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FROM COMMON TO UNCOMMON KNOWLEDGE: AN INVESTIGATION INTO THE SOCIO-COGNITIVE FOUNDATIONS OF INTER-FIRM HETEROGENEITY IN THE USE OF KNOWLEDGE AS A RESOURCE

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From Common to Uncommon Knowledge: An Investigation into the Socio-Cognitive Foundations of Inter-firm Heterogeneity in the use of Knowledge as a Resource

Abstract

A series of recent academic as well as practitioner oriented ideas and movements such as the "Resource Based View", "Absorptive Capacity", "Organizational Learning", "Knowledge Management", etc., have sought to view knowledge as the key strategic resource that leads to sustained competitive advantage. All these movements, however, implicitly assume that firms differ in the ways they understand, create, access, and use knowledge as a resource. Little has been done to explore the fundamental origins of these differences. In this dissertation, I explore the roots of these elemental differences in the socio-cognitive schemas, "executive knowledge schemes", of top managers of firms competing in a largely similar objective environment, that is, a single mature industry- the U.S. Metalcasting Industry.

The essential thesis on which I base this dissertation is that the primary drivers of interfirm heterogeneity are differences between top managers of competing firms in their fundamental beliefs about knowledge and knowledge related processes in their respective organizations. To further develop and test this thesis, I adopt a two-stage (divided into four distinct phases) study, with the first stage involving an interpretive study aimed at exploring the cogent dimensions and relationships through which executive knowledge schemes function, and the second involving a large sample investigation of the emergent relationships.

I find that senior executives of incumbent firms, operating within the same industry, show remarkable variation in their interpretations and evaluations of knowledge, especially in its strategic context. The structure of the executive knowledge schemes that emerged from the study

comprises three primary dimensions – the Competitive Dimension, the Personal Dimension, and the Control Dimension. These three dimensions have five elements or sub-dimensions that together form the pertinent areas of managerial beliefs about knowledge.

First, I find that executive knowledge schemes significantly influence the amount and nature of scanning behaviors that a focal executive engages in. I develop a new approach to conceptualize executive scanning by developing a grounded concept called "Scanning Proactiveness", which entails the specific behaviors that characterize a form of aggressive search for information in a given domain.

I also find that executive knowledge schemes and executive scanning behaviors influence the ways in which a firm adapts and enhances knowledge in its situated practices while facing a problematic situation. These behavioral tendencies, that I term "Knowledgeable Practice" provide a novel approach to conceptualize and empirically measure the specific practices by which knowledge is transformed to create competitive advantage. I find that the nature of knowledgeable practice mediates the relationship between a firm's human, social, and technological capital (i.e. its tangible knowledge assets) and its innovation capacity.

This dissertation serves to expand the current theoretical frameworks of the resource based and knowledge based views of competitive advantage by clarifying the role of executive leadership in the definition, interpretation, and firm level application of knowledge as a strategic resource.

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Dedication

To My Family

Chapter 1
INTRODUCTION

People and their collective expressions (such as, organizations) have often found competition to be a preeminent dynamic that provides meaning and justification to their activities. Given the fundamental importance of competition to organizations, understanding the origins of competitive advantage is perhaps the most important research enterprise of the strategic management field.

In recent years, the resource based view of competitive advantage (Barney, 1986, , 1991; Wernerfelt, 1984) has generated insightful debates and informed research aimed at obtaining a better understanding of why some firms outperform others. This view of strategy (hereafter RBV) emerged in the early 80s as a response to the environmental determinism of the industrial organization-based perspective on business policy and strategic management as developed by Porter (1980). The industrial organization perspective essentially reduced the managerial imperatives to the analysis of a given industry's structure and the selection of a predetermined set of strategic postures (Bain, 1968; Mason, 1957). In response, the RBV emerged in consonance with the development of the strategic choice perspective (Child, 1972) that rejected the constricted views of industrial organization economics and sought to ascribe greater importance to the roles of managerial judgment and organizational idiosyncrasies in influencing firm behavior and outcomes.

The RBV's core thesis is that firms which possess valuable, rare, imperfectly imitable, and non-substitutable resources enjoy sustained competitive advantage over their rivals (Barney, 1986, , 1991). In its initial conceptions, the term *resources* was used to cast a wide net over

several elements ranging from managers and employees, patents, brands, information, financial capital etc. In further theoretical developments, the RBV has been expanded by viewing managers as boundedly rational, who must make resource choices with imperfect information (Amit & Schoemaker, 1993). The introduction of bounded rationality links the RBV with the evolutionary theories of the firm that view the development of resources as intrinsically embedded in a firm's history and culture.

These views shift the focus of the RBV from resources, per se, to the notion of organizational capabilities and routines (in simple terms, a move from *what firms possess* to *what firms do)*, which are inherently grounded in organizational knowledge (Nelson & Winter, 1982). These insights taken together have resulted in the development of theoretical streams, such as the dynamic capabilities perspective and the knowledge based view of strategy (KBV). These perspectives focus specifically on organizational competencies, capabilities, and knowledge that are essentially intangible and inhere in the activities and processes carried out inside firms and which emerge as a result of learning over extended periods (Grant, 1996; Prahalad & Hamel, 1990; Teece, Pisano, & Shuen, 1997).

However, research and subsequent theorizing in the RBV and its related streams has taken a path that might lead to a type of "organizational determinism" that emanates from an excessively "objective" ontological treatment of a firm's strategic resources, including knowledge and capabilities. By including managers along with other firm resources, the RBV has run into the risk of harboring a seemingly innocuous but theoretically barren conclusion that "resources use resources". Such a prediction obfuscates the agency of managerial skills in shaping common resources into unique sources of competitive advantage.

Although Barney (1986) in his postulation of strategic factor markets identified informational asymmetries between executives as a key antecedent to resource heterogeneity and imperfect interfirm mobility, subsequent theoretical and empirical development of the RBV has not focused enough on a fundamental premise that resources do not exist objectively and independently of a firm's dominant coalition but are noticed, evaluated, and defined by it. Although some initial descriptive and normative work has been done in understanding what strengths and weaknesses firms' top executives consider as important (for example, Stevenson, 1976; Aaker, 1989), there has been limited empirical work that develops on the premises of RBV and studies the differential noticing and perceptions of top executives as potential sources of resource heterogeneity.

This oversight is crucial when one considers the arguments forwarded by Penrose (1959) on which much of the modern day RBV rests. Penrose offered the earliest insights about the role of a firm's internal resources and the ways in which its management renders productive services from those resources. Penrose argued,

> "Not only are the significance of resources to a firm and the productive services they can yield functions of knowledge, but-and this is the crucial fact-*entrepreneurs are fully aware of this.* (emphasis in original) (1959, p: 77).

Taking cue from Penrose, the essential argument on which I base this thesis is that *a firm's top executives' cognitive knowledge structures and shared meanings determine what they identify as a firm's strategic resources and their subsequent rationales about the sources of competitive advantage.*

I draw on insights from managerial and organizational cognition, and the upper echelons perspective (Hambrick and Mason, 1984) to refocus the underpinnings of the RBV from objective resource endowments to a socio-cognitive understanding of how a firm's top executives identify and characterize its resources.

From Generic Resources to Knowledge as a Strategic Resource

Although the knowledge based view (KBV), which holds knowledge as the primary competitive resource for firms has extended our understanding of the origins of competitive advantage (c.f. Grant, 1996; Kogut & Zander, 1992, , 1996), the objective treatment of knowledge in these approaches has unwittingly downplayed the fundamental role played by organizational leaders and members in knowledge creation and usage. This view has yet to focus on the intricacies of how organizational knowledge is created and shared within a firm to take the shape of a key resource that can confer competitive advantage. Research on the role of knowledge is waiting for a new direction that focuses more on the interpretive processes and patterns that lead to differences amongst firms in how they perceive, source, create, and share knowledge within and outside their boundaries.

In this dissertation, I develop the position that the sources of interfirm heterogeneity in resources and their imperfect immobility are to be found in the underlying differences in top executives' cognitions about knowledge as a resource. Thus, firms might be conceptualized as differing in resources not because of their objective existence, but rather because of differences in the ways top executives identify and evaluate them. By including managers along with other firm resources, the RBV has run into the risk of harboring seemingly innocuous but theoretically barren conclusion that "resources use resources". Such a prediction obfuscates the agency of

managerial skills in shaping common resources into unique sources of competitive advantage. I search for the fundamental origins of differences amongst firms by investigating the ways in which firm leaders conceive and interpret knowledge and knowledge related processes, and how these differences in turn can lead to interfirm heterogeneity in learning behaviors and consequent firm performance. These insights taken together become more cogent when one looks at the strategic analysis of knowledge as a meta-resource. Knowledge, because of its inherent intangibility, is likely to be highly susceptible to the differential influence of shared managerial schemas or collective interpretive schemes (Gioia, 1986) in its acquisition, evaluation and usage as a firm resource. Top management teams of two firms might differ in their comprehension of the nature of industry level knowledge, so as to put varying emphases on the salience, value, and utility of industry best practices. Alternatively, they might differ in their perceptions about the most useful sources of knowledge. These differences can be critical in explaining why firms, irrespective of having access to the same knowledge, choose to act divergently on that knowledge (Hambrick, 1982).

Taking the view that firms are essentially interpretation systems (Daft, 1985) one begins to see that the decisions surrounding knowledge as a resource and consequent knowledge-related behaviors are much more prone to the beliefs, ideologies, and decision-making frames of a firm's top managers than has been suggested in the existing theoretical frameworks of the RBV and KBV. I argue that to develop a more comprehensive understanding of the role of knowledge as a primary source of competitive advantage, there is a need to view knowledge whose role as an organizational resource is subject to managerial choice and biases. In this view, knowledge as a resource exists "in the eye of the beholder," as its search, creation, and use depend on the distinctive beliefs held by the strategic and technological leaders of a firm.

I explore these arguments to develop a more complete understanding of the fundamental drivers of competitive advantage with the specific focus on the use of knowledge as a strategic resource. My research is guided by the following broad research questions:-

a) *What is the nature and content of managerial beliefs about knowledge as a strategic resource?*

b) *Do executives of firms operating in similar environments differ in their beliefs about knowledge as a strategic resource? If so, then how, and what are some factors that influence these differences?*

c) *How do these beliefs about knowledge influence the ways in which knowledge is obtained and their strategic implications?*

Chapter-2

THEORETICAL MOTIVATIONS

2.1 Bringing Managers Back Into the RBV Framework

The resource based view (RBV) of strategy has received considerable research attention as a perspective that attributes the origins of competitive advantage to unique and inimitable assets possessed and deployed by firms. In this view, a firm's strategy revolves around the creation and/or acquisition of superior resources by which the focal firm can develop competitive products and services. Nevertheless, the RBV sheds little light on how and under what conditions firms operating in the same environment come to choose and develop different resources. The RBV implicitly views the resource choice process as rational and attributes the origins of inter-firm resource differentials to informational asymmetries amongst managers and sometimes to circumstances or luck (Barney, 1986; Makadok & Barney, 2001).

Recent empirical work on RBV has focused on the influence of top managers on firm performance (e.g. Castanias & Helfat, 2001; Daily, Certo, & Dalton, 2000; Harris & Helfat, 1998). This work takes the assumption of "top managers as firm resources" and has thereby tried to study how much variance managers explain in performance differentials in firms. For example, Castanias and Helfat (2001) argued that top managers have either superior or inferior management skills, but they induced this conclusion by looking at firm performance rather than focusing on how managers differ amongst themselves and how those differences in turn affect firm performance. Adner and Helfat (2003), using a variance decomposition method in explaining heterogeneity in firm performance spanning over a period of two decades in the US petroleum industry, found that

differences in managerial decision-making (downsizing decisions in the specific instance) explained a statistically significant portion of variance in firm performance. These authors attributed these differences in managerial decision-making across firms to "dynamic managerial capabilities" that they defined as capabilities that enable managers to build, create, and integrate organizational resources and competences. These capabilities inhere in managerial human capital, social capital, and managerial cognition (Adner & Helfat, 2003). Together, these works have tried to expand the research agenda of RBV by accounting for managerial characteristics and behaviors. More importantly, they point towards the need to explore the underlying substantive differences between managers of competing firms that explain interfirm competitive heterogeneity.

Traditionally, proponents of the RBV, even while recognizing informational asymmetries and cognitive limitations of top executives as important influencers of interfirm resource heterogeneity, have focused limited energies on unpacking the underlying cognitive mechanisms and perceptual differences amongst top executives of competing firms (Ginsberg, 1990, , 1994). These differences have the potential for offering a viable answer to the question posed above, if we recognize the possibility that what RBV theorists treat as strategic resources are actually subjective outcomes of top executives' socio-cognitive processes bearing on organizational knowledge as a key resource.

In the ensuing sections, I take the three dominant literatures focusing the study of organizational knowledge, namely the KBV, organizational learning, and absorptive capacity and analyze their theoretical structures and empirical research to show how each of them have under-recognized the role of managerial judgment and strategic choice as key influencers of organizational knowledge and knowledge related processes in firms.

2.1.1 Managerial Choice and the Knowledge Based View- Some Gaps

The knowledge based view (hereafter KBV) of strategy, which is widely considered as an offshoot of the resource based view (RBV), supposes that the ability to create and integrate knowledge can be an important source of competitive advantage. The fundamental premise of the KBV is that knowledge is the principle productive resource of the firm (Grant, 1996; Kogut & Zander, 1992). Grant observes the need to understand the processes by which firms access and utilize knowledge possessed by their members (1996). Kogut and Zander (1992) argued that organizations not only serve as mechanisms by which individual and social knowledge is transferred, but also as generators of new knowledge. These authors considered organizational knowledge as an ownership of a portfolio of options for future use. They proposed the concept of combinative capabilities that allow an organization to use its current knowledge to explore new economic opportunities.

Research in this area, however, has implicitly assumed an objective view of knowledge as an economic asset, whose value and characteristics are equally applicable and visible to the actors being studied. KBV research has focused largely on the ontological characteristics of knowledge such as “tacitness”, “complexity”, “causal ambiguity” etc. and studied their implications for the ability or inability of firms to generate superior rents from organizational knowledge. The consensual distillation of the KBV revolves around the assertion that knowledge, especially the type that is tacitly held in organizations and grounded in micro-level social processes, can be a source of sustained competitive advantage, as it is difficult for competitors to imitate and acquire freely in factor markets (Kogut & Zander, 1992, , 1996).

Nonetheless, research on the KBV, although explicitly acknowledging the socially and cognitively embedded nature of knowledge, has yet to adequately locate and explicate the

specific socio-cognitive foundations that ake knowledge a source of competitive advantage for firms (Eisenhardt & Santos, 2001; Foss, 2003; Weiss & Miller, 1987). Although the theoretical arguments offered by proponents of the KBV assume the pre-eminent importance of cognitive and social processes that provide firms with distinctive knowledge-based advantages, empirical literature in the KBV tradition as paid scant attention to these assumptions.

There is therefore a need to embellish the KBV with other perspectives on knowledge that provide the possibilities to achieve the following two goals, a) Provide a way to conceptualize and empirically observe the micro-social processes through which knowledge is created, used, and applied in firms, and b) Enable the exploration of the key factors that influence the choice and trajectories of knowledge growth in firms

2.1.2 Managerial Choice and Organizational Learning-Some Gaps

The rich and varied literature on organizational learning, which enjoys a much longer history and greater centrality in organization studies, has offered several insights about how organizations create and use knowledge. Although this work primarily has sought to understand how organizations learn and unlearn (Argyris & Schon, 1978; Hedberg, 1981), most of the empirical work on organizational learning has studied the concept by looking at outcomes. That is, learning has been presumed to occur when firms have changed their structures, capabilities, strategies, etc. in the face of environmental contingencies. Although this focus on studying "change" as evidence of learning has aided our understanding immensely, relatively little light has been cast on the *actual* processes by which learning occurs and how these differ across organizations.

Barley's (1986) work has provided some good insight on this issue, convincingly demonstrating that the introduction of the same technology induced markedly divergent learning responses from two hospitals -- differences he found to emanate from the peculiar social structure and processes of each hospital. Some scholars have explored the possible influence of different organizational learning styles (DiBella, Nevis, & Gould, 1996; Miller, 1996; Shrivastava, 1983). These scholars have offered rich insights into the different modes or tendencies by which organizations learn. For instance, Shrivastava (1983) offered a typology of organizational learning systems, that is, different ways in which organizations learn. Based on a review of extant literature on learning in organizations and empirical research on learning processes in 32 organizations, Shrivastava (1983) developed six types of organizational learning systems that varied along two dimensions – Individual/Organizational Dimension and Evolutionary/Design Dimension. The former pertained to whether learning in an organization depended on a few individuals or whether the organization uses learning methods that are independent of individuals. The latter dimension relates to whether learning is more emergent in the social interactions of organizational members or is carried out through the use of deliberate procedures and systems.

Miller (1996) suggested six different organizational learning modes (Analytic, Synthetic, Experimental, Interactive, Structural, and Institutional) and hypothesized about contextual features that would influence their relative potentials for occurrence, along with their organizational level outcomes. Building on prior research on organizational decision-making by Thompson and Tuden (1959) and Grandori (1984), Miller argued that means uncertainty (the degree to which there are known, reliable ways of achieving goals) and goal conflict (the degree to which managers agree about goals) would be the two contextual features most likely to

influence the type of learning mode that would occur in an organization. Based on high, modest, and low levels of these two contextual features, Miller offered a framework for predicting which learning mode would be the most prevalent in an organization.

The organizational learning typologies offer rich insights about the different forms or modes of learning, but they leave some fundamental questions unanswered such as, why do firms facing similar environmental exigencies learn differently? A corollary to this question is that if organizational learning is indeed a desirable activity and if all firms realize this truism then under what conditions and in what forms can learning provide the foundations for competitive advantage among close rivals? The answers are not achievable in a straightforward manner but do lead us to entertain the notion that for learning to be a source of competitive advantage, organizations (even those operating in ostensibly similar environments) would have to exhibit differential proclivities and patterns of learning. The empirical challenge then becomes one of discerning when and how incumbents learn differently and if they indeed do so, then what are the primary drivers of those differences.

Research in organizational learning so far has followed three somewhat distinct approaches. The first one emanates from a well-developed stream of research that assumes that learning originates in the minds of individuals and gets manifested at the organizational level as changes in performance levels of employees and organizations (Argote, 1999; Argyris & Schon, 1978; Crossan, Lane, & White, 1999; Levitt & March, 1988). Research in this stream typically focuses on the individual manager's and employees learning processes and their outcomes at individual, group, and organizational levels. According to this view, individual learning involves several iterations of action, error detection, and error correction before being encoded as

knowledge at the organizational level in the form of routines (March and Simon, 1958) or changes in an individual's cognitive theories of action (Argyris and Schon, 1978).

Crossan, Lane, and White's (1999) *4-I* model of organizational learning charts out the trajectory of an idea from an individual, through his immediate work group, on to the organizational level in the form of four contiguous sub-processes – Intuition (at the individual level), Interpretation (at the individual and group level), Integration (at the group level), and Institutionalization (at the organizational level). Again, the starting point of this model is the individual and the emphasis of the model is on explaining the formation of organizational knowledge. The essential observation from this approach is that learning involves a process of error detection and correction that results in routinization and changes in cognitive maps and actions of individuals.

A second approach towards learning is one that is based on the works of the Dewey (1922), which looks at human learning as a process involving designing, executing, reflecting upon, and modifying actions. Edmondson (1999) in her study of the effects of psychological safety on team learning uses Dewey's (1922) views on human learning to conceptualize learning as an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of errors. The important contribution of this approach for this dissertation is the premise that a learning process involves and ongoing interaction between reflection and action.

A third approach looks at organizational learning as a process involving activities by which organizations acquire, share, and combine knowledge (Glynn, 2000; Hedberg, 1981; Huber, 1991). This approach looks at the underlying activities as well as the outcomes of the learning process. It assumes that learning has occurred if there is a change in knowledge as a

result of the collective activities. However, missing from this approach is a clear delineation of whether the acquired knowledge is held in the individuals or the organization as a unified entity and the underlying micro-processes that result in the acquisition, sharing, and combination of knowledge in organizations.

A relative new approach to learning in organizations focuses on the collective social practices of organizational members as they make sense of their work lives and carry out their daily activities. Learning in this view is seen less as a process of intended change and more as a feature of the practices which members engage in while performing their work (Brown & Duguid, 1991; Cook & Seely Brown, 1999; Cook & Yanow, 1993). The social practices view of organizational learning draws attention to the social and cultural context in which organizational learning occurs. Whilst the previously discussed approaches to organizational learning are essentially based on a human information processing model with their focus on individual cognition and its anthropomorphism into the organizational level, the social practices perspective on organizational learning challenges that view and sees learning as a socio-cognitive phenomenon where individual members are seen as influencing each others thought processes and behaviors through interactions (Cook & Yanow, 1993; Weick & Roberts, 1993).

Although the brief summaries of various research themes in the area of learning clearly demonstrate its richness and value to the study of organizations, they, as of yet, offer limited insight on the broader questions posed at the beginning of this section. These themes do however suggest that in order to fully understand the role of learning in the creation of competitive advantage, there is a need to explore the factors and conditions that *guide* learning in firms. For example the practice view of organizational learning which draws attention to the social context in which learning occurs, indicates that a firm's senior managers who actively

create and shape its social context are likely to influence the nature of learning that occurs in the firm. Similarly, those perspectives on organizational learning that focus on the processes by which individual ideas get embedded in organizational activities and routines (Crossan et al., 1999; March, 1991), need to consider the role of senior managers in creating, or at the very least, influencing the criteria by which ideas of individual employees are selected for their translocation to the organizational level.

In short, although various streams of research in organizational learning have sought to explain the processes and outcomes of learning, relatively little emphasis has been given on the role of managerial agency in the choice of when, why, and how organizations learn. Thus, in conclusion the literature on organizational learning offers significant gaps for further exploration on the roles of senior executives in shaping and guiding the nature of learning in their respective firms.

2.1.3 Managerial Choice and Absorptive Capacity – Some Gaps

Cohen and Levinthal (1990) offered the notion of absorptive capacity (ACAP) as a way to differentiate between firms in terms of their abilities to appropriate external knowledge and use their current knowledge for productive purposes. They defined absorptive capacity as the ability of a firm to recognize new external knowledge, assimilate it, and apply it to commercial ends.

Zahra and George (2002) expanded the concept by breaking it down into four types, namely acquisition and assimilation that form the *potential* absorptive capacity and transformation and exploitation as processes undergirding *realized* absorptive capacity.

Although their development of the ACAP concept was indeed a watershed in its theoretical development, they left it for future research to explore the conditions and factors that influence firstly the nature and outcomes of absorptive capacity and secondly the *choice* of the processes that create absorptive capacity. Indeed, Cohen and Levinthal (1990) in their initial treatise urged future research to consider the fundamental mechanisms that make absorptive capacity an organizational property.

Subsequent research in ACAP has found clear evidence of the role played by this ability in fostering innovation and performance in firms (Tsai, 2001). Absorptive capacity was found to have a multiplier effect on a firm's centrality in a knowledge sharing network, thus indicating that the ability to assimilate and apply knowledge is as critical as access to it. Research on knowledge transfer within and across firm boundaries has clearly demonstrated the key role of ACAP in ensuring transfer success (Gupta & Govindarajan, 2000).

Although theoretical developments and empirical research on ACAP have significantly enhanced our understanding on how knowledge becomes a major source of competitive advantage, the ACAP concept as such has more often than not been treated passively in most studies. Intuitively, ACAP suggests a dynamic organizational property that would inhere in how a firm's management and employees frame, evaluate, and adapt knowledge to create new ideas. The common operationalizations of ACAP, however, in most studies have been based either on quantitative assessments of R&D investments or structural and human capital proxies such as mode of market entry and percentage of executives representing a particular expertise area.

