous classification of knowledge being procedural or declarative. The separation allowed for a distinction between the "how to" and the "what is" aspects of knowledge. In doing so, I extend the work of scholars in the knowledge area who have suggested that increased granularity is needed for improved understanding of the impact of knowledge in firms.

Secondly, the study used the context of consulting service firms – which is one of the mechanisms of internalizing knowledge, but one that is surprisingly limitedly studied, given the close to omnipresence of consultants in organizational life. While consultants have been extensively used by firms, there have been nagging doubts about their efficacy. This study provides empirical support to the notion that consultants can be beneficial to firms if the relationship is managed well, thus presenting a richer understanding of the

role of consulting service firms – and more generally professional service firms to organizations.

This dissertation has spotlighted the centrality of absorptive capacity to the knowledge management processes of firms. While considerable research has been done in the area of absorptive capacity, this study helps build on that vein of the literature that it needs to be better understood in the context of how it affects new knowledge. A lot of the scholarship has focused on the role of how firms' absorptive capacity can impact their learning by doing existing routines processes. This project then suggests that while that area of research is important, there should also be analysis of how *changes* in routines are impacted by, and in turn impact, the absorptive capacity of firms.

The study of organizational routines is increasingly central to the analysis of knowledge in strategic management. However, as many scholars have pointed out, there has been limited empirical work done in the study of routines. This project has peeled back the empirical layers by directly examining the organizational routines aspect of knowledge management and also its consequent impact on firm performance. As I have said earlier, the area of routines needs deeper analysis, both in terms of quantity of routines as well as how changes in routines affect organizations. This study hopefully helps catalyze further research into this important stream of research.

A final area of research that this study has impacted is the study of the drivers of competitive advantage in organizations. As scholars have suggested, the idea of "sustained competitive advantage" (Barney, 1991; D'Aveni, Dagnino & Smith, 2010) may not be viable and instead firms may need to continuously seek temporary periods of competitive advantage. New knowledge can help address two aspects of competitive

advantage – the tenor of advantage held and the reduction in the intervening period of reaching the next stage of competitive advantage. This can happen as the work in this project has suggested, in that new knowledge can impact both existing routines and also help generate new routines that help keep a firm stay competitive. Further, there may be an element of feedback from new knowledge internalization that helps firms seek more new knowledge, and thus continue to build resources and capabilities that generate competitive advantage.

6.3 Limitations and areas of future research

For this dissertation, I have attempted to be simultaneously comprehensive and focused in my approach. These competing goals can obviously lead to some mismatches and gaps in the analysis of the focal subject, that of new knowledge internalization. I address the limitations of the study, which are occasioned by these competing goals. I also address some areas of future research that have been inspired by the process of conducting the research entailed in this dissertation, at all stages, conceptual, methodological and analytical.

A key driver of this study has been the use of the construct of absorptive capacity as a lens to look at firms and their choices for new knowledge internalization. I have found that perceptual measures of absorptive capacity are limiting in many ways. While the measure that I have used is in many ways far superior to some of the measures used earlier (such as R&D intensity), as well as being in line with extant research, there is still a key concern of the lack of substantial variance in the measure. Expectedly, most managers seem to rate their firms' absorptive capacity relatively high. This lead to a

situation where the median split between high absorptive capacity and low absorptive capacity firms was at a relatively high level (5.33 on a scale of 7).

While empirically sound, it does allow for less nuanced understanding of firms with truly low absorptive capacity. Firms with very low absorptive capacity firms may simply be unaware of their limited knowledge assets. Only firms with almost negligible absorptive capacity will understand their firms' problems, since there is a strong likelihood that their firms will cease to continue operations in any meaningful way over an extended period of time. This was not a concern for the specific set of firms that I have examined in this study, since I was able to get over 5 years of archival financial data on them. An area of future research has to be the development of a more holistic measure for absorptive capacity. Any new measure needs to include both objective and perceptual measures so as to allow researchers to get a better and more holistic measure of the absorptive capacity of firms.

Another important limitation of this study has been the cross-sectional nature of the survey and the analysis. While the project has yielded important insights into new knowledge internalization processes, it is a snap shot and thus faces the concomitant problems. Future research should consider new knowledge internalization from a longitudinal perspective which could also take a processual approach, wherein an entirely new knowledge project is followed within a firm from conceptualization to post implementation completion and integration.