Little effort has been spent on empirically discerning the basic building blocks, that is the social interaction patterns and practices that lead to greater ACAP in firms. Consequently, while we know a lot about the outcomes of ACAP, we know precious little about first, its

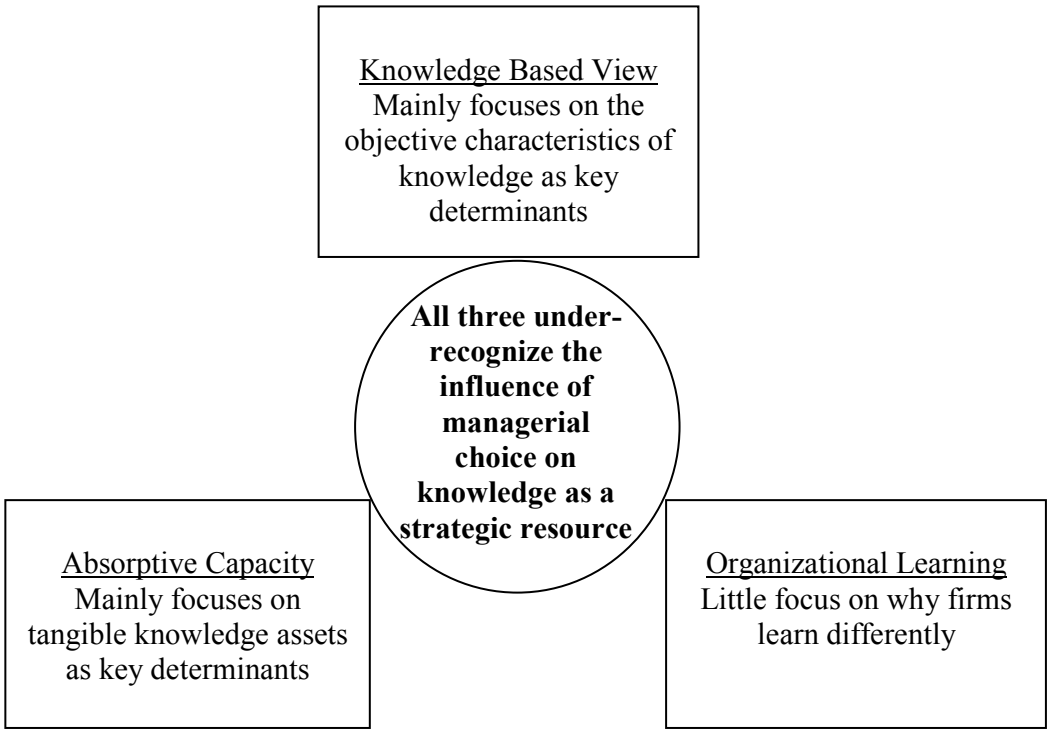
organizational and managerial antecedents, especially how a firm's top management influence the nature and scope of a firm's absorptive capacity, and second, the specific organizing processes that make a firm's absorptive capacity is *better* than that of its rivals. Knowledge of these factors is crucial to understand inter-firm heterogeneity in the ability to recognize and appropriate external knowledge.

Extant research shows that firms differ in absorptive capacity but it does not ask "why those differences occur in the first place". Furthermore, research on ACAP has only begun to focus on the micro-level social processes that undergird how knowledge is created, shared, and utilized in firms, and how these processes differ across industry incumbents. In essence the literature on absorptive capacity which is one of the primary theoretical vantage points to understand the role of knowledge in the creation of competitive advantage, too, pays scant attention to the potentially important role that manager's socio-cognitive frames and beliefs about knowledge and knowing processes might lead firms to place different emphases on external sourcing and internal knowledge usage activities. Research on organizational absorptive capacity, which was originally motivated by human information processing models (Cohen and Levinthal, 1990), has somewhat ironically, paid limited attention to the role played by firms' top managers in shaping the direction of knowledge creation, sourcing, and sharing activities that firms engage in, by focusing on a firm's current knowledge stock as the sole economic factor that determines a firm's absorptive capacity.

To summarize, although organizational knowledge is seen increasingly as the primary competitive asset in modern day firms (Argote & Ingram, 2000; Drucker, 1993; Nelson & Winter, 1982), we still know surprisingly little about the origins of interfirm differences in knowledge and related processes. As argued above the overtly objective treatment of

organizational knowledge and knowledge based assets in theoretical perspectives such as the KBV (Grant, 1996; Kogut & Zander, 1992), organizational learning, and absorptive capacity (Cohen & Levinthal, 1990) could benefit from an expansion that would accommodate managerial cognition, ideologies, and judgment as important antecedents to interfirm heterogeneity. Figure-1 depicts pictorially the opportunity for further theoretical and empirical exploration.

Figure 1- Theoretical Perspectives on Knowledge – Key Gaps



2.2 Insights from Managerial Bases of Strategic Actions

Early works by March and Simon (1958) and Cyert and March (1963) laid the bases for the assumptions that managerial decision-making, especially at the strategic level, usually occurs under conditions of high uncertainty, ambiguity, and incomplete information. Drawing on the core premises of behavioral decision theory, (March and Simon, 1958; Cyert and March, 1963), the authors posit that decision-making in organizations is influenced strongly by the cognitive abilities and biases of top executives. Amit and Schoemaker (1993) laid out a preliminary understanding of the possible linkages between the behavioral decision theory and the RBV. According to them, decisions regarding a firm's strategic resources are surrounded by 1) high uncertainty about a firm's economic, competitive, and regulatory environment, 2) high complexity concerning the interrelationships between the forces that shape the competitive environment, and 3) intraorganizational conflict amongst other decision makers. Under these conditions, decisions on strategic resources are likely to be suboptimal and the perceived relationships between resources and firm performance unclear. Furthermore, the authors argue that most given the above conditions, decisions regarding strategic resources are likely to be based on cognitive heuristics and a limited repertoire of responses.

2.2.1 Review of links between Managerial Cognition and Strategic Actions

A closely related and well developed body of research has sought to understand the fundamental influences of managerial ideologies, schemas, cognitive maps, and dominant logics on strategic decision-making in firms (Axelrod, 1976; Lyles & Schwenk, 1992; Prahalad & Bettis, 1986; Sproull, 1981; Weiss & Miller, 1987). Notwithstanding the multiplicity of terms and concepts to conceptualize managerial social cognition, this literature has provided strong

evidence that the socio-cognitive beliefs of a firm's top managers do have significant effects on firm behavior, characteristics, and outcomes (Porac & Thomas, 2002; Walsh, 1995). According to Ross (1975), all these terms essentially imply managerial "structures of expectations" which signify how one organizes knowledge about the world and utilizes this knowledge to predict interpretations and relationships regarding new information (and/or new knowledge), events, and experiences. Top managers' values, cognitive content, cognitive structure, and cognitive style significantly influence their attention span, perceptions, interpretations, subsequently, strategic actions (Hambrick & Mason, 1984; Thomas, Clark, & Gioia, 1993). Schemas or cognitive knowledge structures (used interchangeably hereafter) are defined as "cognitive frameworks of tacit knowledge, which allow us to impose structure upon and impart meaning to ambiguous situational information, in order to facilitate understanding (Gioia, 1986). According to Fiske and Taylor, a "Schema" is a cognitive structure that represents knowledge about a concept or type of stimulus, including its attributes and the relations among those attributes (p. 98). Schemas are top-down and conceptually driven (based on ones previously organized knowledge), versus being data driven. Schemas contain interpretations of individual experiences and expectations gained over time. Empirical research on the use of schemas in managerial decision-making has found that cognitive frameworks of top executives affect the strategic choices made for the organizations (Barr, Stimpert, & Huff, 1992; Thomas et al., 1993; Thomas, Shankster, & Mathieu, 1994; Tyler & Steensma, 1998).

Executive cognition is in turn affected by functional experience and social influence. The effects of functional experience however, are not persistent and stable. Dearborn and Simon (1958) found strong influences of functional experience on what managers perceive. Walsh (1988) and Chattopadhyay et al. (1999) found contradictory findings. Executive cognition can

be seen as an outcome of an executive's functional conditioning (experience, training, tenure), relational demographics (demographics of other TMT members, and the cognitive schemas of other TMT members. The causal effects however, are not merely direct. Interactions between the various antecedents providing better explanations. Experience in a given domain and learning poses an intriguing conundrum – on one hand executives grow less sensitive to stimuli as their familiarity with a domain increases, and at the same time they grow more sensitive to subtle changes in their domain. These two effects might be complementary. Increasing experience pushes some stimuli into the background and brings other to the foreground.

Empirical research on the use of schemas in decision-making has found that cognitive frameworks of top executives affect the strategic choices made for the organizations. For example, (Gioia & Chittipeddi, 1991) studied how the sensemaking and sensegiving (defining meanings for others) of a university president affected the change process in that university. Bartunek (1984) explored the use of collective "interpretive schemes" in understanding organizational change. Tripsas and Gavetti (2000) found that the shared cognitive beliefs of Polaroid's top managers played an important role in their inability to enter the digital imaging arena. Acha (2002) provided some exploratory evidence of socially shared interpretive "technology frames" of the top managers of oil industry firms that explained variance in their firms' technological output in the form of patents and publications. In a study of two railroad companies (Barr et al., 1992), the researchers traced the evolution of cognitive maps of the top managers of two Mid-western railroad companies, the C&NW and the Rock Island. Only one of the two companies – C&NW survived and the other went under. Although changes in the cognitive maps of top managers were evident in both the companies and were linked to changes

in the external environment, the authors attributed the success of C&NW to a process of continuous experimentation and learning in the cognitive maps of the top managers.

These empirical works are especially relevant as they have sought to tap into the notion of social cognition rather than individual cognition. At the strategic level, managerial influences need to account for the socio-cognitive and socio-political nature of decision-making due to presence of other top management team members (Finkelstein & Hambrick, 1996; Mintzberg, 1983; Pettigrew, 1973, , 1985). Thus, any analysis of managerial cognition and its linkages with firm behavior and outcomes needs to view managerial cognition as a social entity.

2.2.2 Review of the Upper Echelons Perspective

As a preeminent manifestation of strategic choice in the strategic management literature, the upper echelons perspective (Hambrick and Mason, 1984) builds around the central assumptions that managerial decisions are largely made in the face of high uncertainty, incomplete information, and ambiguity. Drawing on the core premises of behavioral decision theory, (Cyert & March, 1963; March & Simon, 1958), the authors posit that decision-making in organizations is limited by the cognitive abilities and biases of top executives. Given the high complexity, uncertainty, and ambiguity linked with strategic decision-making, a focal executive is likely to use her/his existing cognitive knowledge structures to comprehend the decision situation. The upper echelons perspective develops this view of strategic decision making by arguing that discernible managerial characteristics, such as an executive's demographic background, functional experiences, and nature of her/his relationships with other executives are likely to be highly influential on the strategic decisions that s/he is inclined to make.

Some of the earlier works on executive perceptions sought to understand the impact of specific functional experiences on what executives notice and perceive in a given situation (Anderson & Paine, 1975; Downey, Hellriegel, & Slocum, 1977). Dearborn and Simon (1958) offered one of the earliest demonstrations of possible linkages between functional experiences and perceptions. However, subsequent studies have found mixed influences of functional characteristics on managerial cognitive processes. Walsh (Walsh, 1988) did not find evidence that executives were constrained by their functional backgrounds in perceiving organizational issues. The studies by Dearborn and Simon (1958) and Walsh (1988) were carried out in controlled laboratory environments, which did not adequately replicate bounded rationality conditions.

Recent field studies have shed more light on the linkages between demographic characteristics and managerial perceptions. Hitt and Tyler (1991) found empirical support for their contention that executives' functional experiences influence their strategic decisions regarding potential acquisition targets. Tyler and Steensma (1996) found that executives from technological backgrounds viewed technological alliances as more favorable. Although it can be argued that an acquisition target or an alliance partner is an external entity, I contend that acquisitions and alliances can be seen as occasions wherein a firm is involved in sourcing critical resources from the environment. Waller, Huber, and Glick, (1995) found that functional backgrounds of top executives influenced managerial perceptions of internal organizational effectiveness more than their perceptions of environmental uncertainty. Theirs is one of the few studies that sought to empirically study the antecedents and consequences of managerial perceptions of internal organizational characteristics. These authors argued that the influences of

functional characteristics are likely to be greater on perceptions of internal organizational characteristics that are more proximate and relevant than distant environmental variables.

For instance, the RBV identifies path dependence as a vital factor for enhancing resource inimitability between firms. Dierickx and Cool (1989) and Barney (1991) argue that some resources, especially those that are knowledge-based, are developed in firms that are based on historical learning and protracted investments over a period of time. Furthermore, these knowledge-based resources share interlinkages with other organizational processes and resources that are built over an extended period of time. Michel and Hambrick (1992) found that less diversified firms had top management teams with longer tenures relative to diversified firms. The authors termed this finding as similar to the formation of a "clan" which emphasizes shared meanings and values more than diversity of inputs. Path dependent resources require the development strong intra-organizational linkages and understanding that cannot be reproduced easily by competitors.

The RBV and KBV do not explicitly recognize the motivations and biases that might induce top executives to ascribe varying importance to path dependency of firm resources, especially, knowledge. For example, some executives might perceive greater uncertainty in the return potential in some resources and hence hesitate to invest in them. Similarly, some other executives might see greater value in deriving short-term Schumpeterian rents (D'Aveni, 1994) and perhaps avoid leveraging resources that take a long time to develop. It is possible that CEOs who have spent longer tenures in their respective firms would give more importance to path dependent and socially complex resources.

Executive schemas are essentially composed of experiences gained in the past that are used to process new current information. Kiesler and Sproull (1982) proposed that executives

tend to operate more on mental representations of historical environments than current environments. Therefore, they are likely to ascribe greater importance and value to the firm's past successes than current performances. Executives with longer organizational tenures are likely to have to been exposed more to the past successes and failures of leveraging existing firm resources than new resources. Conversely, top executives with lower organizational tenures might be more prone to use the "availability" heuristic (Tversky & Kahneman, 1974). According to these authors, in uncertain situations, individuals are more likely to use information that is readily available to them for making decisions. Path dependent resources are accompanied by a high level of tacit knowledge that might not be freely available to new executives in a firm. Lack of relevant knowledge might dissuade newer executives from leveraging path dependent resources as it might reduce their sense of control over them.

These finding offers further support for the position that managerial characteristics might influence how managers' evaluation and utilization of knowledge as a strategic resource at the firm level. However, the relationship between functional characteristics and their perceptions about knowledge is not likely to be direct. As mentioned before, empirical support for the linkages between functional conditioning and functionally biased perceptions has not been unambiguous (Chattopadhyay, Glick, Miller, & Huber, 1999; Waller, Huber, & Glick, 1995; Walsh, 1988). Bunderson and Sutcliffe (1998)suggested that the relationship between functional experience and perceptions are likely to be influenced by greater perceived rewards and positive feedback in following functionally-oriented organizational goals. Furthermore, these authors argued that situational uncertainty would enhance the relationship between an executive's functional background and the use of functionally biased cognitive processing. An extrapolation from this line of research opens up the possibility that besides the influence of *amount* of

experience in a given functional area, the strategic choices around knowledge as a resource are likely to be affected by the *content* or nature of those experiences in the given area.

The observations above suggest that when it comes to knowledge as a resource, a firm's top executives are likely have their idiosyncratic conceptions that emanate, at least partially from their demographic backgrounds such as organizational and industry tenure. At the same time, the focal firm's experience and history and how managers relate those experiences are also likely to influence their beliefs about the nature knowledge and knowledge related processes in their firms. The Upper Echelons perspective provides the grounds for the consideration of managerial demographics as both antecedents to their cognitions about knowledge and as directly influencing knowledge related behaviors in firms.

2.2.3 Review of the literature on Epistemology of Knowledge

Deeper consideration of how top managers think about knowledge suggests that we needed to account for and explore the epistemology of organizational knowledge. At the individual level, epistemology concerns with the nature and justification of human knowledge. The study of individual or personal epistemology concerns with how an individual conceives knowledge, its properties, and the processes by which s/he comes to know (Hofer & Pintrich, 1997).

Although the study of epistemology traces its roots to the earliest classical works of Aristotle and Plato, more recently, the fields of psychology and education have sought to develop a better understanding of how individuals come to know what they know, the theories and beliefs they hold about gaining knowledge, and how these affect information processing,

comprehension, and performance. In the context of student learning and instructional psychology, research based on individual epistemology has sought to provide a useful intersection between the philosophy of knowledge, psychology, and education (cf. Piaget, 1950; Perry, 1970). This research has explored various aspects of how individuals conceive knowledge and knowing processes.

For instance, one stream of research in this broad domain has focused specifically on *epistemological beliefs,* which are conceived as individual beliefs or theories about the nature of knowledge along specific dimensions (Hofer and Pintrich, 1997). Schommer (1989; 1993), has proposed and empirically tested an instrument designed to assess epistemological belief systems. It is made up of five independent dimensions - structure of knowledge (belief in simple or complex knowledge), certainty of knowledge (belief in certain or tentative knowledge), source of knowledge (belief that knowledge is obtained externally rather than derived from reason), control of knowledge acquisition (belief that learning is innate rather than externally derived), and speed of acquisition (belief in slow, incremental learning rather than fast, single-shot learning).

Schommer (1990) found that epistemological beliefs influence the level and nature of comprehension and students. These beliefs in turn are influenced by the student's familial and educational backgrounds. An important finding in this work is that epistemological beliefs seem to affect the processing of information and ability to integrate knowledge. Some other empirical work in this area has found evidence that differences in epistemological beliefs influence the information seeking behavior of individuals (Whitmire, 2004). In a nutshell, this empirical stream has sought to capture individual beliefs, specifically aimed at knowledge and knowledge related processes.

2.2.4 From Individual Epistemology to Managerial Beliefs about Knowledge

Research in personal epistemology offers a potentially useful vantage point to study managerial beliefs about knowledge as a strategic resource. The notion of epistemological beliefs taps an individual's schemas about a specific domain, knowledge. In this sense epistemological beliefs are distinct from more generic concepts such as cognitive style, values, or other personality related constructs such as locus of control, self-esteem etc. (Hofer & Pintrich, 1997). Furthermore, this perspective enables us to look directly at the content of managerial beliefs about knowledge.

There is however, an obvious need to study epistemological beliefs not only within an organizational context but also as a part of the broader competitive and institutional context in which a firm is embedded. It is possible that unlike generic dimensions of beliefs about knowledge as seen in students, managerial beliefs might have completely different dimensions along with knowledge is conceived and evaluated. One way to accomplish this is to study the epistemological beliefs of all individual TMT members of a firm and then aggregate them to develop a dominant knowledge scheme, along and the lines of the notion of "dominant logic" (Prahalad and Bettis, 1986). This approach can also provide the possibility to study the level of sharedness or variation in a TMT knowledge scheme. The level of sharedness by itself can be studied as an intervening variable.

The second source of support for the espoused applicability of this literature is the past precedence in organizational studies wherein, individual level theories and constructs have been

transmuted to understand organizational level phenomena. Notable and highly relevant amongst these is the work of Cohen and Levinthal (1990) that employed theories on human information processing and cognitive structures to develop the notion of an organizational-level absorptive capacity.

To summarize, in this dissertation I draw on insights from managerial cognition (Gioia & Chittipeddi, 1991; Gioia & Thomas, 1996; Hambrick & Mason, 1984), and the epistemology of knowledge approach (Hofer & Pintrich, 1997; Perry, 1970; Piaget, 1971; Schommer, 1993), to refocus the underpinnings of the RBV from objective resource endowments towards the socio-cognitive frames or "knowledge schemes" that top managers use to evaluate knowledge and knowing processes in their firms.

Chapter 3

OVERALL RESEARCH PLAN

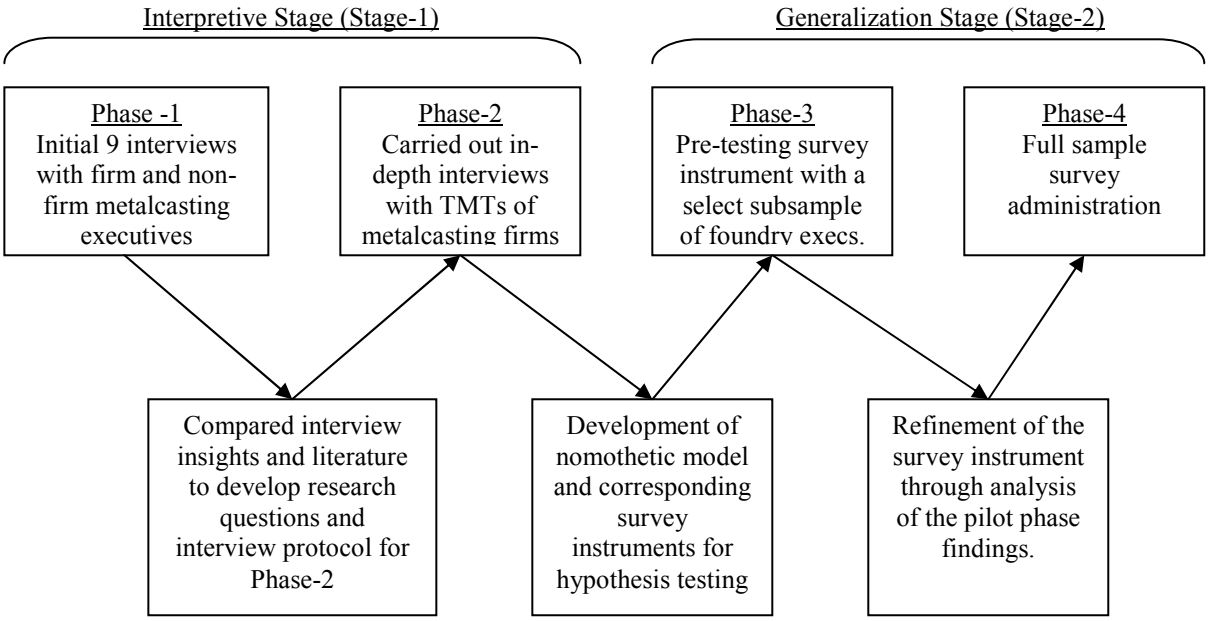
As little prior research has been done in explicating the socio-cognitive foundations of knowledge as a resource, I adopted a two-stage research design with the first stage involving an in-depth interpretive study that generated grounded propositions concerning managerial beliefs about knowledge and their influence of knowledge related processes, which in turn was further investigated in the second stage using a large scale nomothetic study meant for testing the propositions. A primary motivation for adopting a mixed-method approach in this study is the recent observation that research in strategic management in general and the resource based view in particular needs to utilize more in-depth investigations of the sources of competitive advantage rather than depending solely on secondary sources of data (Rouse & Daellenbach, 1999).

Although strategic management research has seen the utilization of qualitative research, the field is still overwhelmingly represented by quantitative analysis-based studies (Barr, 2005) . In recent years, the emergence of the resource-based view has seen the reinvigoration of "context rich" methodological approaches such as in-depth case studies (Rindova & Kotha, 2001), single industry studies (Miller, 1996; Priem, Lyon, & Dess, 1999), mixed methods study (Henderson & Cockburn, 1994) to name a few. These approaches have been necessitated due to the apparent limitations of using financial data based proxies of strategic resources and the empirically studying organizational capabilities that are inherently grounded in the social context of the firm. Research aimed at discerning how some firms manage to create and maintain superior resources even when operating in largely similar factor markets, needs to adopt a more intrusive and

involved approach that takes the researcher into the bowels of the focal organizations to generate in-depth knowledge and insights about value creating processes and tendencies (Rouse & Daellenbach, 1999). Therefore, the need to adopt a more intrusive research approach becomes high especially when exploring the foundations of the use of knowledge as a strategic resource.

Influenced by these suggestions, I selected one industry, the US metalcasting (metal foundries) industry for my study, wherein I engaged with a representative sample of incumbent firms through in-depth interviews with their top and middle-level managers. The interpretive stage was carried out in two phases, with the first phase involving a few interviews that would help me learn the cogent issues facing the industry incumbents and further sharpen my interview protocol for phase-2. In the next sections I briefly describe each of the four distinct phases of the study. Figure-2 shows the two stages (divided into four-distinct phases) of this study.

Figure-2 Research Plan



Phase -1 :Initial Interviews As discussed in the previous chapter, in the first phase of this dissertation, I carried out 9 initial interviews with a panel of senior executives of foundries and university-based metalcasting experts, to develop a fundamental understanding of the key strategic issues in the metalcasting industry and to generate insights about how top managers perceive the role of strategic resources, learning, and innovation in their industry. The first phase interviews were based on a fairly broad interview protocol (see Appendix A) where my efforts were focused more on generating insights that merited further theoretical and empirical investigation. Moving back and forth between these insights and relevant literature enabled me to develop the investigative framework for the second phase of the interpretive stage.

Phase-2:Interpretive Study This phase involved a series of interviews with top executives of metalcasting firms. The actual number of interviews was determined through a process of theoretical saturation, that is further interviewing was stopped when no new theoretical categories are emergent from the data (Glaser & Strauss, 1967). Following a strategy based on the notion of "key informants", I gained access to target top management teams by first interviewing the CEO and then asking them to recommend their key managers for further interviews (Kumar, Stern, & Anderson, 1993).

The interviews were carried out over a seven month period from November 2004 to May 2005. The interviews were conducted using both face-to-face and via telephone, depending on the preferences of the potential informants.

Phase – 3- Survey Pre-testing – Based on the findings and emergent propositions from Phases 1 and 2 of the interpretive stage I developed an emergent theoretical framework for testing its generalizability in stage 2. The first phase of this process involved the development of a preliminary instrument containing the scales for measuring the pertinent constructs. I pre-

tested the instrument with 13 senior and middle level foundry executives and also got the feedback of three senior management researchers and two metalcasting experts. I supplanted the pre-testing with foundry executives with two additional pre-testing cycles, one with eight doctoral students of management and another with 53 MBA students. The scales were modified after taking into consideration the findings from the pre-testing steps.

Phase-4- Large Sample Survey. I followed Dillman's (2000) total design method in designing and administering surveys to a sample of 583 firms in the US metalcasting industry across seven Northeastern and Midwestern states with the highest concentration of foundries. The choice of these states was also motivated by existing linkages with foundry associations of these states and the assumption that firms in these states would be more aware of my university's name and reputation than those in distant states. The sample of firms was drawn from the American Foundry Society's membership directory. The sampling strategy was based on eliciting responses from multiple top management team members from each firm.

To increase response rates, I obtained endorsements and expressions of support from four leading trade associations of the metalcasting industry. These associations allowed me to insert their respective logos on the survey cover letters. Each firm in the sample was mailed a packet containing three surveys along with pre-paid return envelopes. Two rounds of surveys were mailed to the sampled firms with the first round being followed by a reminder post card and the second round, which was sent to non-informants from the first round, being followed by telephone reminders. I also developed a web-version of the survey to provide the informants an online option for the survey.

Chapter 4

RESEARCH SETTING – THE METALCASTING INDUSTRY

4.1 Industry Overview

The metalcasting industry is one of the oldest industries, not only in the US but also in the world. The US metalcasting industry began in the early 1600s (Simpson, 1969). Currently there are some 2420 foundries operating in the US. The industry is composed primarily of small foundries (less than 100 employees) that melt metals such as iron, steel, aluminum, and other alloys, which they pour into moulds to create metal castings that form components that are used in areas ranging from the most basic door hinges to the most advanced aircraft components. . The metalcasting industry has also been facing regulatory pressures to "clean up their act" in terms of reducing energy consumption and improving environmental standards. These extraneous forces have led to a high level of mortality amongst foundry firms. Over the past one and a half decade, the industry has witnessed heightened attrition due to foundry closures, dropping from 3100 foundries in 1992 to 2420 foundries by 2005, a reduction of around 22%. Nonetheless, the steep drop in the number of independent foundries has also coincided with an overall increase in productivity due to increased automation and use of better technical methods (Spada, 2004).

The metalcasting industry represents an early stage of production across most non-food manufacturing industries, rather than a vertical integrated industry such as automotive. As such, most of the output is in the nature of parts or components, sometimes not even machined, which are in turn used in more complex components of final consumer or industrial goods. Thus, the

casting is invisible to the end user. If people outside the metalcasting industry are aware of it, its image is not the best. There is an image of the industry being old, low-tech, and polluting despite the fact a US congressional committee on energy and natural resources classified the metalcasting industry as a "high-tech" industry in 1990.

As an old industry, the metalcasting industry can be seen as having a large body of institutionalized common knowledge and best practices. The possibility of studying the effects of managerial cognition about knowledge and knowing processes on firm practices and outcomes is greater in an industry where all firms have largely equal access to knowledge (unlike a newer industry such as biotech or genetic engineering industry where knowledge is more proprietary and less institutionalized) and therefore, the sources of difference amongst firms emerge from how managers of those firms understand and use the common knowledge differently. The metalcasting industry has in the recent years seen the emergence of new technologies that have provided the potential to improve melting and casting processes. The confluence of these two forces, one the existence of an institutionalized "common knowledge" of metalcasting, and the other, a dire need to revitalize the industry in terms of its core technological and managerial processes, makes this industry particularly relevant for this study.

Importantly, this industry suffers from a poor societal image about being environmentally polluting (although a large number metalcasting firms have been at the forefront in adopting environmentally sound technologies and management practices), a hard and un-ergonomic work environment, and in general low paying. These factors have led to a sever shortage of "fresh blood" in the industry with younger people preferring to opt for more "high tech" and less physically demanding industries. The shortage of manpower has been a major driving factor for increased mechanization and automation in foundries. However, this choice has created a

paradoxical situation. Increased automation has sought to reduce the importance of human skills and "craft" knowledge in the foundry process. A lot of decisions that seasoned molders and other shop-floor personnel used to take on the basis of their intuitive talent, built of years of experience, has been rendered useless by the advent of new technology. Therefore, while automation on one hand has addressed the manpower shortage, it has ironically, created the conditions for "expertise loss" in the form of seasoned foundry technicians being rendered superfluous to the foundry's operations.

4.2. The Metalcasting Process

At this stage, it will be useful to review the fundamental processes involved in a foundry. This will help in understanding the complexities of the production process and the skills required to make high quality castings. The casting process is essentially made up of seven key steps. I discuss each of these in detail.

1. Request for Quotation

The customer, prospective or current, provides a request for quotation to the foundry. This request usually accompanies a document that lays out the design of the casting, technical specifications, and tolerances. Some foundries have in-house designing capabilities that they use to offer value-added design services to customers. However, most foundries obtain the design from the customer's purchasing/engineering department.

The quotation process is competitive in the sense that the foundry has to come up with the most cost efficient way to produce the casting while maintaining the customer's technical requirements. A foundry might also work with the customer's design engineers in making

changes to the casting design to enhance its castability and reduce potential for defects arising during the casting process. The quotation process is the critical first step for any foundry because a flawed costing process might lead to either over-pricing or under-pricing. In the former case, the foundry might lose the order to competitors and in the latter case, the foundry might end up making less money on the order due to unaccounted downstream costs that it cannot pass on to the customer.

2. Pattern Making

If a foundry does succeed in getting an order and the final design specifications are agreed upon by both parties involved, the next step in the process is making the tooling necessary for casting. For sand castings, dies are made for molds and cores. To ensure that the molten metal flows to every cavity of the mold, patterns are made with channels and provisions for placing the cores. Pattern design involves designing the size, shape, and positioning of these channels that are also called sprues, gates, and risers.

Most foundries, especially the smaller ones do not have in-house pattern making capabilities. They depend on the customers to give them patterns of pre-existing jobs (which the customer is moving from a previous foundry) or specialist pattern shops that fabricate patterns. Pattern making is a capital intensive process that is seeing the use of advanced engineering tools such as computer aided design packages. Pattern-designing and fabrication is a critical step in foundry operations because any errors in this step would ensure that the final casting is prone to defects. The process is capital intensive and once made, patterns are expensive to change.

3. Mold and Core Making

The mold-making process is one of the key production steps in a sand foundry, usually occurring in the area where molten metal is poured. The extent of automation of mold making depends upon the size, complexity, and number of castings to be produced. For U.S. and foreign foundries producing high-volume production runs, molding machines are fully automated. These machines feed sand into a flask around a pattern, automatically remove the pattern, position the mold for insertion of cores, close the mold, and convey it to the metal-pouring station.

For manufacturing a casting with hollow forms that requires the creation of internal cavities or protrusions, a core is used, which is essentially a separate component of an external mould. Therefore cores are used as inserts in moulds top create design features that either too complex or hard to be produced by direct/external moulds. Generally, the greater the number of cores in casting, the more complex is its molding and casting process. Additionally, the more intricate the design of the cores, the more care and attention is required during the molding process.

4. Metal Melting and Pouring

Producing molten metal in a furnace and then pouring it into moulds is one of the most critical steps in foundry operations (Beeley, 2001). The quality of the final casting depends significantly on a number of factors at this stage, which begin from the quality of molten metal (being free from impurities, and having the right composition and temperature) that in turn determines the flow and cooling behavior of the molten metal. The primary source of metal (raw material) is in the form of scrap, that is, rejected parts/components from internal foundry operations or other foundries, or, metal and alloy ingots. Another key production step is metal

melting. The metal composition of "metal mix" (in industry parlance) is largely dependent of the casting specifications. However, by mixing some other chemicals a foundry can modify the composition of its metal mix to suit its own internal processes and attain the desired final casting characteristics. The key consideration during the melting process is to control the oxidation of the primary constituents of the mix. Oxidation is a double-edged sword in this process. On the one hand, the best to remove unwanted impurities from the metal is to oxidize them (and eventually remove them as slag) and on the other hand, the metal/alloy that is being molten can also undergo oxidization and lead to metal loss. This in turn can directly affect the profitability of the foundry's operation. Therefore, the melting process, its control and adaptation according to different metal/casting job requirements is a key area of focus in foundry operations.

Once the molten metal is ready to be poured, certain other factors come into play such as the skill of operator in pouring (not that important in automated pouring systems), the design of the mould, gating, and risering systems. The aim is to control the flow and cooling rates of the molten metal once it is poured inside the mould so as to ensure that the final casting will be free from surface and structural defects.

5. Shake-out

Usually, when castings have solidified, they are covered with excess metal and sand. These superfluous materials are removed in the shake-out process that involves various methods such as vigorously shaking the castings The extra metal and sand recovered in this process is generally recycled back.

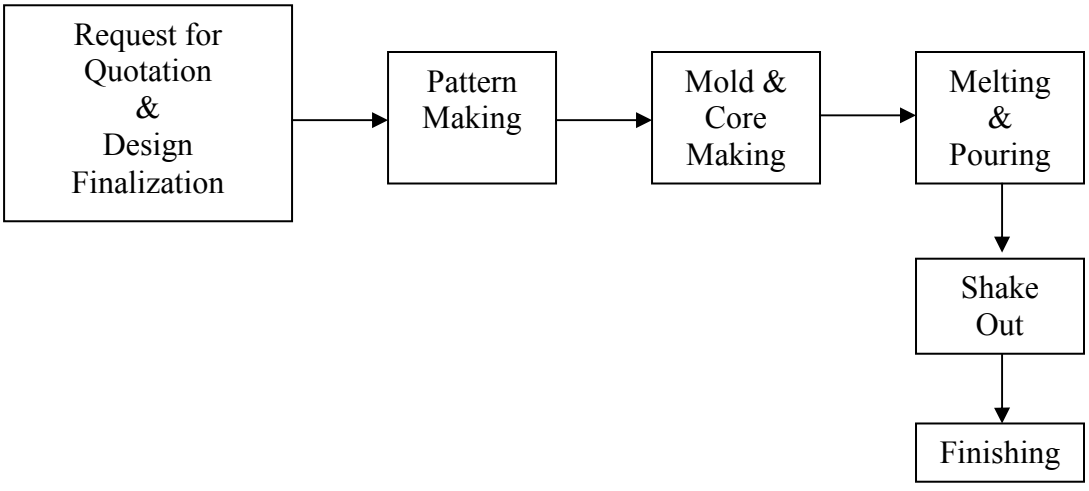
6. Finishing of Rough Castings

Once the large impurities on the castings surface have been removed in the shake out, the casting is given a final finishing which removes unwanted surface deformities and protrusions that might have been left by excess solidified metal and sand. The finishing is usually done in grinding machines. Large foundries use computer operated and controlled machines for finishing and a lot of foundries use suppliers for finishing and machining the castings (as described below).

7. Machining of Castings

If clients require further processing of the castings, the foundry is required to machine them to achieve the desired dimensional specifications. Machining is a value-added and specialized activity that foundries are beginning to diversify into, to provide increased service to customers. Having an in-house machining capability generally requires investment in milling, drilling, grinding, and turning machines besides having skilled manpower in metal working operations.

Figure-3 Key Steps in the Foundry Casting Process



Chapter 5

EXECUTIVE KNOWLEDGE SCHEMES - AN INDUCTIVE STUDY

5.1. Phase-1- Preliminary Study

In July of 2004, I interviewed a panel of 9 firm and non-firm members who are connected with the Metalcasting industry in the state of Pennsylvania. Of these 6 members were top managers (including CEOs) of firms and the remaining 3 are members of a leading university in North Eastern US, who specialize in metalcasting research and work closely with the industry. The 6 top managers belonged to 4 metalcasting firms. All but one of the firm interviews were conducted on-site wherein I had the opportunity to see the firm's operations first hand. I also attended two Pennsylvania Foundry Association conventions to get a feel of the key issues and current trends in the industry and build the necessary informal relationships with members of the industry. During this period, I also participated in the Penn State Metalcasting Best Practices team meetings. The team has been engaged in a process of developing technological best practices by visiting different foundries and then comparing foundry process capabilities. As a participant observer, I noticed that firms in this industry vary significantly in their tendencies in the sharing and sourcing knowledge and expertise, despite the fact that the knowledge provided could benefit the industry as a whole and the focal firms in particular.

The initial 9 interviews ranged from 30-120 minutes in duration, and I tape recorded all but one of the interviews. The original interview protocol (Appendix A) sought to generate a broad understanding of what resources and capabilities are considered important for metalcasting firms. I also asked questions that sought to get the informants views on the nature of knowledge

in the industry, how knowledge is sourced and created within and outside firm boundaries, and how firms manage innovation. These initial interviews showed wide disparities between the informants in terms of the key resources and capabilities for competitive success in the metalcasting industry. However, within these differences, some interesting dimensions emerged along which the variability was more pronounced. These themes had to do with managerial perceptions and beliefs about the value of sourcing knowledge from outside the firm boundaries, the importance of sharing and sourcing knowledge from universities, the preferred modes of sharing knowledge within the organization, and the rationales for codifying knowledge. For example, 3 firm CEOs showed a preference for codifying knowledge (i.e. the use of a central repository of work practices or the use of standardized manuals etc.) but of these, two CEOs justified knowledge codification as a means for controlling variance and reducing the cognitive load of the lower level employees. The third firm, which also considered codification to be important, does so for enabling it to articulate knowledge so that it can be modified and adapted. The CEO of the fourth firm showed a marked lack of interest in knowledge codification as he felt that a lot of foundry work is based on tacit skills embedded in people who learn it over many years. The perceived cost of codifying that knowledge is high and does not offer any added value to his firm's operations. Thus, firms managers showed intriguing variances in their propensities to codify knowledge and gave initial hints about the underlying logics that influenced these differences.

Similarly, one firm perceived its external knowledge sharing environment to be rich (although there were slight disagreements within the top managers of this firm) whereas two firms' top managers consistently said that firms in this industry do not share knowledge. These three firms showed a marked lack of interest in sharing and sourcing knowledge with outside

agencies such as universities, R&D centers etc. The fourth firm's CEO evinced a level of selectivity in terms of accessing knowledge from external agencies. He underplayed the utility of the university research centers and governmental R&D centers citing reasons that had to do with the perception that the research agendas of these agencies are too broad to suit his firm's requirements. He observed that small technical suppliers and consultants played a much greater role in providing critical knowledge that his firm could adapt and use.

The initial interviews with the university experts also provided some germane insights about the conditions in the US metalcasting industry and enabled me to grasp some of the underlying dynamics that emerged from the interviews with foundry executives. The university-based experts were a part of a metalcasting technology best practices program which was aimed at disseminating successful technical ideas across foundries. The experts shared a few common observations about the characteristic behaviors of foundries in Pennsylvania and elsewhere in the country.

There are some foundries which are very active in terms of seeking help from the universities and other R&D institutions serving the metalcasting industry. These foundries often work closely with the source of help to develop new casting methods or improve their current operations. There are also several foundries who demonstrate a marked lack of interest in engaging the services of universities and related agencies. Even amongst those foundries that are open to receiving technical assistance, some foundries, the experts observed, are always on the look out what technologies to source and how they are to be implemented, while there are others that adopt new technical ideas when urged by a key customer or due to some new regulatory requirements. One expert emphasized the importance of technology implementation besides the decision to adopt. He noted that several foundries play a passive role in implementing new

technology, allowing the source (university/supplier/consultancy) pre-eminent control over the implementation process. There are also foundries which work closely with the source during the implementation process and manage to modify the technology to suit their particular needs.

Moving back and forth between these preliminary findings from the initial interviews and the relevant existing literature suggests the need to understand better the drivers of differences between firms operating in the same objective environment in terms of the managerial perceptions about the nature of knowledge in the focal industry, the preferred modes of its use, and their strategic implications. I concluded that it would be useful to ask, why some top managers in these interviews showed a marked preference for knowledge codification whereas some others did not. Similarly, what might explain why managers differed in their perceptions of the utility of external knowledge sharing and sourcing?

Overall, these issues clearly suggest a need to bring to the surface the underlying socio-cognitive beliefs, schemas, and interpretive schemes that top managers of firms use to acquire, adapt and use knowledge as a fundamental meta-resource. The resultant findings from this sort of an investigation might offer hitherto under-recognized and under-explored insights into the influence of managerial beliefs on the role of knowledge as a strategic resource and perhaps provide a novel framework for broadening the scope of the resource and knowledge based views of strategy.

As mentioned earlier, research focusing on the strategic decision-making in firms has considered the influence of managerial cognitive structures on firm structure, strategy and strategic behavior. Nevertheless, this direction of enquiry has yet to look at the socio-cognitive frames or interpretive schemes that firm managers use specifically about knowledge and

knowing processes in organizations that could enable the construction of firm knowledge as a strategic or "meta"-resource.

Figure-4 – Research Framework

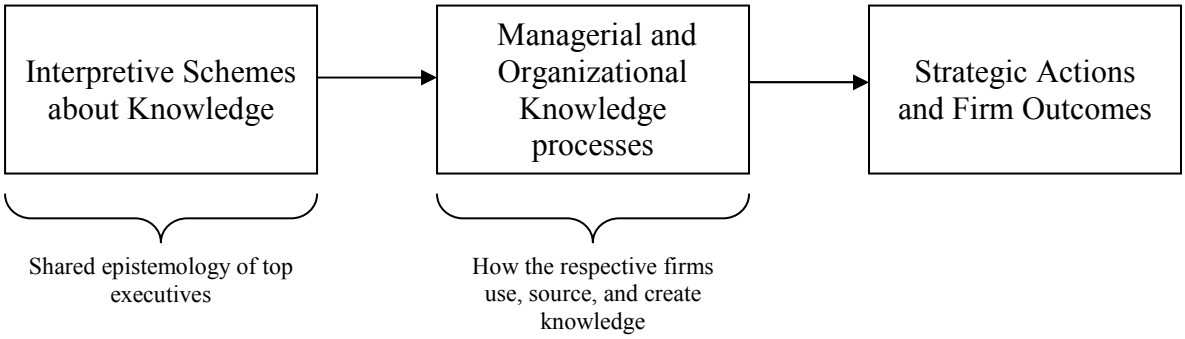


Figure-4 depicts the initial investigative framework that I intend to employ to answer the questions posed in this dissertation. It represents the merging of relevant literature and data from Phase-1 interviews with informants from the metalcasting industry. As we proceed forward it will be useful to revisit the primary research questions guiding this thesis.

1. What is the nature and content of managerial beliefs about knowledge as a strategic resource?
2. Do executives of firms operating in similar environments differ in their beliefs about knowledge as a strategic resource? If so, then how, and what are some factors that influence these differences?
3. How do these beliefs about knowledge influence the ways in which knowledge is obtained and applied in firms?

5.2. Phase-2- Interpretive Study of 22 foundries and Industry experts

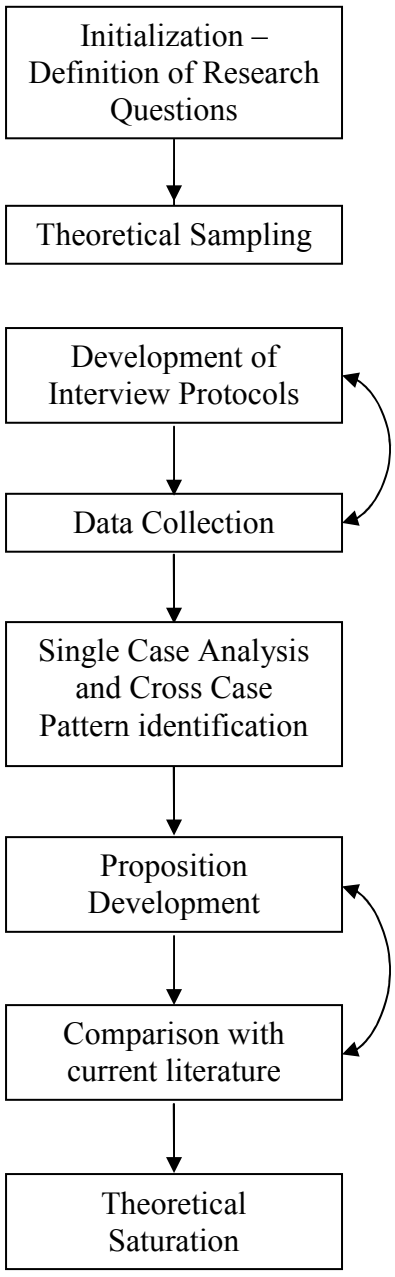
5.2.1. ***Research design.*** The primary focus of Phase-2 was the generation of grounded-theory as there is a shortage of extant theory in understanding the relationships between managerial cognition, choice, and the processes by which knowledge becomes a strategic resource. A grounded theory approach is fundamentally interpretive in nature (Strauss and Corbin, 1990), wherein the theory generation is based primarily on the "voices" of the entities being studied. However the emergence of theory from this process is not one where the researchers' lenses and biases are removed. In an interpretive approach theory emerges from the interplay between the viewpoints of the researcher and of those being studied. The researcher *interprets* how her/his informants make sense verbalize their own interpretations of the issues in focus, and based on those understandings lays the foundation of further theory development (Strauss & Corbin, 1990).

I followed a multiple case-study-based research design to understand the nature of executives' interpretive schemes about knowledge, the factors influencing them, and their implications on strategic behavior. Case studies enable a researcher to understand organizational phenomena within their real-life contexts that in turn provides theoretical richness (Yin, 1984). According to Yin (1984: 23), a case study allows the researcher to investigate phenomena in their real life context especially when the boundaries between the phenomena and context are not clearly evident. Additionally, multiple case studies provide the grounds for replication across several cases or sites and in the process enable the generation of varied aspects of the emergent theoretical concepts and their interrelationships. (Eisenhardt, 1989; Yin, 1984).

Eisenhardt (1989) offered a multi-step approach for the process of theory generation

through case studies. Figure-5 below offers a simplified albeit modified version of the theory building process as outlined by Eisenhardt (1989).

Figure-5: Building Theories from Case Studies – A Process Framework[1]



[1] Adapted from Eisenhardt (1989 p: 535)

I used this framework to guide the interpretive study. Eisenhardt (1989) proposed a diagrammatically linear and sequential process starting from the development of broad research questions and culminating into closure stage when further theoretical development based on the analyzed data is minimal. However, I have modified the framework here by introducing recursive loops between various steps, which make the theory development enterprise flexible and dynamic, until the point of theoretical saturation when no relationships emerge from the data.

For example, the first recursive loop occurs between data collection and the instruments used for data collection (in my case, the interview protocol). For Phase-2, I developed an interview protocol, which itself was an outcome of the interactions between the basic interview protocol that I used in the preliminary study (Phase-1), the insights from Phase-1 and consulting the literatures in managerial cognition and personal epistemology. During my interviews in Phase-2, which I discuss shortly, I kept used the protocol (see Appendix B) as a general guide and as I went through the interviews, I modified the protocol and the questions based on those phenomena that offered germane comparative patterns within and across my case sites.