To better understand the dynamics suggested in this dissertation, it would be ideal to follow one project where a focal firm does the entire project using only internal resources and another where the focal firm uses a consulting service firm. This dedicated

focus on the project would allow for the perspective of consultants, whose voices are not included in relation to specific projects in this dissertation. It must be noted that I did speak to consultants in order to understand the context, but examined the new knowledge internalization from a client firm perspective only. However, a longitudinal study would allow for detailed diary data to be collected from the perspectives of the client firm and the consultant. This would allow for rich analysis in the form of actor-partner interactional models, also known as APIM models (Cook & Kenny, 2005).

A longitudinal study could also provide insights into the creation, change (both intentional and unintentional) and potential expiration of organizational routines. This could help scholars better understand the link between routines and absorptive capacity. As discussed in Chapter 2, scholars have suggested that absorptive capacity could be conceptualized as being a dynamic capability (Teece, Psiano and Shuen, 1997). However the key aspect of studying absorptive capacity as a dynamic capability would be to do so longitudinally, given the inherent temporal nature of dynamic capabilities.

The use of multiple industries which is also in line with extant literature may also pose some challenges while interpreting the analysis. While in most cases the control variables for industry were found to be non-significant and thus ameliorating any concerns on this count, this may be an empirical coincidence. The only way to see the challenges that a specific industry faces would be to limit the design in order to study the idiosyncrasies of that specific industry. However, given that my project did not aim to address the specific concerns of any one industry, this limitation was not of overwhelming concern. Further the use of a multiplicity of industries allowed for more generalization of the results than a single industry study. However in my opinion, similar

analyses within a single industry can help build on the empirical findings of this study. Future single industry research will also help build deeper conceptual insights into the processes of new knowledge internalization in firms.

I have focused on firms that have employee strength larger than 100. While this was useful in terms of the specifics of this study, since a key aspect of routines is the human element, there can be no inferences drawn about truly small firms. While I have made that distinction explicit in many places, it bears repetition here. The issue of size variation for firms with more than 100 employees is addressed by the fact that I have a control variable for that purpose.

An important future area of research that was not a focal area for this dissertation is the role of intellectual capital in organizations (Subramaniam & Youndt, 2005). Intellectual capital is suggested to consist of human capital (Becker, 1993), social capital (Coleman, 1988) and organizational capital (Gort, Grabowski & McGuckin, 1985). The interactions of these different kinds of capital and absorptive capacity, within the context of new knowledge internalization can lead to several rich veins of study for organizational scholars focusing on knowledge.

Finally, future research should examine the specific dynamics of new knowledge internalization in small firms. There are two reasons for this. Firstly, most businesses tend to be small businesses. In the US, small businesses represent 99.7% of all firms that have employees and they employ over half of the private sector employees (Kobe, 2007). Consequently, understanding the specifics of new knowledge internalization would be insightful from an academic perspective and immensely useful from a practice perspective. Second, in many cases small businesses are also start-ups and

entrepreneurial in nature. There would be substantial gains to be obtained by understanding how these firms build capabilities in continuing to learn how to internalize new knowledge.

In this dissertation, I have attempted to build on the work already done on knowledge management, by focusing on new knowledge internalization. The conceptual issues and the context, continue to need deeper understanding, given the ever increasing criticality of knowledge to firms. My hope is that this study has contributed and stimulates further research to that body of work.

APPENDIX A

KNOWLEDGE MANAGEMENT SURVEY

Department of Management
121 Presidents Drive
Amherst, MA 01003
U S A
Telephone: +1-413.545.5675
Fax: +1-413.545.3858
www.isenberg.umass.edu

Dear Respondent,

We are researchers at the Isenberg School of Management at the University of Massachusetts Amherst, USA. We invite you to participate in a research project to study the process of integrating information within organizations. Along with this letter is a short questionnaire that asks a variety of questions about your organization. We are asking you to look over the questionnaire and, if you choose to do so, complete it and give it back to us or our representative.

The results of this research project will help improve our understanding of how firms use information that they receive to improve their performance. We hope that the results of the survey will be useful for organizations as well as academics and we hope to share our results by publishing them in appropriate business journals.

We do not know of any risks to you if you decide to participate in this survey and we guarantee that your responses will not be identified with you personally. In addition, we promise not to share any information that identifies you or your company with anyone outside our research group, which consists of Sudhir Nair and Dr. Bruce Skaggs. We estimate that it will take you approximately 20 minutes to complete the survey. There are no right or wrong answers to the questions, so please answer them honestly. We hope you will take the time to complete this questionnaire and return it. Your participation is completely voluntary and there is no penalty if you do not participate. Regardless of whether you choose to participate, we are happy to share the results of our survey, if you would like the same. To receive a summary, please email us at snair@som.umass.edu.