The second recursive loop in the process involves the interplay between proposition development and extant literature. The propositional relationships that emerge from the within and cross-case analysis, either reinforce existing theory or create the need for extending current theory. In this study, as will be discussed in detail at a later stage, I experienced the latter need by engaging a new literature that helped me frame the patterns, which the current literatures were not able to throw sufficient light on. Consulting these new literatures, enabled me to make sense of the findings in a manner which on the one hand was consistent with the day-to-day realities of

my informants, and on the other, provided me a fresh vantage point to address the broad questions with which I had commenced the study.

5.2.2. ***Theoretical Sampling.*** The broad research questions guiding this study influenced strongly the nature and scope of the sample that I sought to engage in this phase. This form of sampling is different from a random sampling in the sense that persons/cases that are selected as informants represent not only the "general trends" of the population but more importantly are extreme or deviant cases (Lincoln and Guba, 1985: 42). The fundamental motivation of my thesis is to understand the drivers of interfirm *heterogeneity* in the evaluation and application of knowledge as a resource. Therefore, by design, my sampling was aimed at not only seeking general/common trends but also seek variance in the phenomena being studied. In theoretical sampling, the recruitment/selection of new cases goes on simultaneously with data collection, which enhances the possibility of *testing* the emerging theoretical relationships with cases that either support them or offer divergent examples.

Seeking the help of Penn State's Metalcasting Best Practices team and the director of a state foundry association, I got access to an initial set of foundries for site visits and interviews. I took care to ensure that the sampled foundries represented variance not only in terms of product and metal ranges (Ferrous/Non-Ferrous, Simple/Complex castings) etc. but also those based on my prior observations and discussions with university based experts, trade magazine articles, and industry association leaders. These observations had provided me valuable anecdotal information about foundries that were innovative and those that weren't. Based on this evidence, I sought to engage foundries that fell on both ends of the spectrum.

As I progressed in my data collection, I also used a snow-balling technique to pursue other foundries for this phase of my study. Through my interviews and site visits to several foundries, I developed close relationships with several executives, and I sought their views and perception of which other foundries that they would I suggest I contact. Based on this information, I would then seek the help of the Metalcasting Best Practices team leader to get access to the foundries. I also sought the assistance of the executive director of a leading foundry technology association to get access to some other foundries, mostly outside Pennsylvania. Lastly, I visited online industry discussion groups and from one such group, I was able to access to a couple of foundries. I posted a broad question about the importance of knowledge management in the foundry industry. From the responses, I tried to contact the individuals for interviews, and if possible site visits.

5.2.3. ***Data Sources.*** Before and during data collection, I made it a point to learn the "industry parlance" which enabled me to gain acceptance in the metalcasting community. For example, in the early stages of my engagement in the industry, I realized that most senior executives of metalcasting firms use the term, "foundryman" to describe themselves. In fact the use of the term "metalcasting" is more prevalent amongst university experts, regulators, and governmental agencies, whereas the industry incumbents prefer the term "foundry". As I learned these linguistic minutiae, I found that it became easier for me to "break the ice" in my interviews.

Following the traditions of interpretive research, I chose to use multiple sources of data for this study, based predominantly on semi-structured interviews, personal visits to several foundries, and consulting published material in leading metalcasting industry trade journals, research articles involving the foundry industry in academic journals, and industry reports

generated by governmental agencies and private database services. I used these multiple sources to get a comprehensive perspective of the industry context and the *lived* realities of my informants in their foundries. I now discuss each of these data sources in detail.

5.2.3.1. *Semi-Structured Interviews.* Before and during data collection, I worked to develop close working relationships with my focal industry's members. Over a period of six months, I carried out 45 interviews with foundry CEOs, senior and upper middle level foundry managers and three foundry experts. Of these, 42 interviews were with foundry executives and the remaining 3 were with industry experts. Two of the three experts are executive directors of two leading foundry industry associations, one of which focuses disseminating technological information to member foundries and the other, which is a state-level association plays an important role in acting as an interface between external stakeholders such as the government, regulatory authorities such as the state department of environmental protection, and as an organizer of foundry employee training programs. The third expert is a high-level executive of a large technology solutions provider to the US foundry industry and has strong ties with several trade associations and incumbent foundries.

The interviews ranged from 60 - 180 minutes, with multiple interviews with some of the informants. Appendix B shows a semi-structured protocol that I used for the interviews. In all, I conducted 14 interviews via telephone. I tape recorded and transcribed all interviews leading to a total of 722 transcribed pages. For the face-to-face interviews, I made every effort to visit each foundry and spend time beyond the interviews observing activities in the shop floor, thus getting a close perspective of the actual day-to-day operations in the foundry.

This engaged approach helped me develop a better understanding of the research context and an appreciation for the key issues that foundries face, which in turn, helped to make the interviews meaningful for my informants. The interviews with industry experts, allowed me to triangulate my emergent findings from interviews with foundry executives. During this phase, I realized that large technological solutions providers and suppliers play an important role in providing access to latest R&D information and organizing training programs for foundry workers. In my interview with a senior executive of one such supplier, I got a complementary perspective from a major stakeholder in the industry.

During the initial interviews in Phase-2, it became evident that my informants did not see knowledge as an objective entity but rather understood it more along the lines of *doing* something when faced with a situation. Furthermore, I also found that approaching the informants with a singular idea of knowledge was not proving to be fruitful and therefore changed my approach based on the respondent's demonstrated tendencies to emphasize expertise and skills in separate domains of functions such as marketing, costs, and shop-floor technology. I modified by questions in subsequent interviews to reflect these separate domains.

5.2.3.2. *Focus Groups and Archival Sources.* In addition to the interview data, I also organized 2 impromptu focus group discussions with foundry CEOs and senior managers during state level metalcasting trade association meetings. In these meetings, I was invited to speak about my ongoing research in the metalcasting industry and during the process of discussing my emergent findings, several foundry participants shared their views and critiqued by grasp of the relevant issues. Before going into these meetings, I would develop a list of questions that had emerged from my ongoing interviews. These questions were meant to 1) understand if the findings from

the interviews were plausible and relevant, and 2) seek insights that could provide new angles to analyze the interview data. I also collected and analyzed archival data from the following sources:-

1. Trade Magazines – *Modern Casting* and *Foundry Technology*
2. Transactions of the American Foundry Society Annual Meetings
3. Articles published in academic journals focusing on foundries.
4. Industry Reports

The archival data provided me to obtain a fine-grained understanding of the industry dynamics that provided the source material for strategic vignettes that I used in the generalization stage of my study. It also enabled me to account for contextual factors that were likely to affect the strategic

5.3 Analytical Approach

As I collected the data, I also inductively analyzed it, adhering closely to the guidelines specified for methods of naturalistic inquiry (Lincoln & Guba, 1985) and constant comparison techniques (Glaser & Strauss, 1967; Strauss & Corbin, 1990). These approaches provide the basis for rigorous, systematic collection and analysis of qualitative data and assist in determining the sampling and content foci of later data collection. Additionally, they provide the basis for delineating themes and analytical dimensions through the examination and comparison of key events (Isabella, 1990).

I utilized two separate-but-interlinked analytical approaches to gain a form of triangulation for this study (Jick, 1979). The first approach used was an overarching "grand-

view" perspective aimed at getting general sense of the thoughts and views of each individual informant and discerning patterns across informants (Van Maanen, 1988). I also utilized the transcripts, field notes and discussions a senior researcher to aid in this overarching analysis of the data. The second analytical approach was a more systematic and rigorous approach to the data that emerged from the interviews with the key informants.

Based on Miles and Huberman's (1984) suggestions about analyzing data from multiple sites (in my case, multiple foundries), I began by first analyzing each foundry in detail, a process termed as "within-site analysis". I coded each interview separately on the basis of "in-vivo" words, phrases, terms, or labels offered by the informants (i.e., first-order categories) based on the categorization and theme analysis processes suggested by Miles and Huberman (1984). The development of first-order categories was essentially descriptive as I made no attempt to interpret them, but only to codify them using the informants' "voice". The decision heuristic that I used to collate the individual codes into first order categories was multiple informants expressing a similar idea/issue. I conceptualized the data by breaking down each interview into observations/sentences/phrase and giving each of these a name that it stands for – phenomenon labeling. I then re-read each interview several times, to note phrases and passages that were similar to and different from each other to discern similarities and differences across informants. For those foundries where I had interviews with multiple informants I engaged in constant comparison across multiple informants and over time to detect conceptual patterns (Glaser & Strauss, 1967).

During the within site analysis, I also proceeded to start "cross-site analysis" which was aimed at comparing the emergent categories, their conditions and scope across different foundries. The focus on culling out similarities and differences was meant to develop multiple

perspectives of the same phenomenon being discussed by the informants across several foundries. I continued coding the interviews until I could not find any more distinct, shared conceptual patterns in the data across the informants.

Contemporaneously with the development of first-order categories, I started discerning linkages between the first-order categories that could lead to the development of second-order themes (which were researcher-induced, at a more abstract level, albeit with an attempt to apply informant labels if those labels represented theoretical concepts). These themes constituted the basic, emergent theoretical concepts. The emergent linkages enabled me to cluster, i.e., to collapse first-order categories and cluster them into theoretically distinct groupings. I then collated the second-order themes into overarching dimensions that enabled me to develop a theoretical framework that linked the various phenomena that emerged from the data.

For comparing the second order concepts across multiple foundries, I developed detailed data matrices where each foundry where a set of concepts had emerged was compared with other foundries. This comparison was based on whether the concepts were similar or dissimilar across foundries. A simple heuristic that I utilized for making the matrices amenable for cross-site analysis was whether a concept came across as “high” or “low” in terms of its strength and importance in a given foundry. This heuristic formed the basis of the next step which is crucial for theory development, that is, the stage where first-order categories are related to each other to form emergent propositions.

This step is called the axial coding process through which I hope to develop relationships between the above-mentioned categories. According to Strauss and Corbin (1990), during axial coding, the categories are classified into –

a) Phenomena and their properties –The central ideas/events/happenings

b) Causal Conditions – Events/ideas/happenings that lead to the central phenomena.

c) Context – The specific set of properties pertaining to the occurrence of a phenomenon and in which action/interactional strategies are taken.

d) Intervening Conditions – The structural conditions that influence the action/interaction strategies.

e) Action/Interaction strategies -Strategies taken to manage/handle the central phenomena.

Consequences – Results of Action/Interaction strategies

By using data display matrices, I was able to visually trace patterns of relationships between the categories and concepts that emerged from the data and in the process, develop tentative propositions for further exploration. Finally, I chose to focus on those concepts and the relationships between them that came across as the most relevant to my overall theoretical framework and emerged as the most prevalent yet insightful relationships.

5.4 Ensuring Trustworthiness

I followed a number of suggestions offered by Lincoln and Guba (1985) to ascertain the credibility and trustworthiness of my data and findings. A senior researcher, who participated in some of the initial interviews and group discussions with industry executives, provided a constant sounding board to discuss and assess the plausibility of my interpretations of the data. Secondly, I carried out multiple interviews with the same informant and checked my emergent understanding of their experiences (i.e., a process labeled as "member checking – Lincoln and Guba, 1985). I did this either by incorporating specific questions in my later interview protocols

or reading out short summaries of my understanding to the informants. I meticulously observed the following rules during data collection and analysis:

a) Extended engagement in the field- I spent a total of 8 months in carrying out the interviews and in most cases I spent a considerable period of time visiting the shop-floor and other facilities of the foundries whose executives I was interviewing. The visits to the shop-floor gave me a "real world" view about the day-to-day happenings in a foundry and helped generate a thicker and deeper understanding of the context in which the interviews were conducted

b) Taking extensive field notes- During and after every interview, I made it a point to make field notes, which in turn acted as a constant source of reference for generating new questions and considering new ideas and approaches for understanding the data.

c) Discussions with research colleagues and industry experts- I made it a point to discuss my emergent findings with research colleagues, especially senior researchers and industry experts. I took care not to divulge the identity of the firms while discussing the emerging strands of ideas from the interviews.

d) Member Checks – When possible, I sought to share my emerging findings with some of the informants who agreed for follow-up interviews. I also used the focus-groups for discussing my understanding of the industry dynamics, as I had learned from the interviews and published data sources. These checks helped me to maintain a sense of relevance and credibility of my data analysis and findings.

e) Extensive Data Tabulation – As mentioned above, I used detailed matrices to lend order and structure to the collected data.

Chapter-6

EMERGENT FINDINGS FROM PHASE-2 OF THE INTERPRETIVE STAGE

6.1. Preview of Main Findings

A pure rendition of findings in grounded theory research usually entails an extended presentation of data *before* the main theoretical structure becomes evident i.e., the theory is presented *after* the data (Daft, 1985), an approach that often makes it difficult for the reader to grasp the most important emergent concepts and their interrelationships. Hence, before presenting the individual "trees" that constitute the findings from this phase, I present a "forest" view to ease comprehension and tractability of the emergent theoretical dynamics.

A central finding from my analysis is that managerial beliefs about knowledge, especially those of the CEO or the head of a particular firm, influence how knowledge is acquired (that is scanned by the focal CEO) and used in a firm – which lends support the central premise guiding this research that senior managers influence the choices and uses of competitive resources, in this case, knowledge.

Across the sample of firms, I found patterns of variation in beliefs among senior foundry executives in how they understand, evaluate, and conceptualize knowledge in the strategic and day-to-day management of their respective foundries. These beliefs, which I conceptualize as "Executive Knowledge Schemes" (hereafter EKS) represent the *content* of a firm's senior managers' cognitive frameworks about knowledge as a strategic resource.

In the metalcasting industry, I found three domains or areas of knowledge that recurrently came across as the most important, namely *shop-floor or production technology, sales and marketing*, and *cost management*. As mentioned earlier, the metalcasting industry has in recent years faced significant regulatory pressures from the government, especially in the area of environmental pollution regulations and health and safety issue for workers. However, knowledge in these areas did not come across as high in importance especially when the competitiveness of foundries was concerned. These areas are a part of the larger regulatory context that is affecting the industry as a whole.

The EKS in turn are composed of three primary dimensions along which I found the patterns of variation to be most meaningful and influential of subsequent behaviors and firm level activities. The three primary dimensions are, Competitive Dimension, Personal Dimension, and Control Dimension. The competitive dimension captures those aspect of managerial beliefs that concern the perceived importance (criticality) of knowledge in a specific area to competitive success in the industry, the perceived ease of obtaining useful knowledge in that area from sources external to the firm, and the evaluations surrounding the ease/difficulty with which knowledge in the area as possessed by the focal firm can be appropriated or imitated by competitors. The personal dimension captures the senior manager's own level of perceived effectiveness, hence the quality of her/his personal knowledge about a given area, and lastly, the control dimension reflects the managers' beliefs about the vertical/hierarchical concentration of expertise and knowledge in the firm for a given area.

Further analysis suggested that EKS are likely to influence the nature and level of external scanning that a focal executive engages in. This finding offers a potentially fruitful development for new theoretical development because the extant scanning literature, while

offering a rich understanding of antecedents such as perceived environmental uncertainty and organizational strategy, has not yet explored deeper cognitive drivers of external scanning behaviors of top executives. My findings indicate the plausibility of the influence of beliefs about knowledge on executive scanning. A corollary to this finding is that scanning by senior executives is an essential and often under-recognize knowledge sourcing mechanism that has yet to be theorized in the extant framework of the RBV and KBV.

Although this fundamental finding provides good grounds for expanding the current understanding of the RBV and KBV, what followed was another theoretically rich set of findings, which provide evidence about the importance of situated knowledge application as a progenitor of interfirm heterogeneity. I therefore expanded the initial premises of this research, which were built on the existence of cognitive differences among firm's top executives in terms of their understanding of knowledge, to investigate the recognition that these cognitions manifest in organizational level tendencies concerning how well knowledge is adapted and enhanced in a firm.

The consequence of this general finding implies that the focus of this study needed to be broadened from one that focused solely on developing a set of new dimensions along which managers of competing firms might vary to one that looked at the inter-relationships between the contextually relevant beliefs about knowledge and the situated behaviors that reflect how existing knowledge is actively adapted and new knowledge is generated in a firm.

In the ensuing sections, I delve deeper into these findings and offer theoretical propositions that constitute the essential grounded framework that emerged from the interpretive stage of this dissertation.

6.2 Findings concerning Knowledge Domains

A first key difference that I found across executives of different foundries was their emphases on those areas of or domains of knowledge that they deemed as critical for the success of foundries in the present competitive context. Some foundries seemed to value expertise and knowledge in sales and marketing as a key prerequisite for success, whereas some others stressed that the lack of a fundamental understanding of shop-floor operations and technology was a key weakness in the foundry industry. On the other hand, some other foundries valued knowledge related to cost management as a key differentiator between themselves and their competition. The three domains or areas of knowledge which came across as bearing high strategic importance are therefore:-

1. Shop-floor/Production Technology – This knowledge domain pertains to expertise and skills in those areas that concern how casting processes are carried out in the foundry. The very complexity of the casting process, a brief preview of which was discussed in chapter -4 of this document, makes this domain multifaceted. Therefore shop-floor technology knowledge deals with areas such as casting design, melting techniques, mold-making, metallurgy, and heat treatment—the key areas of casting fabrication that a foundry needs to be aware of.
2. Cost Management – As discussed earlier, foundry operations are highly complex and the industry as a whole has been facing downward price pressures from customers, a condition aggravated by competition from low labor cost countries. A key area of knowledge in metalcasting is foundry production costs that include cost of material, labor, energy, equipment, and overhead. The challenge for a foundry executive is to be able accurately to predict/forecast costs of a potential new casting and then track it during actual production runs. This task becomes complicated especially in jobbing foundries where a wide range of

castings are produced that vary in complexity, dimensional standards, and engineering requirements.

3. Sales and Marketing – The majority of incumbents in the metalcasting industry are small to medium-sized job shops. These shops do not generally have a specialized sales and marketing department. Several job shops hire sales agents on a commission basis and therefore, only get "second-hand" information about market trends. Furthermore, several foundries tend to rely on long-term relationships with a few customers and therefore, traditionally, have found little need to develop expertise in sales and marketing. Nonetheless, the need for developing expertise in this knowledge domain is being felt increasingly because of acute competitive pressures from the developing economies that have eroded long-standing client relationships and led to orders moving overseas. As a result, there is a growing realization in the industry that sales and marketing capabilities are crucial for future sustenance and growth.

In the area of shop-floor technology, I found evidence of the importance of the somewhat unstructured, non-canonical, and craft-based adaptation of technical knowledge to solve casting problems. Some informants termed this process as "tweaking". A common rationale supporting the importance of this process was that although basic knowledge about foundry operations is available from sources such as the American Foundry Society, equipment suppliers, and research universities, the real source of competitive advantage lies in the how that knowledge is used to solve local (firm level) problems. I will develop this insight shortly.

In the area of cost management, some of the informants noted that the ability to critically understand costs, especially in the new job quotation process was a key differentiator between foundries that succeed and those that fail. On further question and analysis, I found that firms

that professed to be strongly capable in "understanding costs" apply primarily efficiency, low-cost, and technological incrementalism-based strategies to their businesses. These foundries generally find themselves on the low end of innovation and tend to follow a top down approach in knowledge dissemination.

Although this was true for some foundries, I also came across foundries where the quotation process was utilized as a key "knowledge application event," wherein members of the TMT closely analyzed the new job requirement, matched them with their current technological capabilities, and found ways to improve upon the casting design. These foundries used the quotation process not only for finding the lowest cost method to produce a job but also find new ways to improve the job and exceed customer expectations.

In the area of sales and marketing, I found some subtle variations across the cases that I studied. In an interesting comparison between two foundries, one in a Northeastern state and another located in the Midwest, I found that the focus on the customer varied greatly. The Northeastern foundry's CEO focused a lot of her attention on the business conditions of her current and prospective customers. Her reasoning was that the firm should work with those customers who are themselves sound and stable in their business performance. This CEO visits all her major customers and uses her personal contacts with senior managers of the customers' organizations to keep track of the financial developments there. This CEO seemed to be following an "enactment" interpretation mode (Daft, 1985) wherein, he drives and selects her customer base based on perceived fit with her foundry's technological capabilities and financial goals.

In her words, the CEO summarized the tendency as,

> "Now our customers have all been with us for a number of years. The only way we lose customers is if we throw them out. We are throwing out thirty (customers) right now. It's about every ten years that we rearrange our customer base. These customers that we are letting go, they have bad pattern equipment which reflects on higher scrap. Some of them are just bad technique problems. There are a few that were good customers at one time."

On the other hand, the Midwestern foundry is widely known for its innovativeness, having won various industry casting competition awards regularly over the past few years. Both the foundries are known for their technological prowess. Nonetheless, the CEO of the Midwestern foundry does not pursue/search information about current customers as her Northeastern counterpart. Instead she focuses more on maintaining excellent relationships with existing customers by matching and exceeding their quality standards and delivery standards. Further analysis suggested that executive beliefs about knowledge constitute some of the drivers of the above discussed differences in scanning tendencies and emphases that I observed across several foundries. I discuss these beliefs in the next section.

Interestingly, issues regarding environmental pollution regulations and worker's compensations and safety also came in some interviews, but did not surface as primary areas of strategic focus among senior managers. Although, as discussed in Chapter-4, over the past several years the metalcasting industry in the US has faced severe regulatory pressures from the US Environmental Protection Agency, the focus on environmental management and pollution issues at best came across as a taken-for-granted reality that was affecting the entire industry commonly.

The only instances in which these regulations had a strategic importance were the overall competitiveness of the US metalcasting industry vis-à-vis competition from developing countries

whose foundries enjoyed a clear cost advantage due to lax or non-existent environmental regulations of their respective governments. However, in the context of inter-firm competition within the US, environmental regulations and workers' compensation and safety issues came across as common factor that reduces the discretion of US based foundries. These areas/domains of knowledge hence are seen more as a part of a "constraining context" with very little discretionary possibilities for focal executives, while on the other hand, the three knowledge domains of shop-floor technology, sales and marketing, and cost management offer the greatest possibility for foundries to influence their competitive contexts.

6.3 Executive Knowledge Schemes

As briefly discussed earlier, I found evidence that metalcasting senior executives displayed variation in their beliefs or conceptions about knowledge as a strategic resource. I term these beliefs collectively as "executive knowledge schemes". This variation was evident not only across all three knowledge domains but also along three phenomenologically distinct patterns. At this point it is important to note that the content of the knowledge schemes emerged from the interviews across several firms. The patterns, however, did not come off as a direct answer to my interview questions but emerged from my informants' detailed descriptions of their understanding about the drivers of success and failure in the metalcasting industry and from response to my related inquiries about describing real situations in which they found themselves engaged in strategic decision-making.

As evident in my protocol, I did not ask leading questions in my protocol such as "what are your beliefs about knowledge in the metalcasting industry", but instead adopted a more open-ended and unstructured approach to be able to unearth how individual managers understand

knowledge as a factor in the strategic management of their firms. For example, one of the common questions that I asked was, "how does one create competitive difference/advantage in the foundry industry?" This question in no-way induced a respondent to talk about her/his beliefs about knowledge. It was only after the manager listed out the ways and means to create competitive advantage, did I pursue the matter further by asking questions such as- "if this factor is a key differentiator, then what are your views about the expertise and know-how that a foundry such as yours need to obtain advantage in this area?" The patterns formed the constituent structure of executive knowledge scheme and emerged from the analysis of the interviews as inductively derived categories along which senior managers of metalcasting firms differed from each other. I labeled these categories as three *dimensions* of the executive knowledge schemes. These are:

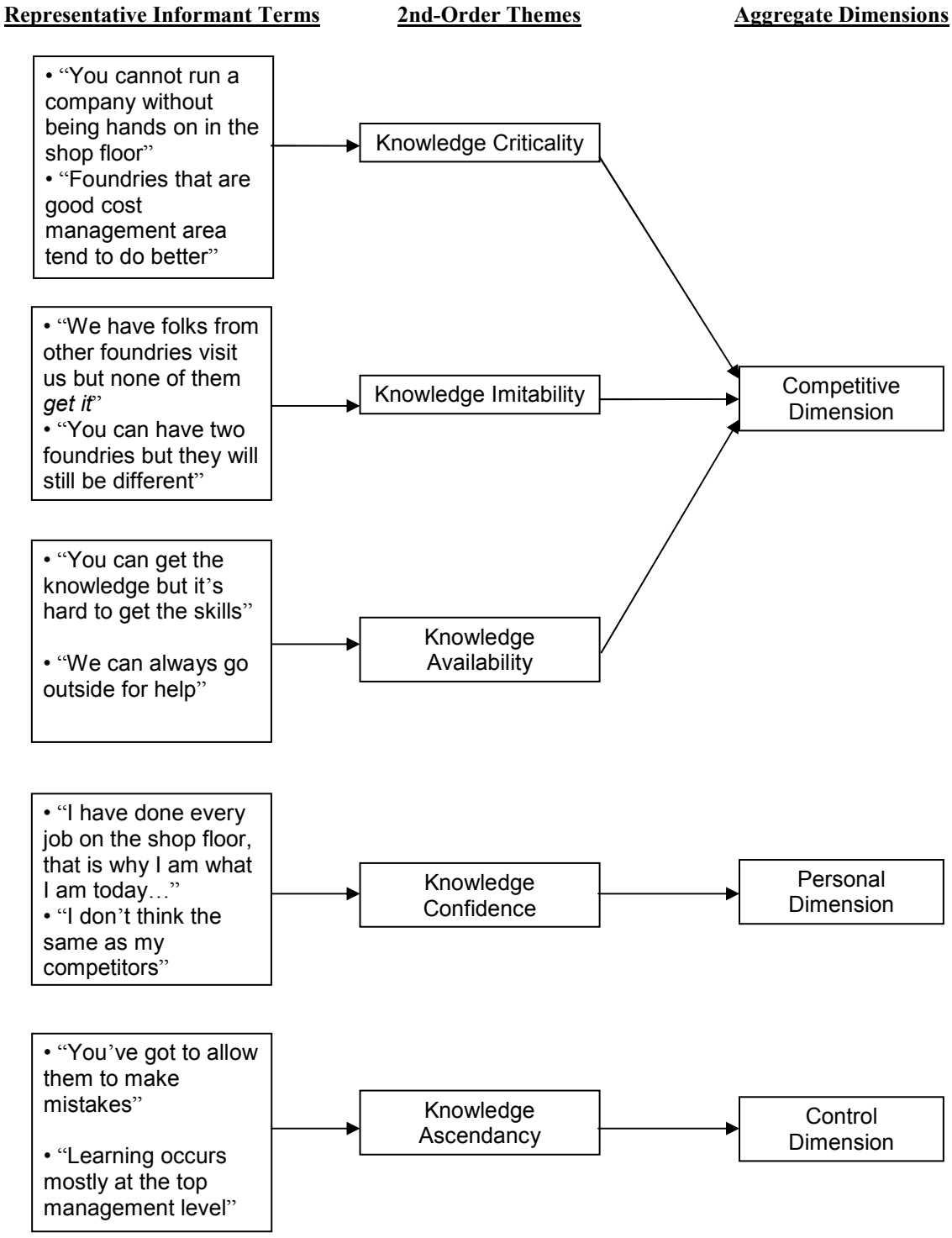
1) *Competitive Dimension*

2) *Personal Dimension*, and

3) *Control Dimension*.

Figure-6 shows the data structure of the executive knowledge schemes concept that emerged from the interpretive analyses. The data structure shows the underlying first-order terms/codes which are informant words and phrases collected under one representative code, leading to second-order themes, which in turn lead to aggregate dimensions. I discuss each aggregate dimension and their constituent second-order themes in greater detail.

Figure – 6 - Data Structure for Executive Knowledge Schemes



Competitive Dimension – This dimension relates to senior executives' beliefs about the nature of the firm's knowledge in operational technology, cost management, and sales & marketing in the context of its relation to their understanding of the factors that determine competitive advantage in the foundry industry. It has three sub-dimensions:

1. Knowledge Criticality – This sub-dimension reflects the level of importance that a focal senior executive ascribes to a particular knowledge domain in terms of its effects on the success of her/her enterprise. The data showed that senior executives vary in their ascriptions of what type and domain of knowledge is critical to their firms. For example, the CEOs of two gray cast iron foundries, operating primarily in the same segment, showed a marked difference in the areas of knowledge that they considered most important for foundry success. One CEO emphasized shop-floor technology as the primary differentiator while the other emphasized sales and marketing as important for foundry success,

> "We think one of the critical factors is the awareness of the technology that is out there. We think a little bit of philosophy, but we think the foundry industry is a very archaic industry and we fought to keep it that way."

Several other foundry CEOs observed that for success in the foundry industry it is essential for a CEO to "know the costs". On further inquiry, I found that knowing the costs meant different things and varied for having a thorough understanding of the quotation process which commences when a prospective customer approaches the foundry with the design of a part and technical specifications. Table 1 shows a representative set of first-order informant quotes that show both low and high levels of knowledge criticality.

Table-1 Representative quotes underlying 2nd-Order Theme "Knowledge Criticality"

First-Order Codes	Representative Quotes
You cannot run a company without being hands on in the *shop floor*	The basis of our sales to other outside customers is price and delivery. Quality is a very important part of it, which is appearance and also the metallurgy has to be within certain specifications. So those are factors too, but they are a little bit lesser than price and delivery – **Lo**
	I think one of the critical factors is the awareness of the technology that is out there. – **Hi**
	What we are being faced with everyday are increased engineering and quality specs. Design engineers today are making some very unusual demands and we as producers of ductile iron and castings cannot respond to those demands. That is why it is important that we stay on the edge of technology so we can meet the criteria- **Hi**
Foundries that are good in *cost management* area tend to do better	See, a lot of the success in this business is you've got to understand what your costs are of the drivers. – **Hi**
	Right there is a critical point of a foundry industry, in that you have the background, the knowledge that you can legitimately put a quotation together. If you were too low on your quotation you will get the work, but you will not be profitable when you bring that work in. If you were too high in comparison to the market that you are in you will not even see the work. So right there is a very knowledge-intensive process. – **Lo**
	Most foundries will give back the cost of the casting or replace it, but will not replenish the cost of the lost machine time. So more and more customers I think are looking for those shops that have a strong process control that can guarantee a quality part and a quality casting.- **Lo**
Marketing is what's missing in this industry	It is the foundry industry as a whole. It has the worst track record as far as marketing is concerned. If there is one weak link right at the very beginning it is basic 101 marketing. You cannot sell castings over the Internet. – **Hi**
	People (Other foundries) are selling castings without any knowledge whatsoever what the costs are**.** They are strictly marketing driven. That is a problem. – **Lo**
	I think the positions that we're looking at in sales management and human resources, I'm not sure that's the kind of areas that are that critical. It's not the technical knowledge that's important and you would lose it if people were to leave – **Lo**

Several of my informants observed that a lot of foundries to gain customers speedily, often do a shoddy job in working out quotations which results in a situation wherein even though they win the contract, the production of that part eventually costs the foundry more than the revenues earned. Table-1 lists a selection of representative quotes underlying this sub-dimension. The importance of "knowing" ones costs also surfaced in a different context wherein some senior executives emphasized the need for a foundry's senior management to have a strong understanding of seemingly mundane but financially important aspects of foundry operations. These had to do with energy costs ranging from the abilities to check for excessive power use in non-productive operations and finding ways to modify the design of the casting or the molds to save on metal usage and therefore costs.

2. Knowledge Inimitability – This sub-dimension represents senior executives' beliefs about the quality of a competing foundry's knowledge in a particular domain and as a corollary her/his own foundry's ability to protect its perceived advantage in that area. Table-2 offers a representative list of first order quotes that show instances of both high and low knowledge inimitability. Across my sample, I found wide variance along this dimension. I found that senior executives of some firms viewed shop-floor technology and operational capabilities as the key strength areas of their respective foundries. For example, the CEO of a foundry, known for its technological prowess had this to say when I asked him to discuss about his firm's strength areas.

> "We think it goes back to the philosophy of how you run your business. Without sounding a little bit too bold, we like to say we have people (other foundries) in the same business. But as far as competition, very few. That being said, we invite people from foundries that are very much similar in size to our operation to visit us. We've let them walk through and they can see all the castings and materials and the supplies of the materials that we use and they can see the type of equipment that we have. And we have not had them make any inroad into our customer base.

Based on information gathered from published industry sources, I was aware that the focal foundry is well known for its technological capabilities, which led to me entertain the possibility that because this CEO views his foundry's technological expertise as fairly superior and inimitable by competitors. This became evident from his "observation" that even though their foundry invited even direct competitors for detailed plant tours, the competitors had not been able to "take away" their customers.

Table-2 Representative quotes underlying 2nd-Order Theme "Knowledge Inimitability"

First-Order Codes	Representative Quotes
We have folks from other foundries visit us but none of them *get it*	Maybe we're one of the only foundries that does it because of the leadership or guidance of the owner or the ideas that are his ideals that we are here to continue to grow in technology and not stand still. – **Lo**
	To a certain extent it is common, but there are some jobs that we make and some alloys that I think the other three or four foundries can't make but I am not saying that they can't learn – **Hi**
	I would not tell him (competitor) how much business we have or how we handle it or what metals we use and stuff like that. I think that is pretty proprietary. – **Hi**
You can have two foundries but they will still be different	You have different humidity. You have different temperatures. You have a different building. Different air flow. There are a lot of variables that contribute to a casting process that is why every foundry is unique. - **Hi**
	Every time you will find it is going to be unique on the sand characteristics. It will be unique on our melt. Because we might melt certain steel that has a certain chemical…. If everyone were buying the exact same raw materials we were they would have a fighting chance of doing it the same, the same equipment, but that is never the case. – **Hi**
	There is a lot of common know-how across foundries because we help each other a lot. – **Lo**

Therefore, it was plausible to conclude from this observation that the CEO was referring to those "intangible" aspects of his shop floor operations that were "inimitable" in his eyes, as different from the clearly visible equipment, raw materials, and supplies. This point brings to relief the notion of *knowledge* inimitability, as it is likely that the CEO was focusing on knowledge and expertise as compared to some *tangible* advantages that his firm possesses.

3. Knowledge Availability – This theme refers to the belief about whether foundry knowledge in a given domain is easily accessible to all foundries from external sources. An insightful pattern that emerged in the interviews was that several informants said that while it was easy to get access to several sources of information in the industry such as the American Foundry Society, technical associations, consultants, and research universities, more often the problem their foundries faced to get *useful* information, that is know-how and skills that their foundries could appropriate and utilize to solve their immediate problems. As one executive lamented, "The bad thing about our business, is that there are no schools, there are no study classes, there are no books written about our process as to how to make a good casting."

Across my informants, equipment and casting materials suppliers found unanimous support in terms of being the most favored source of knowledge in the industry. On further questioning, I found that several suppliers provide free training seminars and consulting services which in turn help their sales efforts. Also, supplier salesmen act as "conduits" of information about the internal happenings of foundries to their competitors. Once again, I found CEOs across firms differing in their perceptions about availability of knowledge in a given domain.

Table-3 Representative quotes underlying 2nd-Order Theme "Knowledge Availability"

First-Order Codes	Representative Quotes
You can get the knowledge but it's hard to get the skills	Number one, a mature industry one as a fact, if you learn something from somebody it might not be the right thing that you learn. You might learn some bad habits, bad practices and other things. Knowledge can be passed on and so can bad habits. – **Hi**
	It's not that big of an industry any more. You hire engineering as there are some good engineering firms. You can get competitive advantage through help – **Lo**
	We worked with a company and a university on a problem for several years and nothing happened. I am not saying that they did not put in an effort but we are still stuck with the problems – **Hi**
You can have two foundries but they will still be different	For sand related problems we have gone to the AFS. We have gone to ABC Supplier (name changed) if it's involving a new molding process. ABC is one of the most technically useful sources for us…. I mean, they run seminars all the time on mold making, core making and problem solving. Their biggest thing is their technical support, if you have casting defects. - **Lo**
	One of the ways that I find I can educate my guys the best is having them visit other foundries. They love going to see somebody else's foundry and talking to somebody that does what they do. We have lot of fairly easy access to touring other people's facilities - **Hi**
	The biggest difficulty is to find that consultant who has that expertise because if you contact some who says, "Oh, we can do it." But then they have to do an awful lot of preliminary research to educate themselves – **Lo**

Personal Dimension - Some of the foundry senior executives expressed a level of assuredness in their roles as leaders of their firms and their own abilities as foundrymen. On the other hand, some other informants showed a marked dependence on external conditions that ranged from helplessness to consternation. This was more evident in those foundries whose CEOs perceived a high threat to their well-being because of increased foreign competition and "unfair" government regulations. On the other hand, the CEOs demonstrating high self-assuredness ascribed little or no importance to foreign competition and clearly saw the advantage of their foundries in being able to handle complex products and being flexible in response to customer needs. I also found these CEOs to be more proactive in industry trade associations, in relationships with other foundries, as well as more demanding of suppliers, and most importantly, a marked tendency to gain an in-depth understanding of technological trends and conditions of their current and future customers. This variation in assuredness or confidence levels led me to consider self-efficacy theory (Bandura, 1986, , 1997) as a potential lens for conceptualizing this dimension. Building on insights from Bandura's work, I termed the second-order them underlying the personal dimension as "Knowledge Confidence".

I also found that the belief in high Knowledge Confidence came across in the form of arrogance towards competitors and customers. For example, a senior executive with a strong engineering background and before joining the current foundry had worked in the foundry division of one of the largest earthmoving equipment companies in the world. This senior executive had a critical view of other foundries especially for what he saw as an over-reliance on craft-based and intuitive approaches to shop-floor technology. This executive downplayed the importance and value of using creative ideas on the shop floor and instead emphasized the

importance of measurement and close management control as the path to success. Table-4 lists a selection of representative quotes underlying this dimension.

Table-4 Representative quotes underlying 2nd-Order Theme "Knowledge Confidence"

First-Order Codes	Representative Quotes
I have done every job on the shop floor, that is why I am what I am today	You know, number one it's extreme pride in our own success in doing a job that maybe other foundries would say it's not even possible to think about. I guess it's the pride in winning rather than the defeat of losing. – **Hi**
	Like I said, I am very quick with customers and I am. Like an old saying, if it walks like a duck and quacks like a duck, you have a duck. There are certain customers that will cost money and they follow a certain trend. I have been down this road too many times and I just pick up on it very quickly. – **Hi**
	Being an engineer in an engineering background I am not the typical sale person. So you know our people and our managers in our plant are like Vice President of Operations, he grew up in the plant. We are not good sales people.– **Lo**
You can have two foundries but they will still be different	See, there is no substitute for brains. I don't know how to say this. Well, what makes a good school vs. a bad school? One that's performing and one that isn't. And 90% of the time it's the principal who matters.- **Hi**
	The guys that have done well generally, like myself, came up through the organization. Generally speaking, the people that I know on a personal basis that have done well in the foundry business have all come from pretty much the same background. They are not MBA's. They are not financial people. They are hands-on and they know basically how to make a casting and a good one and they generally know what the customer expects- **Hi**
	The biggest difficulty is to find that consultant who has that expertise because if you contact some who says, "Oh, we can do it." But then they have to do an awful lot of preliminary research to educate themselves – **Lo**

Control Dimension – In some of the metalcasting firms where I carried out interviews, I found a distinct tendency among CEOs and senior managers to view lower-level foundry employees as merely rule followers. The Control Dimension of a senior executive's EKS pertains to her/his level of perceived hierarchical concentration of knowledge and intelligence in an organization. Beliefs in this dimension have to do with how much importance and cognitive independence the senior executive ascribes to lower-level employees in terms of their abilities for independent knowledge creation in the organization. I termed the underlying second-order theme as "Knowledge Ascendancy" to describe this belief pattern.

A somewhat surprising finding from the interviews is that some CEOs follow an almost paternalistic top-down approach towards knowledge dissemination and validation in their firms. Although this approach might seem outmoded and dysfunctional, a careful analysis suggests that this directed approach represents a form of organizational learning wherein the top managers act as primary interpretation agents for the firm (Daft and Weick, 1984).

The foundry industry is a knowledge intensive industry where metalcasting process control and manufacturing quality are important customer satisfaction criteria. Given this situation, it is reasonable to expect that the CEO and other senior managers would ascribe a significant amount of their foundries' success to their own abilities. Nonetheless, I found differences between foundries in terms of the importance and value ascribed to lower-level employees, especially in their worth as knowledgeable persons.

It is important to note here that the majority of foundries are small- to medium-size enterprises where the organization often resembles a "one man institution". For example one foundry's CEO emphatically commented, when asked about the sources of innovation in his company,

> "When we got into austempering fifteen years ago, if that was a type of innovation and of course that came from the top down. We decided to get into heat treating and austempering. Would you call that an innovation? But it was not some guy on the floor that decided that, it was management. That is the good thing in terms of innovation if it comes that way. We are putting in a new and more modern molding machine that will enable us to compete. I think our innovation is coming more from the top and availability of capital than it is from the guys down on the floor."

On the other hand, I came across several CEOs who showed an opposite proclivity, that is, those who see their employees as highly capable individuals willing to learn and experiment with new things in the foundry. These foundries too are small and facing more or less similar external and internal constraints but have *chosen* to view their lower level employees as idea generators. In one foundry where I interviewed a shop-floor employee who was somewhat of an "all-hands" person working across areas such fire safety to handling the development of new casting alloys, who, devoid of any formal training, in a span of a few years had learned most of the significant operations in the foundry. He had worked in a few other foundries before that and when I asked him to describe what was different in the current foundry he said,

> "There is no "I" here. There is nobody above anybody here. Even our supervision, that's the main thing right there. There is nobody higher than anybody else in this shop. They have a title, but there is nobody here higher than anybody else. We work as a unit. Everybody is equal. Everybody is treated equal and you don't have that. I mean, power goes to a lot of people's head and we don't have that here.

Similarly, I found several other foundries where the CEOs evinced a marked tendency to value the inputs of lower-level employees, often depending on their ideas to resolve the company's operational and sometimes, strategic problems. Table 5– provides a collection of representative quotes that suggest both high and low knowledge ascendancy across senior managers of foundries.

My findings also suggested that beliefs about knowledge ascendancy in turn influence the knowledge search behaviors of the executives and the ways in which knowledge is utilized in their respective firms. I discuss this in the next chapter.

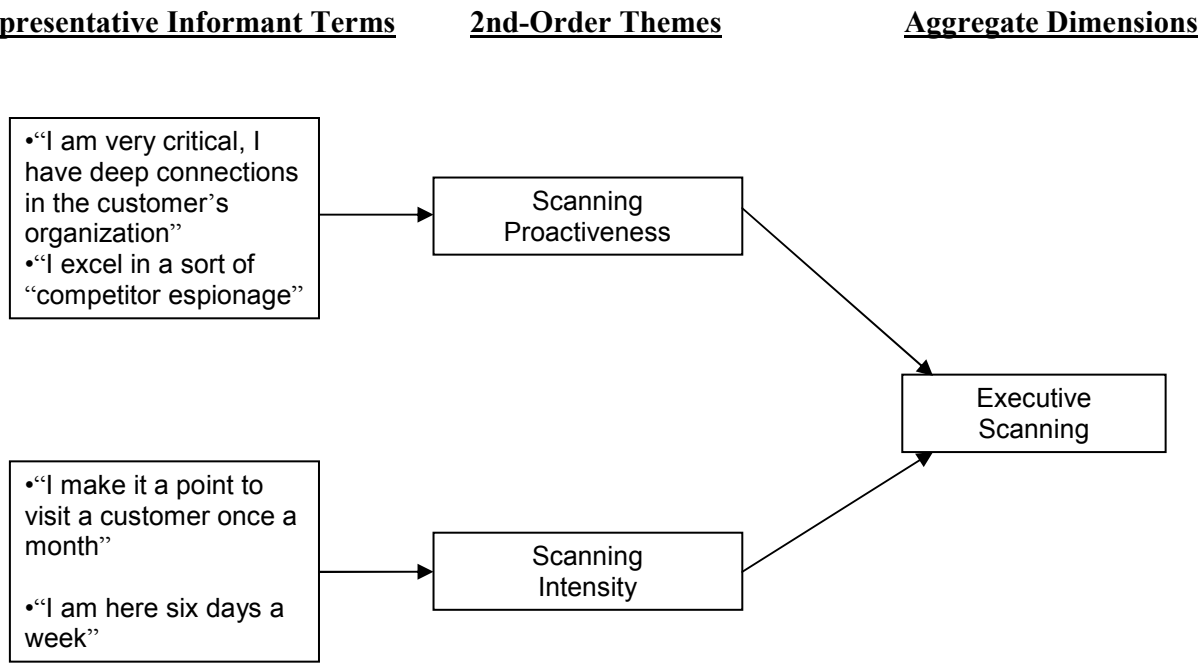
Table-5 Representative quotes underlying 2nd-Order Theme "Knowledge Ascendancy"

First-Order Codes	Representative Quotes
You've got to allow them to make mistakes	Most of what you find that are good constructive ideas that come from the floor are ideas. People that think about ways of perhaps doing it better, not knowing that it can or it cannot work, but when they bring up the idea could we try this and it makes sense and we try it and it works they just become knowledgeable. – **Hi**
	You have leadership and people that are supervisors underneath you, you have to give them the leeway to lead. You cannot be telling them exactly what they have to do day in and day out. And you as a leader, whether it is a department head or whether it is a foreman or whether it is a manager, vice president or whatever, you have to give the people underneath you those opportunities. – **Hi**
	It goes back to the people aspect again, that we've got a very good group that's assembled that's not only doers, but thinkers. It's not my management style to dictate without flexibility. – **Lo**
Learning occurs mostly at the top management level	The top foremen pass it on. My fellow in charge of the lab, he will handle that. When they pour. What temperatures they pour. When to add the additives. How hot to get it before they pour. How to skim it off. That is passed on from the lab to the foreman to the people.- **Lo**
	Well, we have regular communication with our employees. It starts at the employee level. Every two weeks there is a payday and with the payday we have a bulletin that tells our employees exactly what's happened over the past two weeks. Also financially, but also in a realm of safety, the realm of new orders that we received. We try to give them a look into the future that we're looking at so that they have a comfort level with the job and are not concerned about next week I'll be out of business. – **Lo**
	As long as we have one or two that know why we are doing it, monitor it, police it, enforce it. It gets beyond them. It gets beyond their capabilities that we hired them for. The melters are a little bit different– **Lo**

6.4. Executive Scanning Behaviors

A vast and well-developed literature exists about external (and internal) scanning as an important managerial activity. In my interviews, however, managerial scanning emerged as an important concept within the ambit of managerial beliefs about knowledge and the behavioral tendencies that undergird how knowledge is used as a resource at the firm level. The data also suggest an expansion of the scanning construct along two dimensions – scanning intensity and scanning proactiveness. Intensity of scanning has been conceived in extant literature as the *frequency* or *amount* of search and my data too supported this concept. However, another hitherto under-realized aspect of search emerged from the data that pertained to the actual activities that executives do while searching for information. Figure-7 shows the data structure underlying the executive scanning theme.

Figure -7- Data Structure for Executive Scanning



a) Scanning intensity: - This concept refers to the amount of knowledge search in a given domain. Hambrick (1979, 1982) used a multi-method approach to measure the frequency with which executives scanned environmental sectors. This sub-dimension represents the amount of time that firm's senior executives invest in searching for information in a given knowledge domain. Table-6 depicts examples of high and low scanning among executives of various firms. As evident, executives, operating within the same industry showed wide variation in the amount of scanning in a given knowledge domain.