If you have any questions or concerns about completing the questionnaire, please feel free to contact the researchers – Sudhir Nair (snair@som.umass.edu or telephone number +1-413-230-7866) or Dr. Bruce C. Skaggs (bskaggs@som.umass.edu). The Chair of the Institutional Review Board (IRB) at the Isenberg School of Management at the University of Massachusetts Amherst has approved this study. If you have any concerns about your rights as a participant in this study you may contact the Human Research Protection Office via email (dabutter@mgmt.umass.edu) or by telephone (+1-413-545-5678). **Thank you** in advance for your help! Your participation is critical to the completion of our study and provides support to the research mission of the University of Massachusetts Amherst.

Sincerely,

Sudhir Nair
(Principal Co-Investigator)

Bruce C. Skaggs, PhD
(Principal Co-Investigator)

KNOWLEDGE MANAGEMENT SURVEY

Principal Investigators:

Sudhir Nair
Department of Management
Isenberg School of Management
University of Massachusetts Amherst
Amherst MA 01002
USA
+1 413 230 7866

Bruce C. Skaggs
Department of Management
Isenberg School of Management
University of Massachusetts Amherst
Amherst MA 01002
USA
+1 413 545 5684

Section 1 - Respondent Information

Please tell us your name: _____

Please tell us your designation: _____

How long have you been working in this organization (in years)? _____

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Section 2 - Ability to Seek and Use Knowledge

This set of questions inquires about the ways in which your firm searches for and uses new information about its products / services, business, industry etc. Please respond to these questions from the perspective of what your firm currently does.

- Our company actively seeks firm-relevant information from external sources
- Our company motivates employees to use external information sources
- Our company ensures that there is quick information flow across business units
- Our company holds regular cross-departmental meetings to exchange information
- Our employees are able to link existing information with any new information received
- Our company regularly works on the development of new business practices for products and services we offer

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Section 3 - Current Business Processes

This set of questions relates to your existing business activities and processes. Please respond to them from the perspective of how your firm currently operates.

- Our company regularly generates alternative uses for our current technology
- Our company regularly reconfigures existing processes
- Our company regularly updates our manuals
- Our company regularly ensures that all updated information regarding operating procedures is made available to employees
- Our company regularly trains our employees to ensure that they understand all available technologies that are relevant to their job
- Our company regularly trains our employees to ensure that they understand all company processes

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Section 4 - Ability to Document and Share Information

In this set of questions, please answer in the context of how your organization records and internally shares its operating procedures and business processes.

- Our organization uses patents and licenses as a way to store knowledge
- Much of our organization's knowledge is contained in manuals, databases, etc.
- Our organization has substantial documented proprietary information for use by our employees
- Our employees perform their jobs predominantly using their own individualized knowledge
- Our organization's clients seek out our firm's research
- Our organization works at keeping research and relevant information up-to-date
- Our organization's work processes and procedures are clearly documented
- Our organization's 'ways of working' are well known and familiar to our employees
- Our employees are given the latitude to perform their jobs in ways as they see fit
- Our employees regularly consult training manuals
- Our organization places a strong emphasis on "best practices"
- Our employees are strongly encouraged to use standard practices with customers

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Section 5 - Employee Skills and Abilities

This set of questions is designed to measure the level of skills and abilities of your employees.

- Our employees are highly skilled
- Our employees are widely considered the best in our industry
- Our employees are creative and bright
- Our employees are experts in their particular jobs and functions
- Our employees develop new ideas and knowledge

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Section 6 - Employees Interactions

For this set of questions, please answer in the context of how the employees in your organization interact with each other.

- Our employees are skilled at collaborating with each other to diagnose and solve problems
- Our employees share information and learn from one another
- Our employees interact and exchange ideas with people from different areas of the company
- Our employees partner with customers, suppliers, alliance partners, to develop solutions
- Our employees focus on knowledge within their own domain area only

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Section 7 - Strategic Project

For this set of questions, please recall a specific project of strategic importance that happened in your company within the last three years. By strategic, we mean any project that required large resource commitments in terms of time, effort, money, etc. that involved most of the
organization. Examples of this can include entry into a new market, the launch of a new product or service, or a large scale change in production technology. Please focus on a strategic project that has been completed and is no longer in "project mode".

Please describe this specific strategic project to us in a few words:

_____
_____
_____
_____
_____
_____
_____
_____

When a firm undertakes a new strategic project, many times it gains information about things that it did not have before. For example, the project may cause the firm to acquire information about new and/or changing customer preferences, the existence and use of new technologies, or about how different industries compete that are outside the firm's present industry. When answering the next set of questions, please focus on the new information your company gained from the strategic project you identified above.