Table-6 Representative quotes underlying 2nd-Order Theme "Scanning Intensity"

First-Order Codes	Representative Quotes
I make it a point to visit a customer once a month	I talk as much as I possibly have time with customers to find out how they are doing. There is an issue right now with the one of a possibility of some of the work going over seas. I was just speaking with them right before you called. I was talking with my customer about that possibility.- **Hi**
	We probably have ten core customers that we work with. I probably talk to everyone at least once a week. . – **Hi**
	We try to develop a relationship with a customer that is a personal one. We know them. We know the customers very well. We have them here frequently. We visit with them frequently.- **Lo**
I am here six days a week	Well, I will tell you what. A lot of it is keeping your nose to the grindstone. When I took over this plant my boss used to go to Florida for six months a year. I do not do that. Maybe I could do it, but I won't do it. I am here six days a week. Even on a Saturday when there is not much to do I am here watching my maintenance people. You have to be here. - **Hi**
	I do an awful lot of reading, both technical and other areas and not to the degree that it's so deep that you don't understand it because I don't have that background. But I stay abreast of what's happening in the industry locally and then also somewhat worldwide what part we play in the global market. Current events naturally you have to be abreast of. – **Hi**
	Up until a year or two ago we were never that active in the AFS activities. We are getting much more active in AFS activities now than we were before.– **Lo**

My comparisons across the foundries involved in the study showed that senior executives, even those who work in foundries of similar size and broad strategic contexts differ in the intensity of scanning. For instance, I found that the top executives of two gray iron foundries operating largely in the same customer segments emphasized different domains of knowledge in the amount of time they allotted to scanning. The CEO of the first foundry invested a lot of time collecting information about new technological developments outside the firm and operational information within the firm, whereas the President of the second foundry focused on current and prospective customers.

While scanning intensity in and of itself is not a new construct that emerged from this study, it is interesting to note that beliefs about knowledge seemed to influence the regularity with which a focal executive searched information in a given area. For example, perceptions of criticality of knowledge domain generally were associated with greater intensity of executive scanning in that domain. Similarly, executives who displayed high levels of self-efficacy in a particular knowledge domain scanned more intensely in that domain.

b) Scanning proactiveness:- This aspect of scanning behavior is more than just the time employed by a focal manager in acquiring information about external domains. It also captures the tendency of the manager to be a critical observer, use multiple sources within the same domain to triangulate relevant information, and experiment with new ways to collect information in a given domain. The concept of scanning proactiveness is similar to the notion of organizational intrusiveness as developed by Daft and Weick (1984), who viewed it as a firm-level behavioral tendency along a continuum between passive and active information acquisition and interpretation. They argued that organizations that engage in active intrusiveness are generally "rule breakers" who engage in constant experimentation and manipulate critical factors

in the environment. Thus, scanning proactiveness represents not just passive information gathering but seeking qualitatively better knowledge than rivals.

It is important to note here that the notion of proactiveness in one's scanning had more to do with specific knowledge search and evaluation behaviors rather than the amount of time that one spends in that search. This distinction offers the potential for expanding the scanning concept, as extant scanning literature has focused largely on the latter. In my interviews I found several instances of both high and low scanning proactiveness among foundry senior executives. The theme emerged from patterns of findings about how the focal CEOs went about accessing information in a given knowledge domain. For example, one CEO discussed his close personal relationships with several managers in his client organization, which was much bigger than his own foundry. He had built these linkages over several years and he used them to "keep tabs" on the "health" and "direction" of the client company. This CEO believed that if the client company's business was stable and growing, so would his foundry's and went to the extent of claiming that he would not be averse to firing the client if it wasn't performing well. On further inquiry the CEO explained that when a client company faces financial pressures, it has a relay effect on his foundry in terms of requests to lower casting prices and offering longer credit periods, all factors that harm his bottom line. Similarly, a senior executive in another foundry shared what seemed like a marked tendency on his part to engage in occasional "competitive espionage". This executive would even go to the extent of analyzing the reject parts and scrap materials of close competitors to see what kind of castings they were making and for which customers. Another CEO emphasized the importance of his sharp focus on information about foundry closing news in his area and other parts of the country. Whenever he would get wind of a foundry closing its operations he would make it a point to engage with the senior executives of

that firm to learn who their clients were so that his foundry could get those casting orders. Once again, the emphasis here was on specific activities that these executives carried out as regards to the amount of time they spent gathering information in a particular knowledge domain. Table 7 shows instances of high and low scanning proactiveness among senior executives of different foundries.

Table-7 Representative quotes underlying 2nd-Order Theme "Scanning Proactiveness"

First-Order Codes	Representative Quotes
I watch things very critically	I guess the other thing that stands out and I get in a lot of foundries and all I have to do, is take one step inside the actual foundry and you can tell exactly how that organization functions. One of the big things that I look at is the electrical system. You walk in and by God you will see (not audible) Allen Bradley or anything they could get a good buy on at the time.– **Hi**
	I like to know everything that is going on here. I am a bit of a control freak, they think. Especially if I do the costing here. I will look at the history of the job and I find that all of a sudden the molding times are way out of whack. So I call the foreman in and I say what is going on here? Is there a problem with it and he will get the job out and we will look at it and kind of trouble shoot and find out what is going on between the two of us. – **Hi**
	Oh, I watch technical stuff, yes. I haven't really seen anything important coming up in several years. The furnaces that we have here are 30 years old and we maintain them very well.– **Lo**
I excel in a things like "competitor espionage	I guess the other thing that stands out and I get in a lot of foundries and all I have to do, is take one step inside the actual foundry and you can tell exactly how that organization functions. One of the big things that I look at is the electrical system. You walk in and by God you will see (not audible) Allen Bradley or anything they could get a good buy on at the time.– **Hi**
	I have been very active. I try and like I was mentioning about the furnace revitalization project, I contacted three different suppliers as far as what I should put in here. I contact Thermtronics, Dynarads and Inducto. They each gave me a proposal. So I try to be very active. I am the type of person that I want some information, I will pick up the phone and call whoever I can. – **Hi**
	I do an awful lot of reading, both technical and not to the degree that it's so deep that you don't understand it because I don't have that background. But I stay abreast of what's happening in the industry locally– **Lo**

6.5. Knowledgeable Practice

My interviews suggested a focus on the practices that embody *knowledgeable* behavior in the organization. My use of the term of "knowledgeable" was driven largely by the persistent referral by my informants to "wise" or "smart" application of knowledge (and information) in day to day foundry operations. This notion is made clear by the following quotes,

> "Just because you get information (from external sources) doesn't mean anything; it is what you *do* with that information. We might hear that foundry B is having trouble or foundry B's customer is looking or not happy. Okay, you are the manger of foundry B and you get the same information. It is what you do with the information that you get. (CEO, Shop Foundry) [name changed for purposes of anonymity]"

> "It is one thing to know it, but that does not make you successful. Applying it is what makes you successful, the application of knowledge." (V.P. Manufacturing, Goodluck Foundry)

The specific term "knowledgeable" came from one such interview with a Midwestern foundry's V.P. Manufacturing. I quote the actual sequence of our conversation.

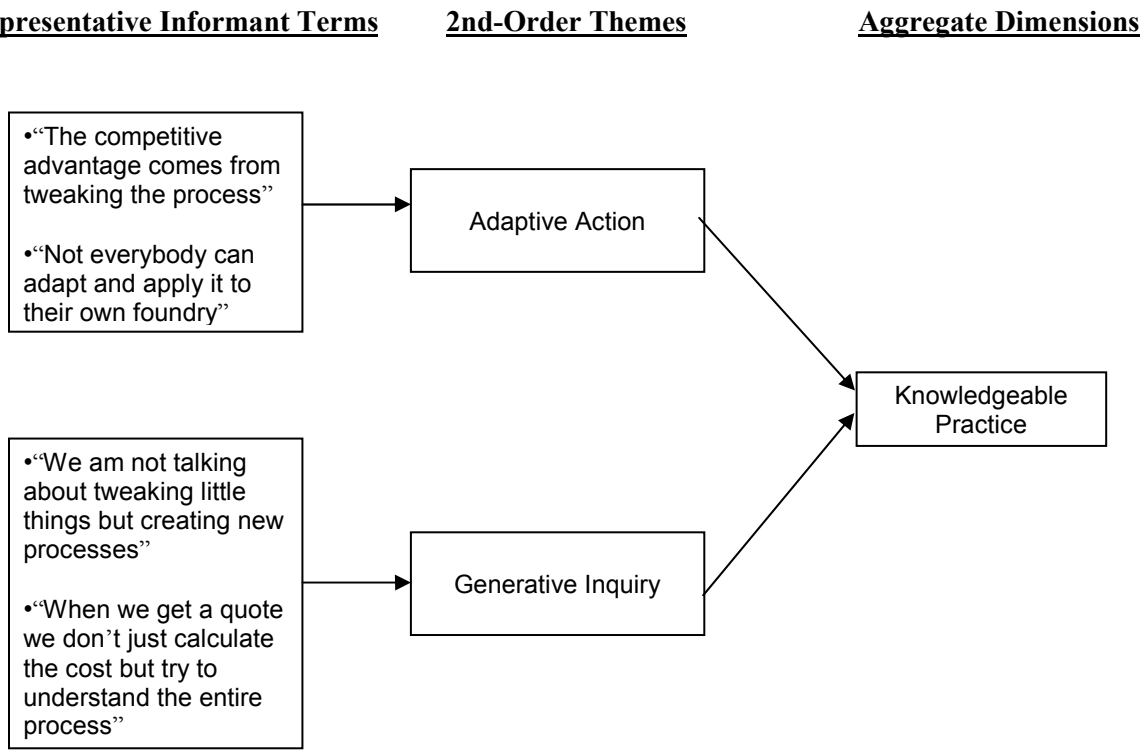
> V.P.- There are many, many software programs that are set up that will duplicate the metal solidification process from liquid to solid, which gives a novas as a screen a picture of how the inside of the casting solidifies. It's there, but how do you know except by experience and/or hands-on experience how to use that knowledge to make a casting from it?
>
> Q - I've heard that word *experience* by other foundrymen. Do you mean that the key is to have experienced people?
>
> V.P. That doesn't mean they're knowledgeable.

Across the interviews, a common pattern emerged that shows that these industry informants view knowledge as embedded in localized practices that represent how *well* knowledge is *used* or *acted upon* in a given strategic or operational situation.

I term this property *as "Knowledgeable Practice,"* which is defined as *the ability of the firm to reflect upon, apply, and adapt knowledge through the activities of its members.* From the

interviews, two distinct but inter-related components or dimensions of knowledgeable practice emerged. Figure-8 shows the data structure of the knowledgeable practice concept.

Figure – 8 -Data Structure for Knowledgeable Practice



a) *Adaptive Action:*- The first type of knowledgeable practice captures those patterns of conduct where knowledge is applied to find new and creative ways to improve operational activities. The emphasis here is on finding local solutions to common problems using ingenuity and creativity. In some firms this tendency was seen as the ability to "tweak" a standard technology. Some firms were generally secretive about these local tweaks and believed that they bestow competitive advantage. Furthermore, I found that the ability to tweak a given technology or equipment ranged from minor tweaks to substantial re-engineering of equipment. One firm's senior manager, while giving the example of tweaking, actually cited an example of a referent

firm that had developed the ability to take a commonly available core-making machine and completely re-engineer (or rebuild) it to suit its internal requirements. The level of output that the firm gets from this adaptation was much better than the competition. In this case the firm had hired a group of engineers and had a strong experimental culture.

On the other hand I found that a minor adaptation in the melting process was cited as a secretive tweak that gave a relatively small foundry some key advantage. The following vignette represents a an adaptive action mode of knowledgeable practice,

> "Chuck (a new engineer) was running some tests on the machine. He ran all of the jobs that were rigged the way the machine says you are supposed to rig it. One day he said, we don't have any work because we don't have anything rigged as per specifications. We said, 'come on.' We went to the pattern shop and we got scrap metal and got masking tape. We just took the tape and blocks of wood together and made it the width and height that suited our jobs. Chuck didn't learn that in college. He told me the book does not say that is what you are supposed to do. We said, but now we're going to teach you education. You learned from the prof for four years. Now we're going to teach what he didn't teach you. That's hands-on."

I also found tendencies of adaptive action in cost management and marketing domains. For example, a western Pennsylvania-based foundry's CEO, described an instance when he found some workers who had gotten minor injuries at work, sitting at home and enjoying hefty workers' compensation checks from his company. Not only was this a steep cost but also a major drain on the firm's trained manpower. The top management team came up with an idea of setting a separate room in the factory premises where he asked all those workers who were getting compensation to come and just sit there, instead of being in their homes, during regular shift hours. After a while these workers got bored of sitting in a room all day and started going to the shop floor. They eventually settled the workers compensation cases within a reasonable amount. The company was thus able to reduce its compensation cost and at the same time increase its available manpower. When I asked the CEO where he got this idea, he remarked

that he had heard from his worker's compensation insurance agent about a worker in another foundry who was notorious for having minor injuries all the time and was making a minor fortune while sitting at home collecting compensation checks from the company. The focal firm took this insight and extended it to come with the *room* idea. The CEO was very proud of this action as it led to non-trivial cost savings for the foundry. This example shows an ability to come up with novel adaptations of ideas without carrying out in-depth cost-benefit analyses and major experimentation.

It is necessary to note here that although the term "adaptive action" might seem to be disjointed from knowledge, it actually captures a distinct mode of *collective* knowledge application as embedded in specific actions that are undertaken inside a firm. Adaptive action seeks to capture the processes by which new knowledge is created by adapting existing knowledge, irrespective of whether that knowledge sourced from within or outside the firm, while solving local problems in novel ways. For example, in the vignette, the new engineer Chuck was facing challenges in using his college training to guide him in resolving the rig problem when the CEO showed him a simple way to accomplish the same task. On one level, what the CEO did could be seen as a standard case of knee-jerk problem solving but at a deeper level the action represents the adaptation of knowledge gained from years of shop-floor work to create new ways to solve a problem. This solution was expounded by Chuck himself when he said that the specific incident helped him to *fit* his formal engineering education into a different perspective. The CEO, in a separate conversation proudly professed that from then on, Chuck was a different person on the shop floor.

Table-7 Representative quotes underlying 2nd-Order Theme "Adaptive Action"

First-Order Codes	Representative Quotes
The competitive advantage comes from tweaking the process	You may take existing equipment. The machine is here, but we can update it. We did the same thing with our electric furnaces. We updated the controls with new technology. You do not have to go out and reinvent the wheel and buy a brand new piece of equipment just to get the new technology. – **Hi**
	I started getting more into the meat of the problem. We had this job that does not run. Let's get in there and get hands-on. Let's solve these problems. We also have specs on the raw materials we buy so the raw material is the same coming in. I would set these up for middle tolerance of the raw material, so there is a little bit of tweaking. Once you get your lab results back and see where you are at it is not going to be that far off that you have a bad problem. – **Hi**
	I don't like that word tweak. Because tweaking is not scientific. I think everything you can measure, you can fix. I don't think there is a tweak. I think there is a reason why it happened. You have no magic people. People perceive a foundry as magic. I don't believe it is magic. If you can measure it, you can fix it. -**Lo**
Not everybody can adapt and apply it to their own foundry	It's a little finesse after that, the wash, how to do this, how to cheat Know what you can get away with. Know what weight has to go on top of the mold so you don't run out. No rule of thumb. How to size the gating system. Yes, there are foreigners out there and there are computer programs that say you should size this gate for this modulus. We don't have time, expertise, resources, to sit down and design this thing to death. We go with experience. **Hi**
	But that being said, it's not the machine that is the valuable asset, it's what you do with it and what your employees can create with it. On the thermojets it has approximately a 9-inch cube for talking purposes. We have manufactured parts that are 18 inches wide and 4 feet long using that equipment. Most people wouldn't even attempt it, but we've got the ability to go through and modify the data file and slice it up, and we actually assemble wax patterns to produce a finished component. – **Hi**
	I have found that a lot of it has been researched in the industry already. So the actual implementation of it we have a lot of in-house problems. So you actually could have obviously technical people and we did have very good technical people, but they could not manage the information. So we ended up putting in very difficult systems to manage and process that were not very simple – **Lo**

b) *Generative Inquiry:*- The other form of knowledgeable practice concerns those actions or behavioral tendencies to reflect upon, stretch, and go beyond what the firm already knows about a specific problem situation. The emphasis here is less on solving a particular problem at hand and more on going beyond the bounds of that problem to generate new collective understandings and insights while still taking what it "*at hand",* that is, the firm's extant expertise and skills. Generative inquiry therefore represented a different *conduct* of knowledge application from adaptive action.

Generative inquiry builds something new by critically re-examining and furthering what it already known about a certain problem situation, whereas adaptive action is the smart use of what is known to sort out a problem situation in new ways. It is important to note here that both these forms of knowledgeable practice came across ways of applying organizational knowledge that led to the creation of something *new.* However, the critical difference was that in generative inquiry, the end result was most often the creation of new ways of looking at the same problem, new insights, and new skills, whereas the result of the adaptive action was the creation of a new method of resolving a problem at hand.

Like adaptive action, I found that generative inquiry was a tendency that the foundries displayed at the *collective* level. In those foundries that were high in generative inquiry, this tendency manifested in attempts to ensure that lower-level employees' skills are continuously upgraded and that they are given opportunities to experiment with new solutions and ideas. In these foundries the upper level managers see their roles more as coaches or translators who would ensure that the lower-level employees developed an understanding of "why" things were done in a certain way, as well as the principles behind the activities. The following vignette gives an example of generative inquiry,

> "When we get a new job, we dig right into it and take everything we know, everything we've done in the past, and try to find similar things that we've done and apply it to that. We go out and make one casting. We then cut the part up and look inside, we check the wall thicknesses, we look for internal shrinks, and then go on… until we get to the point where we feel like we "get it" and then it's submitted to the customer."

I also found evidence of "generative inquiry" in other domains besides technology. Notably, several CEOs and senior managers observed that the understanding of costs is important for the success of foundries. The ability to understand costs and share that understanding within the foundry is an example of generative inquiry.

In the domain of marketing and customers, generative inquiry manifested in behaviors and tendencies that enhanced the use of market and customer knowledge within the foundry. Activities that pertain to gathering, disseminating, and scrutinizing market and competitive trends all fall within the purview of generative inquiry. Table 8 shows a selection of quotes that represent instances of low and high generative inquiry.

Table-8 Representative quotes underlying 2nd-Order Theme "Generative Inquiry"

First-Order Codes	Representative Quotes
I am not talking about tweaking little things but creating new processes	But as far as what you were saying before that we haven't changed the process of investment casting, it's still a wax pattern, it's still a ceramic coating, and it's still pouring molten metal into that form. What we have done is married it to different alloys and different approach of where our product can be used and how it's being used, and that's the differential – **Hi**
	We do spend a lot of time and a lot of research and we look at our customer's growth, the markets they are in. We look at our customers from the standpoint of how much money they are reinvesting in their businesses. Are they growing or are they kind of dying on the vine?– **Hi**
	Once we have the routine down you don't want to screw with it. The last thing you need is a real creative metallurgist because you'll screw up your routine, so you've got to be very careful about what you change. So if somebody wants a new alloy or something we're willing to do that, but I'm not really anxious to mess around, well, let's take the manganese up. **Lo**
When we get a quote we don't just calculate the cost but try to understand the entire process	Well, I will tell you what. A lot of it is keeping your nose to the grindstone. When I took over this plant my boss used to go to Florida for six months a year. I do not do that. Maybe I could do it, but I won't do it. I am here six days a week. Even on a Saturday when there is not much to do I am here watching my maintenance people. You have to be here. **Hi**
	When we get a request for quoting we look at it not just from a standpoint of what that finished casting is going to cost, we go back and we analyze the best method of constructing a tool. We don't just look at it as a simple operation and take every quote and figure it by the pound or by the hour or whatever. We actually put a little bit of time into it. – **Hi**
	We want thinking people. We don't want just people that show up and do a job. We want them thinking about their work all the time. How can they make it better? How can they make this casting better? How can they clean it better? Is there a different grinding wheel to use, a different speed, a different configuration, a different grid pattern? We want them thinking about that and we want them trying new things and working with our suppliers to come up with these new ideas. That is not happening right now– **Lo**

6.6. Meta-Concepts Emerging from Stage-1

The findings discussed above can be seen as the three meta-concepts of a grounded theory framework that throws new light on the nature and role of managerial beliefs about knowledge. These meta-concepts are 1) executive knowledge schemes, 2) executive scanning, and 3) knowledgeable practice. Below, I reiterate the key findings so far:-

The analysis suggested the existence of "Executive Knowledge Schemes", which represent the cognitive *content* of managerial interpretive schemes about knowledge as a strategic resource. The schemes subsumed three dimensions, namely Competitive, Personal, and Control dimensions. The Competitive dimension, in turn, was composed of three sub-dimensions, namely, Knowledge Criticality, Knowledge Inimitability, and Knowledge Availability. The second order themes underlying the Personal and Control Dimensions of EKS are Knowledge Confidence and Knowledge Ascendancy, respectively. While the Competitive Dimension refers to beliefs about knowledge in the ambit of managing the firm's performance, the Personal dimension refers to the senior executives' self-perception about the quality of their own effectiveness in a knowledge domain, and the Control dimension refers to the executives' beliefs about the locus of intelligence and knowledgeability in their organizations. Therefore, whereas the Competitive dimension is *externally* directed, and the Control dimension is *internally directed* with reference to the organization and the Personal dimension is directed towards one own self. I found that senior executives across foundries have marked differences/variation in their Executive Knowledge Schemes *in spite of working in a highly regulated and mature industry*.

Executive scanning behaviors are the second meta-concept to emerge from the findings so far. I find that scanning is not just the *amount* of time devoted to information search (i.e., scanning intensity), but also *how* the information is searched for (i.e., scanning proactiveness).

The situated use of knowledge, which I term "Knowledgeable Practice," emerged as a novel way to understand how firms view the importance of knowledge as a strategic resource. This importance lies less in *how much* knowledge is possessed and more in the *application* of knowledge in the context of new situations that the foundry faces. The two dimensions of knowledgeable practice, namely Adaptive Action and Generative Inquiry represent two related but divergent ways of applying knowledge in the service of managing foundry operations. The findings suggest that firms differ in the levels of Adaptive Action and Generative Inquiry.

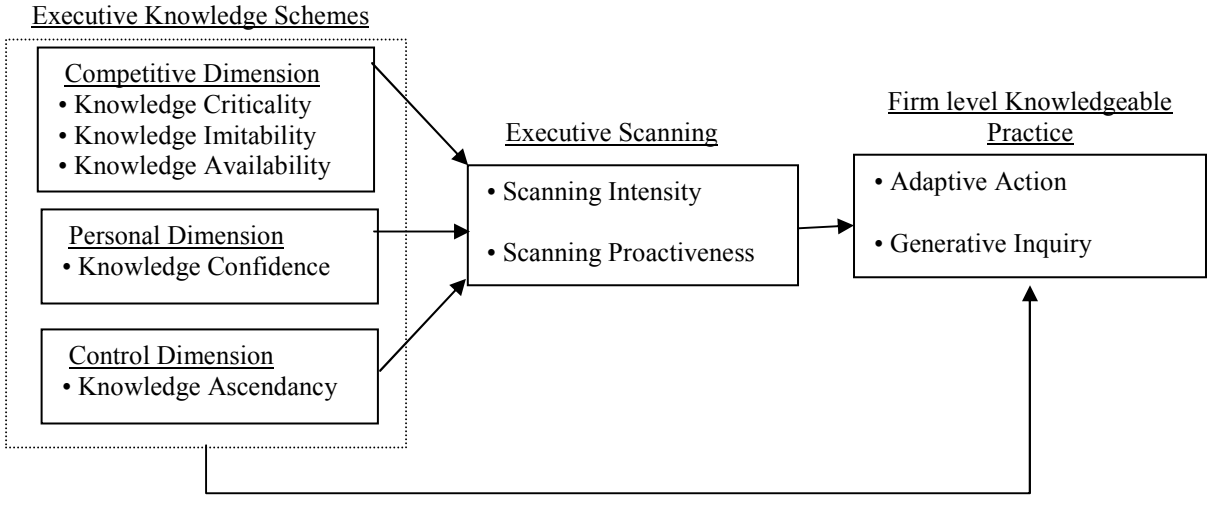
Analysis of the data also suggested that these emergent concepts might fall into a nomological net wherein executive knowledge schemes influence scanning and firm level knowledgeable practice. In the next chapter, I develop the grounded theoretical framework and lay out some tentative propositional relationships between the three meta-concepts, EKS, executive scanning, and knowledgeable practice, which in turn will form the basis for a large scale generalization study in the metalcasting industry (i.e. Stage-2) of this dissertation.

Chapter-7

EXECUTIVE KNOWLEDGE SCHEMES, SCANNING, AND KNOWLEDGEABLE PRACTICE- A GROUNDED MODEL

In this chapter, which can best be viewed as an extension of the findings of Stage-1 of this dissertation, I present the relationships among the three main second-order concepts that emerged from the analysis. Figure-8 shows the grounded model of the relationships between executive knowledge schemes, executive scanning, and firm-level knowledgeable practice[2]. I develop a series of testable propositions that form the elements of a grounded theory that helps understand the interplay between managerial cognition and knowledge as a strategic resource. The first set of important relationships that emerged was based on the influence of EKS on scanning behaviors of the focal executives. I discuss these in detail. Figure-9 presents a detailed view of this emergent theoretical framework, which in turn forms the basis of the next stage of my dissertation.

Figure-9- Emergent Theoretical Framework from Stage -1



[2] Although a purist rendition of grounded theory would have the grounded model presented at the end of the findings, I am introducing it at this stage to ensure ease of reading.

7.1 Executive Knowledge Schemes and Scanning

7.1.1 Knowledge Criticality and Scanning

My findings suggested that the knowledge domains that a CEO perceives to be of critical strategic importance to the firm are also likely to be the ones where s/he scans the most and is largely proactive in the search process. For example, a CEO of medium-sized gray iron foundry in Pennsylvania observed that knowledge of sales and marketing was very important not only to his own firm's continued success but more significantly to the success of the industry as whole. This view was echoed by some other CEOs, industry experts, and published articles in industry trade journals. The metalcasting industry as a whole is seen as relatively poor in the general area of sales and marketing.

The CEO of the Pennsylvania foundry, while stressing the importance of marketing, emphasized his own activities as far as scanning in that area was concerned. He gave me examples of how often he would spend time visiting his key customers and making every effort to build relationships with a wide range of managers in the customers' organization. He felt that this was an important activity as it allowed him to "keep tabs" on his customers' financial health. The moment he felt that a given customer's business was suffering, he would being that information back into his foundry and from then on, the business that the foundry got from that customer would be *watched* more closely to ensure that his foundry was not ending up supporting a loss-making account.

Another senior executive, while speaking about his CEO, emphasized the "quality" of his abilities in managing foundry costs. This executive stressed that a true understanding of costs is essential for financial success in present day foundry operations. When I inquired further as to why he felt that his foundry's CEO has a strong ability in the cost management area, he gave me

examples of the CEO's search activities both inside and outside the foundry. For example, this CEO insisted on daily reports on production runs, scrap (reject rates), and quality control data. The CEO would personally spend time in those areas of the foundry where there were cost overruns. These evidence supporting this finding offers the possibility of laying out a general proposition that,

P1: Executives are likely to scan more in those knowledge domains that they consider critical for success.[3]

7.1.2. Knowledge Availability and Scanning

As discussed in Chapter 6, senior executives across the foundries I interviewed tended to show marked variance in their beliefs about the amount and quality of knowledge available from outside their firm's boundaries. Some foundry CEOs were in appreciation of the quality of information and expertise that is available from major state and national level trade associations, and key suppliers. There were other CEOs who interpreted the overall foundry community to be very receptive and cooperative in terms of sharing knowledge about casting challenges and techniques, potential casting orders, etc. However, the relationship between knowledge availability and the scanning emphases of a focal executive is somewhat complicated. On the one hand the beliefs about knowledge availability in a given domain seems to make senior executives put greater emphasis on external scanning, because they believe that competing foundries, including those that are overseas, can easily access knowledge from external and internal sources

[3] My use of the term scanning in this propositions developed here includes both scanning proactiveness and scanning intensity.

and, therefore, the source of advantage might lie not just in connecting with those sources but ensuring that the focal firm's quality of information gained is better than the competitors. This entails a need on the part of senior executives to be more aggressive and involved in their scanning activities rather than being passive recipients of "free advice".

This factor came out in a number of interviews, the first one with a ductile iron foundry's president who noted that one of the most important sources of competitive information is salespersons of technical equipment and raw material suppliers. These salespersons play an intriguing role of somewhat like "information traders" in the sense that they provide a focal foundry key internal information about its competitor foundries such as the casting jobs in which they are not doing well, internal management developments and challenges etc. While the president acknowledged the value of entertaining the salespersons, he shared his own technique to ensure that he was getting quality information from a given sales person. This president would use his personal contacts to cross-check the information with other salespersons and with his own employees who had contacts with the competitor foundries. In this way, he would be able to "qualify" his salespersons in terms of who gave useful information and who didn't.

A senior executive in another Wisconsin-based foundry wanted to "challenge" a belief in the industry (as he perceived it) that it is hard to get high quality information in the foundry industry. This executive remarked that "the information is all around us….people have to look in the right places" which, when I asked him to expand on, meant that he believed in building extensive contacts with personnel in key supplier companies (those that supply major foundry equipment) and actively participate in industry technical workshops to be on the forefront of receiving early information on technical advances. This observation suggested that a perception that information in a given domain was widely and easily available led an executive to scan more

rather than less, to ensure that they stayed ahead of the competition in sourcing and using it. Therefore I offer the general proposition that,

P2: Executives are likely to scan more in those domains where they perceive that knowledge is easily available from industry sources.

On the other hand, I also found some evidence of a reverse relationship between knowledge availability and scanning. Some senior executives seem to "take for granted" the help given by entities such as technology suppliers, state and federal government sponsored consulting programs, and research dissemination from universities, to the extent that they feel that even if they just maintain a passive stance, information is going to reach them one way or the other. This led to me entertain the contrary argument that believing in high knowledge availability might be related with *lower* scanning by the senior executive in that domain. Therefore conversely,

P2a: Executives are likely to scan less in those domains where they perceive that knowledge is easily available from industry sources.

7.1.3. Knowledge Inimitability and Scanning

I also encountered senior executives who believe that their foundries' expertise and know-how in a given area is imitable and surmountable by competing foundries. For this reason, these executives came across as very protective and averse to sharing and searching for information in those areas with both competing and non-competing foundries. For example, one

CEO claimed that they had developed a way of improving the metal charge (molten metal that comes out of the furnace) by making a small change in the melting process and this method was almost a "cult secret" in their foundry and no one was allowed to discuss that with outsiders. In some foundries, the CEOs expressed a marked openness to sharing and seeking information, even from close competitors. Further inquiry revealed that these executives were confident that their firms' advantages in a given area would not be appropriated even if competitors came to know of their activities. The believed that their foundries had achieved adequate capabilities in the concerned area to maintain their competitive advantage. Therefore, I propose,

P3: Executives are likely to scan more in those knowledge domains where they perceive their firm's knowledge and skills to be more inimitable.

7.1.4. Knowledge Confidence and Scanning

A dominant finding from studies of self-efficacy is that high efficacy beliefs in a given area usually lead to heightened interest, motivation, and focus on that area. According to Starbuck and Milliken (1988) managers are more prone to focus on those areas where they have achieved mastery because those areas are cognitively central to them. My analysis also suggests that high levels of confidence in a given knowledge domain seems to enable senior executives to take risks and, therefore, be more critical in their perspective in that domain and engage in a form of "reinforcement scanning". In other words, a senior executive who sees her/himself as having high efficacy in a production technology is likely to spend extra effort to ensure that s/he stays at the forefront of knowledge development in that domain and continuously improve her/his understanding about it. Therefore, I propose that

P4: Executives are likely to scan more in those domains in which they have higher confidence in their own knowledge.

Interestingly, I also found some limited evidence of an opposite relationship in a few interviews. In these cases, I had objective information from industry publications, as well as prior interviews with industry experts and competitors, that the CEOs were very competent in a given domain – in one case, shop-floor operations. Nonetheless, in the interviews with these CEOs, they did not emphasize the need to search for information in the shop-floor technology area, while evincing a level of understated confidence about their skills in that area. Therefore, it is possible that high knowledge confidence in a given area might actually serve to *reduce* the amount of search activity in that area as the focal executive feels that there is little to learn from out there. Therefore,

P4a: Executives are likely to scan less in those domains in which they have higher knowledge confidence

7.1.5. Knowledge Ascendancy and Scanning

My analysis of the data suggested that senior executives differ in their beliefs about the level of intelligence and autonomous expertise in their organizations. Some executives came across as task-masters, viewing lower-level employees as rule followers and in the process taking on the onus of most of the "intellectual processing" in the organization. Almost correspondingly,

most of the scanning activities were carried out by these executives, almost suggesting that the firm was a "one man" institution[4].

A complementary facet of knowledge ascendancy was that some of these executives who attributed relatively "low" intelligence to the lower echelons were also the ones who spent a significant amount of time personally following trends within their foundries as well. Given the complexity of the metalcasting processes, this sometimes came across as a well-appreciated trend among industry experts. For example, one industry expert gave an example about a large steel foundry's CEO who he found to be extremely aggressive on the shop floor, often cutting through hierarchical levels to solve day-to-day problems, even when he has the managerial resources at his disposal. I interviewed this CEO and found that the same high level of knowledge ascendancy in him. Therefore, I came to the tentative conclusion that

P5: Perceptions of greater knowledge ascendancy in a knowledge domain are likely to drive executives to scan more in that domain.

7.2 Executive Knowledge Schemes and Firm Level Knowledgeable Practice

Besides suggesting linkages between EKS and executive scanning, my findings also point towards the possible influence of knowledge schemes on the levels of adaptive action and generative inquiry that occur in a focal foundry. I expand on those insights here.

7.2.1. Knowledge Criticality and Knowledgeable Practice

The relationship between beliefs about knowledge criticality and firm level knowledgeable practice was not straightforward. In a few instances I found that in a given

[4] One might argue that the smaller the foundry, the greater the incidence of a "one-man" institution. However, I found this tendency in larger foundries as well.

knowledge domain where the perceived criticality was higher, the CEOs tended to take most of the key decisions themselves without involving lower and middle level employees. Furthermore, some of these CEOs demonstrated a tendency to take hands-on decisions pertaining to these areas.

P6: Executive perceptions of increased criticality of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type.

On the other hand I also found several foundries where the areas the CEOs believed to be critical were the same ones they emphasized that employees throughout their organization should spend efforts to improve their skills in that area. The CEOs also emphasized the need for employees to be given opportunities to engage in searching for creative solutions to problems in that area, that is, greater firm level knowledgeable practice. On the whole the latter pattern seemed to dominate; i.e., greater perceptions of criticality of a given knowledge domain were associated with CEOs emphasizing a higher level of "intellectual" work from their lower-level employees. Therefore I propose,

P6a: Executive perceptions of increased criticality of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.

7.2.2. Knowledge Inimitability and Knowledgeable Practice

In general I found that those areas which the senior executives perceived that their firms have a strong advantage vis-à-vis their competitors were also the areas where firms exhibited high level of knowledgeable practice. However, differences emerged in whether a firm displayed

a greater tendency to engage in adaptive action or generative inquiry in a given area. In some firms, I found that the senior managers extolled their firms' abilities in shop-floor operations and when I asked them to give me examples, they shared several instances which had a common theme. In most of these instances, the focal foundry had either developed a perceivably novel/secret "recipe" solution to a vexing metalcasting problem faced by several foundries or the foundry had been able to come up with a simple, low-cost, solution when it was faced with a problem that would have ideally required a larger capital expenditure. From these instances, I concluded that the beliefs about knowledge inimitability (in this case, in the shop-floor technology domain) were closely related to the kind of knowledge application (adaptive action) that these managers encouraged and valued in their foundries. As a corollary, perceptions of inimitability appeared to be related to a lower need for engaging in generative inquiry, or in other words, extending the bounds of the firm's current knowledge base in a particular area. Therefore, based on these findings, I propose that

P7: Executive perceptions of increased inimitability of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type.

or,

P7a: Executive perceptions of increased inimitability of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.

7.2.3. Knowledge Availability and Knowledgeable Practice

The relationship between knowledge availability and knowledgeable practice was more straightforward. In those cases where the senior executives displayed a perception that on the

whole it is easier to access knowledge from industry sources, I found evidence of enhanced levels of generative inquiry in those areas. A common pattern emerged in the findings pertaining to this relationship, which is represented by the following quote,

> "You always have access to the AFS technical consultants. You can always "buy" experts to solve your problems. The challenge is what you "do" with all that help. For example, this foundry rebuilds all the equipment it buys from the scratch and final product is a lot better than what competitors are able to get from the same machines".

Therefore, I propose that

P8: Executive perceptions of increased availability of knowledge in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.

7.2.4. Knowledge Confidence and Knowledgeable Practice

The relationships between perceptions of confidence in a given knowledge area on behalf of the firm's CEO/President had a similar relationship with knowledgeable practice, as was seen in the relationships between knowledge confidence and executive scanning. On the one hand, I found that in those foundries where the senior executives had high confidence in a given knowledge area, the rest of the organization tended to be "subservient" to that executives directives and expertise in that area. But at the same time, it became evident that in these foundries the nature of knowledgeable practice was more of the adaptive action type. A potential reason for this could be that the remaining employees of the organization were so "dependent" on new knowledge generation by the top executive, the best they could come up with were smart and creative adaptations of what the senior manager told them. Therefore, I reasoned that,

P9: Executive perceptions of knowledge confidence in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type.

On the other hand, I also encountered some other foundries where the executive, even though s/he was highly confident about her/his capabilities in a given knowledge area, found greater value in engaging the entire organization in generative inquiry. In these instances, it seemed that perceptions of high confidence provided the executives with the confidence to allow and encourage lower-level employees to think beyond the box in that corresponding area. I therefore offer the alternative proposition that

P9a: Executive perceptions of knowledge confidence in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.

7.2.5. Knowledge Ascendancy and Knowledgeable Practice

As discussed earlier in my interviews, I found wide variations among foundries in the quality and effort that the organization put into sharing, educating, and listening to ideas from employees. In some foundries most of the "intellectual" work is seen as falling in the sole domain of the upper echelons. The tendency in these foundries is to see middle and lower-level employees as "doers" rather than "thinkers". Hence, the upper level manages see their role as one that primarily focuses on maintaining conformity to set routines and controlled behavior. On further scrutiny I found that the upper-level managers of these foundries believe that most lower-level employees are not qualified and educated enough to come up with new ideas to improve operations. By and large, the evidence suggested that foundries with higher perceived knowledge

ascendancy among senior executives, devoted limited efforts to developing an organization-wide orientation toward greater understanding of foundry operations. This led me to propose that,

P10: Executive perceptions of increased knowledge ascendancy in a given domain are likely to reduce the tendency of the firm's knowledgeable practice (both adaptive action and generative inquiry).

7.3 Executive Scanning and Knowledgeable Practice

I also found evidence of potential associations between foundry executives scanning behaviors in terms of both proactiveness and intensity, on the level of knowledgeable practice carried out in the firm. In general the patterns of findings suggest that both scanning proactiveness and intensity are likely to have a dualistic relationship with knowledgeable practice.

On the one hand, my findings suggest that by being more proactive and scanning more intensely in a given knowledge domain, the senior foundry executives are taking on a "cognitive processing" load for themselves and in the process freeing up the rest of the organization to engage in other knowledge domains. In other words, this relationship is *complementary* in nature. Therefore, I propose that

P11: Greater the executive scanning in a given knowledge domain, lesser will be the knowledgeable practice in that domain.

I also encountered some cases where the opposite effect was perceivable, that is, increased scanning proactiveness and intensity in a given knowledge domain acted as a signal to

the rest of the firm to engage in knowledgeable practice in that domain. This relationship was *reinforcing* in nature, where the senior executives' scanning emphases in a particular knowledge domain set an example for other employees to engage in knowledgeable practice in that domain. Thus,

P11a: Greater the executive scanning in a given knowledge domain, greater will be the knowledgeable practice in that domain.

The above propositions, which emerged from the analysis of the data that I collected in Phase-2 of my dissertation, form the primary concepts and relationships among concepts that permit the generation of a theoretical framework that links the role of managerial cognition about knowledge as a strategic resource and how those cognitive factors influence managerial scanning and firm-level knowledgeable practice. The ensuing stage, which is a large-scale quantitative research project, is aimed at further investigating the emergent relationships over a representative sample of metalcasting firms across the United States. In the next chapter, I lay out the theoretical rationale for Stage-2, which is based on discussion of the findings from Stage-1 and the comparisons of those findings with extant literature.

Chapter -8

DISCUSSION OF STAGE-1 AND THE CONCEPTUAL BASIS FOR STAGE-2, LARGE SCALE QUANTITATIVE STUDY

In Stage-1, the interpretive, grounded theory development stage of this dissertation, I have attempted to understand better how the cognitive beliefs of senior managers influence their own knowledge search behaviors and the ways in which knowledge is actually used in situated activities. First, I find evidence that CEOs and other senior executives of firms operating in a largely homogenous industry do display variability in their cognitive beliefs about knowledge as a strategic resource. These beliefs, which I call Executive Knowledge Schemes, operate in more than one knowledge area or domain and influence the scope of executive knowledge search and firm level knowledge application.

In the next sections, I discuss the broad theoretical implications of the findings from stage-1 taking each of the three meta-concepts (and their constituent themes) at a time. I then proceed to draw linkages with extant literature and generate a few supplemental propositions to enhance the broader relevance of the findings.

8.1. Executive Knowledge Schemes

Competitive Dimension

This theoretical construct captures the nature of interpretive judgments that a firm's top managers ascribe to knowledge about its importance in the creation and maintenance of firm performance. Knowledge is an important resource that firms can obtain from their external

domains. In the case of small firms, especially, external knowledge can play a more pertinent role as these firms do not have the financial resources to support massive R&D programs for internal knowledge generation. However, as evident in the findings from the interviews and some past research (c.f. McEvily & Zaheer, 1999), firms exhibit wide variance in their proclivities to source knowledge externally. Trade associations, governmental regulatory agencies and research universities usually act as important sources of technical and managerial knowledge for firms. However, firm's top managers might differ in the level of importance and deference they ascribe to sourcing knowledge from these sources.

Personal Dimension

The notion of self-efficacy has attracted significant research in behavioral and cognitive psychology. Some of this work, especially in the field of educational psychology has examined how self-efficacy beliefs influence information search and learning in students (Pajares & Miller, 1994; Ryan, Gheen, & Midgley, 1998). Wood and Bandura (1989) in their development of a socio-cognitive theory of managerial behavior demonstrated that managerial self-efficacy beliefs influenced their analytic strategies and performance. Bandura (1997) defines self-efficacy as the belief in one's capability to organize and execute the sources of action required to manage prospective situations (Bandura, 1986).

The findings from Stage-1 suggest that a senior executive's perceptions of efficacy in a given knowledge domain not only influence the nature and scope of information search in that domain but are also likely to influence the nature of knowledge application in the organization. The concept of "Knowledge Confidence" is therefore, a more specific instance of the general self-efficacy construct.

Control Dimension

What is considered as valid organizational knowledge is an outcome of social and political exchanges that occur within a firm. Taking the view that knowledge is "justified true belief," knowledge creation and utilization is likely to involve power differentials in a firm (Nonaka, 1994; Nonaka & Takeuchi, 1995). Intraorganizational conflict and competition for resources might bring knowledge right to the center of power struggles within organizations (Pfeffer & Moore, 1980). The ability to stake a claim for legitimizing knowledge is an important and understudied aspect of knowledge creation processes in organizations. Additionally, the use of knowledge within a firm is likely to be closely linked to notions of organizational control (March & Simon, 1958; Taylor, 1911). As an essential productive input, a firm's top managers are likely to perceive the need to control and channel knowledge to ensure that this input, like other factors of production enables them to achieve the objectives of their shareholders. Thus, knowledge in a firm and the processes involving its production and utilization are likely to be influenced by the political factors. The "Knowledge Ascendancy" concept brings forth this phenomenon and offers a new way to understand managerial beliefs about knowledge, especially in the context of organizational power and politics.

To summarize, Stage-1 has revealed some important, hitherto less understood aspects of managerial beliefs about knowledge as a strategic resource. An important issue raised by these findings is the question, "Why do managers operating in similar objective environments vary in their beliefs about knowledge?" An interesting area of research might be the exploration of factors that influence these beliefs. For this I explore linkages with extant literature on managerial demographics. Past research as discussed in Chapter 2 has shown that managerial

demographics do influence managerial beliefs and interpretations. Therefore, to supplement the emergent findings, I offer a general proposition that

P12: Demographic factors such as functional experience, firm and industry tenure, education, and age will influence content of Executive Knowledge Schemes, along the dimensions obtained in the study so far.

8.2 The Drivers of Executive Scanning

As one of the earliest researchers of managerial scanning, Aguilar defined it as the "activity of acquiring information about events and relationships in a company's outside environment, the knowledge of which would assist top management in its task of charting the company's future course of action."(Aguilar, 1967: 1) Studies on executive scanning have enjoyed a long and fruitful tradition in strategic management research. The concept of scanning assumes organizations to be open-systems (Katz & Kahn, 1978) and views managers as "information processing" entities (Mintzberg, 1983; Walsh, 1995).

Traditional environmental scanning literature has paid limited attention to drivers of scanning behaviors in top executives, focusing primarily on their perceptions and/or the objective conditions of a firm's environments or strategies (Garg, Walters, & Priem, 2003; Hambrick, 1982). Table-9 provides an annotated list of empirical studies that have looked at factors which influence managerial scanning and information search. While this list is undoubtedly rich, relatively little work has been done in understanding how managerial cognition influences scanning. In the studies listed in Table-9, only Dollinger (1984) directly

studied two cognitive factors – integrative complexity and intolerance to ambiguity as drivers of managerial scanning.

Table-9- Empirical Research on Antecedents of Managerial Scanning[5]

Empirical Study	Antecedents of Scanning	Scanning Activity
Hambrick (1982)	Firm Strategy	Scanning Frequency Scanning Interest Scanning Hours
Culnan (1983)	Task Complexity Source Accessibility	Information Search Behaviors
Dollinger (1984)	Integrative Complexity Intolerance to Ambiguity	No. of search hours in a sector No. of external contacts
Ghoshal (1988)	Mimetic Isomorphism (Institutional Forces)	Types of Information Acquired Scanning Modes Information Sources
Daft, Sormunen, and Parks (1988)	Strategic Sector Uncertainty	Scanning Frequency Scanning Sources
Boynton, Gales, and Blackburn (1993)	Role Uncertainty Role Threat	Amount of Search Activity
Sawyer (1993)	Perceived Environmental Uncertainty	Scanning Frequency Scanning Interest Scanning Sources
May, Stewart, and Sweo (2000)	Perceived Strategic Uncertainty	Scanning Frequency Scanning Sources

[5] The breadth of the scanning literature precludes an exhaustive listing. Efforts here are aimed at displaying maximum variety in antecedent factors.

While this work is highly relevant, little has been done since then to understand the effect of managerial beliefs and values on the amount and nature of scanning they engage in. This apparent scarcity is paradoxical in the face of major theoretical and conceptual predictions about the likely importance of these antecedent factors. For example, Hambrick and Mason (1984) argued that "executive orientations" that include among other factors, managerial cognition, directly influence their "field of vision", which represents the areas they are likely to search information in. Similarly, Hambrick and Finkelstein (1996: 65) have proposed that factors such as managerial cognitive styles and functional backgrounds are likely to influence the nature of scanning activities. Nonetheless, on the empirical front, even though the scanning literature has attracted significant attention, we know relatively little about why managers scan differently in the first place. Within the realms of the upper-echelons perspective (Hambrick and Mason, 1984), there is a marked lack of research that has sought to understand the linkages between managerial cognition and scanning, regardless of whether cognition is studied directly or through the use of demographic proxies. I therefore at this stage offer a general proposition beyond those that emerged from Stage 1 that

P13: Demographic factors such as functional experience, firm and industry tenure, education, and age will influence the level of scanning proactiveness and intensity in which a senior executive engages.