- Our company had existing standard operating procedures to use the new information received
- Our company had to create completely new processes that were applicable to the new information received
- Our company had existing work manuals that described precisely what people working with the new information would need
- Our company already had the necessary technology to apply to the new information received
- Our company found that the new information received fit into our existing business processes

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Section 8 - Interaction with Consulting Firm

PLEASE ANSWER THIS SET OF QUESTIONS ONLY IF YOU USED A CONSULTING FIRM TO IMPLEMENT THE STRATEGIC PROJECT YOU IDENTIFIED EARLIER. IF YOU DID NOT INVOLVE A CONSULTING FIRM, PLEASE SKIP TO SECTION 9.

This set of questions relates to the way in which your organization interacted with the consulting firm to implement the project you identified above.

- In association with the consulting firm, our company jointly decided on the time lines for the project
- In association with the consulting firm, our company jointly decided on the resources needed for the project
- In association with the consulting firm, our company jointly decided on the specific actions to be taken by each of us during the project
- Our company decided on the specific success criteria for the project independent of the consulting firm
- The consulting firm we engaged clearly explained the links between the actions to be taken and the expected outcomes
- The consulting firm we engaged provided limited training to enable us to make effective contributions to the project
- Our firm and the consulting firm we engaged ensured that effective communication channels were open during the project

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Section 9 - New Knowledge Gained from Strategic Project

For this set of questions, please think of any new knowledge that was gained from the strategic project you identified above.

- Our company stored the new knowledge we received in our databases
- Our company stored the new knowledge we received in policy statements, sales reports or memos
- Our company stored the new knowledge we received in process flow charts
- Our company understood what resources were needed to utilize the new knowledge we received
- Our company was unable to understand how to use the new knowledge we received
- Our company understood potential outcomes of using the new knowledge we received

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Section 10 - Outcomes of Strategic Project

To what extent do you agree that the new knowledge your firm gained from the strategic project you identified earlier led to the following outcomes:

- Increased productivity / efficiency
- Firm growth
- Better focus on core competencies
- Improved organizational flexibility
- Improved service quality
- Better access to new markets
- Breakthrough process improvement(s)
- Major product innovation(s)
- Increase in firm's overall competitiveness

Thank you for taking the time to complete the survey.
Your responses are very valuable to the success of the project.

APPENDIX B

RELIABILITY ANALYSIS

Absorptive Capacity

Reliability Statistics

Cronbach's Alpha	N of Items
.864	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
AC1	25.53	31.786	.624	.848
AC2	25.61	32.391	.621	.848
AC3	25.15	32.076	.727	.829
AC4	25.29	32.270	.589	.854
AC5	25.45	32.169	.738	.828
AC6	25.09	32.500	.672	.839

Existing Procedural Knowledge

Reliability Statistics

Cronbach's Alpha	N of Items
.897	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EPK1	25.69	35.250	.615	.897
EPK2	25.60	36.350	.672	.886
EPK3	25.61	34.145	.773	.871
EPK4	25.30	34.544	.731	.878
EPK5	25.30	33.173	.814	.864
EPK6	25.38	34.561	.740	.876

Routine Consistent Knowledge

Reliability Statistics

Cronbach's Alpha	N of Items
.706	5

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
RCK1	19.05	14.534	.632	.582
RCK2	19.00	22.757	-.093	.865
RCK3	19.16	14.344	.679	.563
RCK4	18.97	13.793	.716	.542
RCK5	18.48	16.164	.579	.616

Knowledge Co-production

Reliability Statistics

Cronbach's Alpha	N of Items
.835	7

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
KCP1	32.07	19.903	.779	.781
KCP2	32.05	21.631	.633	.806
KCP3	31.97	22.116	.626	.808
KCP4	33.02	22.108	.369	.856
KCP5	32.32	20.004	.689	.795
KCP6	32.43	22.014	.506	.825
KCP7	31.90	22.840	.602	.813

New Procedural Knowledge

Reliability Statistics

Cronbach's Alpha	N of Items
.690	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
NPK1	24.00	18.417	.635	.578
NPK2	24.16	18.803	.603	.590
NPK3	24.17	17.711	.627	.574
NPK4	23.95	19.744	.614	.597
NPK5	26.25	26.353	-.128	.867
NPK6	23.73	20.468	.624	.604

Performance (Perceptual measure)

Reliability Statistics

Cronbach's Alpha	N of Items
.911	9

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
P1	44.43	57.210	.630	.906
P2	44.13	54.500	.761	.897
P3	44.22	56.042	.731	.899
P4	44.37	54.915	.725	.899
P5	44.33	53.859	.751	.897
P6	44.16	56.062	.611	.907
P7	44.48	53.598	.697	.902
P8	44.58	54.172	.610	.909
P9	44.03	55.506	.787	.896

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