Hambrick (1982) studied the influence of firm strategy on managerial scanning but did not find a consistent link between firm strategy and executive scanning emphases. Some others have studied how beliefs about the environment, such as its complexity, dynamism etc. influences scanning behavior in that environment (Daft, 1985; Garg et al., 2003). Although these studies have given us a firm understanding of the importance of scanning as a key managerial

activity, we have not yet asked a more fundamental question about why managers show variance in their scanning tendencies, even when operating in largely similar operating environments. The findings from Stage-1 of this dissertation suggest that *beliefs about knowledge influence differences in the intensity and nature of scanning among senior executives functioning in largely similar objective environments.* Hambrick (1982) observed that managerial scanning is an important driver of organizational adaptation. This observation is cogent for my findings from Stage 1, wherein I found scanning activities to have a potentially strong influence on the ways in which knowledge is applied in firms. Past studies have shown that executive scanning influences or drives managerial and organizational level outcomes such as managerial power (Hambrick, 1981), interpretation of strategic issues (Thomas et al., 1993), firm performance (Dollinger, 1984; Daft et al. 1988, Garg et al., 2003). Nonetheless, studying the potential effects of managerial scanning on firm level knowledge application can enhance our understanding of the key processes by which scanning enhances organizational adaptation.

8.2. Knowledgeable Practice

As seen in Figure-8, knowledgeable practice is likely to be influenced by both the meta-concepts discussed earlier. In this section, I develop the concept of knowledgeable practice further.

The knowledgeable practice concept finds support in the pragmatic philosophical works of Dewey (1922) and Ryle (1949). Although the early works of Dewey and Ryle were framed largely at the individual level, they can be applied at the collective level as well. For example, Weick and Roberts (1993) utilized Ryle's concept of the mind as "heedful action" in developing their notion of a collective mind in organizations.

Although Dewey's notion of reflection has not been directly adapted to the collective level, the opportunity for such an application exists. In more recent works, some scholars like Schon (1978), Cook and Seely Brown (1999), Dougherty (1992; 2004), and Pentland (1992) have built on Dewey's and Ryle's earlier insights linking knowledge to action. In doing so, they have developed a "practice" perspective on knowledge and knowing wherein the former is seen as a "tool" that is employed in performing day to day activities. These works have also been enriched with sociological theories of practice (Bourdieu, 1977) with the core idea that knowledge is not something that is an abstract object but inheres in situated performance. For example, building on Dewey's notion of reflection, Schon developed concept "reflective practice" by which he implies an active experimentation with a given situation at hand using whatever knowledge one has (Argyris & Schon, 1978). This online, real-time experimentation and research into one's practice constitutes situated knowledge. Dutton and Thomas (1985) argue that "know-why" develops from "learning by studying" that is, through controlled experimentation and simulation to understand the fundamental principles and theories underlying technological systems. Garud (1997) argues that "know-why" is generated from a process of cumulative synthesis in which ideas from different domains are joined to create a novel insights. He likens this to the process of "bisociation" where two ideas from unrelated fields are associated to generate a totally new idea (Koestler, 1964).

Pentland (1992) uses Ryle's (1949) argument that "knowledge" refers to certain kinds of individual performances, and extends it to the organizational level to show empirically that organizational knowledge refers to certain kinds of organizational performances. By "performance," one should not confuse the concept with the more commonly studied measures of organizational performance. Instead, Ryle (1949) and later Pentland (1992) refer to it as the

abilities and patterns of behavior that organizational members engage in order to solve day-to-day problems.

The bifurcation between adaptive action and generative inquiry as two distinct facets of knowledgeable practice is guided primarily by findings from the interviews that also resonate with another rich stream of literature in sociology and education on "knowledge and information utilization" (Caplan, Morrison, & Stambaugh, 1975; Holzner & Marx, 1979; Larsen & Werner, 1981). Hitherto under-utilized in organizational studies, barring a critical review and extension of utilization research by Beyer and Trice in the Administrative Science Quarterly (Beyer & Trice, 1982), research in knowledge utilization has focused primarily on the use of social science research knowledge by public-policy makers and administrators. In the field of education, this work has focused on the "levels of use" of educational innovations in schools, as seen primarily in the works of Hall and his colleagues (Hall, Loucks, Rutherford, & Newlove, 1975). Although focused at an individual teacher level, these authors have sought to measure the level or advancement of innovation adoption ranging from no awareness of the innovation to "renewal" use, where the innovation is not only adopted but actively modified by the adopter.

Research in knowledge utilization has made a major distinction between "instrumental" and "conceptual" uses of knowledge. Whereas the former refers to the use of knowledge to solve a particular problem or in a specific decision, the latter refers to use of knowledge for general enlightenment and understanding rather than any current action (Caplan et al., 1975). Scholars in the field of marketing have adopted research in knowledge utilization to study the use of market research information in firms (Deshpande & Zaltman, 1982; Menon & Varadarajan, 1992; Moorman, 1995).

The key insights from the knowledge utilization literature that are pertinent for this dissertation are first, this approach provides support for conceptualizing and measuring the *use* of knowledge rather than measuring knowledge itself (a distinction, as I have argued earlier, has not been made explicitly in the knowledge based view literature). Second, the division between instrumental and conceptual use of knowledge provides theoretical support for the empirical finding from the interpretive phase that adaptive action and generative inquiry are two related but distinct aspects of knowledgeable practice.

In the next section, I venture to locate knowledgeable practice within the broader ambit of strategic outcomes such as innovation. If knowledgeable practice represents a novel way to conceptualize and empirically study how knowledge is adapted, enhanced, and applied in organizations, then such a concept can play a major part in understanding/predicting relevant firm outcomes. I discuss some relevant literatures to explore these possibilities.

8.3.1. Knowledgeable Practice and Firm Outcomes – Open Questions

The concept of knowledgeable practice enables us to grasp the micro-level organizational practices by which knowledge is *applied* in the service of creating and maintaining competitive advantage. It therefore, opens up a potentially new area of inquiry wherein the degree of knowledgeable practice might influence firm outcomes, especially its levels of incremental and radical innovation. Furthermore, because knowledgeable practice represents how well knowledge is used in strategic situations, one can begin to explore the role that it plays in enhancing the value of knowledge assets that a firm possesses. The knowledge-based view of competitive advantage views knowledge as a primary strategic resource. Therefore, the main prediction of the KBV revolves around how a firm can maximize the output from its knowledge-

based resources. Two such resources have garnered attention in the managerial and economics literatures – Human Capital and Social Capital.

8.3.1.1. Human Capital

The notion of human capital emerged in the education field (Schultz, 1960) and has been developed further by labor economists and management scholars. The human capital view is based on the fundamental premise that organizational employees possess skills and knowledge that brings economic value to the firm.

Past research has shown that investments in human capital have generally been associated with enhanced firm performance (Cardinal, Hatfield, & Korn, 2002; Hitt, Bierman, Shimizu, & Kochhar, 2001; Manev, Gyoshev, & Manolova, 2005). However, this research has also pointed to possibility that human capital, by itself, might not lead to positive firm level outcomes but it needs to be *leveraged* and utilized in consonance with other organizational mechanisms (Cardinal et al., 2002; Carpenter & Fredrickson, 2001). Recent research, surprisingly, has found that high levels of human capital, hinder the radical innovation capacity of firms (Subramaniam & Youndt, 2005).

There is therefore a need to look at *how* the knowledge assets that are embedded in a firm's human capital base are actually employed in order to understand the conditions under which human capital becomes a useful resource in the creation of positive firm outcomes such as innovation. I argue that knowledgeable practice offers a way to understand this linkage. In other words, the effect of human capital on organizational innovation is dependent on the level of knowledgeable practice in which members of the organization engage. Therefore,

P14: Knowledgeable Practice will mediate the relationship between the quality of human capital and a firm's innovative output.

8.3.1.2. Social Capital

Social capital was comprehensively defined by Coleman (1988) in his study of the effects of social structure on the dropout rates of high-school students in North American schools. However, the idea of social capital as a viable determinant of firm behavior and outcomes was developed by Burt (1992). I need to qualify this statement by adding here that even though Burt's ideas of social capital were not presented at the firm level, they were indeed nested in the realm of competitive economic activity and can be used to understand firm level behavior. Burt posits that the social ties of a player (in our case, a firm) provide it with a source of competitive advantage because of differential access to information about investment opportunities. Some scholars on the other hand, have defined social capital as the set of resources, tangible or virtual, that accrue to a corporate player through the player's social relationships, facilitating the attainment of goals. (Gabbay and Leenders, 1999). The concept of social capital as the determinant of economic success is based on the premise of an imperfect market. In a market with perfect competition, all resources (information, technology, and raw-materials) are uniformly distributed. Investment flows from low-yield ventures to high-yield ventures and eventually the market reaches a point where the rate of return is uniform. On the other hand, in an imperfect market, entities can have varying access to resources through their relationships and affiliations and consequently, varying opportunities for investment and profit. This implicit competition for resources determines firm behavior and eventual survival in an imperfect market. The availability of dependable information on time is a key to ensuring firm survival especially

in an unstable environment. The apparel industry that Uzzi (1996) studied was prone to sudden changes in fashion tastes. It was in this context that he found that strong social ties acted as conduits of highly dependable and timely information which would enhance the focal firms' ability to adapt to the changing market situation and avoid loss-making investments which might threaten their survival. Powell, Koput, and Smith-Doerr (1996) in their study of Biotechnology firms found a strong correlation between a firm's centrality in its network of social ties with other firms at a given time, and its subsequent innovative output as measured by the number of patents filed. Tsai (2001) found strong support for the role social capital in enhancing firm performance and innovation. However, this relationship was enhanced by the level of absorptive capacity of the firm. Tsai found that absorptive capacity significantly moderated the relationship between a firm's position in a knowledge-sharing network and its innovative output.

Nahapiet and Ghoshal (1998) offered a comprehensive framework that links a firm's social capital to competitive advantage. They argued that this relationship was contingent on the firm's "intellectual" capital which they conceived as the ability of the firm to create new knowledge. The concept of Knowledgeable Practice offers a way to empirically study and extend the notion of intellectual capital. I therefore propose that

P15: Knowledgeable Practice will mediate the relationship between social capital and a firm's innovative output.

8.3.1.3 Technological Complexity

While both human and social capital are types of knowledge-based assets that inhere in organizational members and their social relations, knowledge in the form of technology can also be embedded in a firm's current equipment. As mentioned in Chapter 4, the foundry industry has

undergone major technological developments to the point where the level of process automation has increased significantly and US foundries as a whole have been graduating towards increasingly complex casting designs. Both these organizational factors, that is, level of automation of equipment and complexity of castings can represent a foundry's "knowledge" as it is embedded in the engineering aspects of equipment and castings. Therefore, I categorize a firm's technological complexity as one of its knowledge assets. I propose,

P16: Knowledgeable Practice will mediate the relationship between technological complexity and a firm's innovative output.

In the next chapter, I lay out the structure of the second stage of this dissertation that involves a large sample field study of US-based metalcasting firms. A simplified view of the quantitative study would be to see it as an occasion for *testing* the propositions that emerged from stage-1 of this dissertation. However, I would like to urge the readers to evaluate the next stage on the premise that it too is a *continuation* of the grounded theory development process. While discussing the processes of grounded theory development, Strauss and Corbin (1998) stress that the process involves *verification* throughout the research project and might involve the use of multiple methods (p: 161). As is evident from the propositions developed above, some of them have alternative propositions suggesting the concerned constructs might be related in somewhat opposite fashion from what is proposed. Stage-2 of the dissertation is intended to *investigate, clarify* and *distill* the relationships further to see which relational directions predominate.

Chapter-9

STAGE-2 EXECUTIVE KNOWLEDGE SCHEMES, SCANNING, AND FIRM LEVEL KNOWLEDGEABLE PRACTICE – A QUANTITATIVE INVESTIGATION

In this chapter I present the details of the large-scale survey study designed to further investigate the propositions stemming from the grounded theory framework. I first discuss the overall design of the study, followed by the sampling strategy, development of measures, construct reliability and validity, test of emergent propositions, and results.

9.1. Research Design

In this study, I utilized a cross-sectional survey-based, mixed-mode field study. I used paper and web-based survey formats based on suggestions from some industry incumbents that a web-based option would help in enhancing response rates. I followed Dillman's (2000) tailored design method to implement the survey. I engaged the services of a university-based survey management service that helped me in printing, mailing, and coding the survey responses (see Appendix C for survey cover letter). The paper version of the survey was designed on in a computer scannable form which significantly reduced the need for hand-coding the of the survey data. This method not only reduces errors in coding but also saves on coding time.

I pre-tested the survey instrument with 13 senior foundry executives. Besides these, I pre-tested the knowledgeable practice scales with 8 doctoral students of management and the executive knowledge schemes with 53 MBA students (Please see Appendix D for the final survey instrument).

The mailing of paper surveys was done in two rounds, interspersed by a round of reminder cards and phone calls. A third round of mailing was carried out, although on a limited basis given the lack of funds for carrying out a full-scale third round of surveys. Each firm in the sample was sent a package containing a cover letter to the CEO/President explaining the aim of the research project and a form of inducement wherein for every survey received, I promised a contribution of five dollars to the Foundry Education Foundation, an industry association aimed at improving the human resources available to the US metalcasting industry. Researchers have argued that inducements whether in monetary form or otherwise do enhance response rates. I did consider the option of proving a dollar bill in the surveys but was advised not to do so by some foundry CEOs during pre-testing of the survey instrument as such an act would be seen as an affront. I also promised a summary report to all those firms that would participate in the study

The survey package also contained two more surveys along with self-addressed postage paid envelopes, with a request to the CEO to assign the surveys to two members that s/he sees as members of the foundry's top management team. The use of multiple respondents was meant to obtain a TMT level perspective on the phenomena and relationships being studied. The survey mailing period started in the third week of March and is still progressing.

Prior to mailing out the surveys, I received endorsements from four leading foundry trade associations, namely the American Foundry Society, the Steel Founders' Society of America, the Non Ferrous Foundry Society, and the Iron Cast Research Institute. I also garnered support from state level foundry trade associations which helped in creating high level of awareness about the survey.

9.2. Sampling Strategy

Surveys were sent to a total of 583 foundries in 6 key north-eastern and Mid-Atlantic States, New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, and Wisconsin. I obtained the addresses of the foundries from the American Foundry Society's comprehensive directory of foundries (2004) version. 13 survey packets came back as undeliverable of which 11 were from foundries that were no longer in operation and 2 were foundry suppliers and declined to participate in the study. The metalcasting industry is usually segmented along the lines of the metals cast with "Ferrous" and "Non-Ferrous" foundries as a broad classification. Nonetheless, I chose to use a more fine-grained classification based on the specific metals that a foundry specializes in. I created 8 metal categories to classify the sample.

A total of 173 foundries responded to the survey with 40 foundries sending in multiple surveys. In total 230 individual foundry executives participated in the study. Because of the relatively low number of foundries that returned multiple surveys from TMT members, I decided to test my propositions at the CEO level, instead of the TMT level. The 173 foundries represented an effective response rate of 30.1%. This response rate is quite reasonable given the fact that the sample is predominantly one of small to medium-sized firms that are known traditionally to be un-enthusiastic about surveys, and the key participants are hard-to-get busy senior executives. By metalcasting industry standards as well, the response rate seems to be higher than most surveys. Table 10a and 10b show the distribution of responses based on metal classification and states.

Table-10 (Sample Classification by Metal and States)

Metals	Frequency	States	Frequency
Ductile Iron	46	Michigan	24
Aluminum	58	Pennsylvania	40
Steel	24	Indiana	14
Brass	7	Wisconsin	31
Grey Iron	28	Ohio	27
Bronze	5	New York	10
Others- Lead, Zinc	2	Illinois	17
Total	170	Other-states	8
Missing	3	Total	173

Of the 173 responses, eight were received from foundries outside the six key states because these firms are divisions of foundries who have headquarters in the key states. The average size of the foundries that responded was 106 employees.

Non-response bias test

I performed t-tests to check for non-response bias by firm size (number of employees) and metal classification. The t-tests were all non-significant at $p<.05$ confidence level, thus suggesting that there is no systematic difference between non-respondents and respondents (please see Appendix E for test details).

Inter-rater Agreement

I also measured agreement levels between executives responding from the same foundry on those items that measured firm-level attributes. Average correlations were 0.67 ($p<.001$) which were surprisingly similar to an earlier study by Zahra and Nielsen (2002). The high inter-rater agreements enabled me to proceed with using the CEO responses as the "voice" of the organization, on those scales that measured firm level attributes.

9.3. Measures

9.3.1. Executive Knowledge Schemes

Although for each EKS dimension, three to four items were generated, pretest of the survey showed that respondents were showing signs of fatigue or impatience while filling the survey. Therefore to limit the length of the survey, the two best items (in terms of reliability estimates) were selected for use in the final survey.

Knowledge Criticality. The criticality scale was based partly on past research on perceptions of resource criticality (McKinley, Cheng, & Schick, 1986). Pfeffer and Salancik (1980) conceived the criticality of a resource as the ability (or the lack of it) of an organization to survive in its absence (p: 44). I used the interviews to adapt the theoretical insights on resource criticality to develop measures for knowledge criticality. The four items for measuring criticality are shown in Table-10. Reliability estimates were at acceptable levels.

Knowledge Inimitability. I developed a new scale to measure knowledge inimitability based on insights from Barney's (1991) definition of imitability, and partially derived it from the language used by the informants in stage-1. Barney (1991) argued that a resource is imitable if competitors can easily copy or implement the benefits obtained from a particular resource. The imitability scale was based on a scale used by Autio, Sapienza, & Almeida (2000) (who initially based their scale on Zander, 1991). However, I adapted the scale to suit the context of the metalcasting industry. Reliability estimates were at acceptable levels and improved in the final survey.

Knowledge Availability. Kahn (1990) defined "psychological availability" as the sense of having physical, emotional, and psychological resources available in a given moment. The

concept of knowledge availability operates at the competitive level where the focus is on managerial beliefs about whether knowledge in a given domain is available from external sources. Table 10 shows the four items used for developing the knowledge availability scales. Reliability estimates were at acceptable levels here too and they improved in the final survey.

Knowledge Ascendancy. The knowledge ascendancy concept represents the level of intelligence and autonomous knowledge work that a focal manager attributes to lower level employees in the organization. Ideas for developing the scale, were sourced from studies on implicit theories of power distribution in organizations, because the notion of power, like knowledge is also a resource in the hands of organizational members. The knowledge ascendancy scale was partially motivated from a scale developed by Coleman (2004) to measure implicit theories or beliefs about power distribution in organizations. Although the pretest reliability estimates were acceptable, unfortunately, the knowledge ascendancy scale is suffering from reliability levels slightly lower than the acceptable level of.0.60 for exploratory studies (Nunnally, 1970). This creates a potential problem in using the knowledge ascendancy scale for proposition testing.

Knowledge Confidence. The concept of perceived self-efficacy enjoys a rich tradition in a wide range of social sciences. Several scales have been developed to measure self-efficacy, some that seek to measure it in a given context, such as a particular job, individual and collective level, etc. For this study, I used Jones's (1986) self-efficacy items as a general guide to develop the Knowledge Confidence scales. However, the lack of pre-existing measures of "Knowledge Confidence" necessitated the use of interview data in building the scale. Reliability estimates were at acceptable levels, but reduced in the final survey.

Table 10 - Measurement Scales and Items used for EKS Dimensions

Dimension	Pre-Test Reliability	Survey Reliability
Knowledge Criticality – • **Knowledge in ……. is critical for success in the foundry industry**[6] • **Having better information in …….. is very important for a company's success in the foundry industry** • Superior Information in …… provides competitive strength in the foundry industry	.85	.79
Knowledge Availability- • **Most companies in find it easy to get …….know-how from industry sources** • **It is generally easy for companies to acquire useful know-how and information in ……. from foundry industry sources** • Most useful know-how and information in …… can be easily obtained from industry sources	.82	.86
Knowledge Inimitability- • **It would be hard for a competitor to develop the level of expertise that we have in …..** • **It will not be easy for a competitor to imitate the know-how and skills that our company possesses in ……** • Expertise in …… enables us to differentiate our company from others • The key methods and ways of managing a foundry successfully in …… are pretty well known across foundries	.70	.89
Knowledge Confidence- • I usually excel in ….. • **I am confident of my skills in …..** • I generally perform quite well in ….. • **Compared to my counterparts in competing companies, I have better skills in** ….	.91	.75
Knowledge Ascendancy- • Key information in this area generally resides largely with top managers in our company • **The higher a person is in the company, the better is his/her expertise in ……..** • **Without the guidance of top managers it is difficult for lower level employees to work effectively in ……** • Key information in this area always flows from top managers down to the lower level employees	.71	.57

[6] Items in bold are the ones used in the large sample survey

9.3.2. Executive Scanning Measures

Scanning Intensity. I developed the scanning intensity scale based on the "frequency" approach suggested by Aguilar (1967) and Hambrick, (1979; 1982). I asked the respondents to rate how frequently they actively seek useful information in a list of areas that emerged as important from the interviews. It is noteworthy here that I did not use the environmental "sector" approach for developing the scanning intensity scale, as has been the tradition in scanning research but chose to use the areas that my informants viewed as relevant for foundry operations. I broadly divided the areas into competition, current and prospective customers, operating costs and quality control information, and shop-floor technology. The response format for the scanning intensity scale was an interval scale ranging from 1-5, with 1 representing once a year and 5 representing daily, in terms of the frequency of search. Table 11 shows the scale used for Scanning Intensity.

Scanning Proactiveness. The scanning proactiveness measure is a new measure and its development was motivated by the insights of Daft and Weick (1984). The interview data suggested that scanning proactiveness manifests in the form of specific *behaviors* that managers engage in. I culled out these behavioral patterns to develop a group of items that would measure proactive scanning behavior in the areas of competitor scanning, customers, shop-floor technology, and cost management. In the area of competitor scanning, I found that a form of proactive scanning was an almost "espionage" form of information gathering about competitors activities. Some foundry executives expressed their constant efforts to keep tabs on the relationship between the competitors and their customers – in the hope that the first sign of trouble would mean an opportunity for them to win a job contract. Similarly in the area of technology, I found that proactive executives not only attended foundry technology trade shows

but also spent significant efforts in gaining new insights with key technical personnel of equipment suppliers. Lastly, in the area of costs, two types of proactive scanning were prevalent, one where a focal executive personally analyzed operating costs (and not just depended on cost accounting reports) and second, where a focal executive compared cost data with those of competitors. The second form of scanning is much harder to perform because it is not easy to discern costs of competitor foundries without having a rich understanding of their internal operations. Table-11 shows the items used for measuring scanning proactiveness.

Table 11 - Measurement Scales and Items used for Executive Scanning

Scanning Measures	Response Format
Scanning Frequency – • Competitor information (Marketing) • Current customer information (Marketing) • Shop-floor technology information (Shop Floor Technology) • Prospective customer information (Marketing) • Operating costs information (Cost Management) • Quality control information (Cost Management)	Please tell us how often you actively seek useful information in the following domain. 5 point anchored scale (1- Once a year, 2-Few times a year, 3-Monthly, 4- Few times a week, 5-Daily)
Scanning Proactiveness- • I try to attend most major trade shows on foundry technology (Shop Floor Technology) • I spend time with suppliers to understand technological trends (Shop Floor Technology) • I discuss market trends and new market opportunities with top executives in other foundries (Marketing) • I visit competitor foundries (Marketing) • I spend time at customers' premises (Marketing) • I gather information about competitors' customers (Marketing) • I spend time analyzing my foundry's production costs (Cost Management) • I personally compare my foundry's costs with other foundries (Cost Management)	For the set of statements below rate the degree to which you carry out these *personal* activities in your foundry. 7 point semantic differential scale with 1 representing "Very Rarely" and 7 representing "Very Frequently"

9.3.3. Knowledgeable Practice Measures

I developed the scales for measuring adaptive action and generative inquiry in the three primary domains directly from the interviews. I designed these scales to operate within a situated context that was created through the use of two strategic vignettes. The strategic vignettes described two common *problem/challenging* situations that foundries have been facing in recent times. The information for these vignettes was culled from the interviews and articles in leading metalcasting trade journals. The primary emphasis for the knowledgeable practice scales was to capture the situated and localized practices that represented general tendencies of knowledge application in foundries. The use of the strategic vignettes aided in offering specific situations where knowledgeable practice (or lack of it) could be observed and measured.

Past precedence exists for the use of strategic vignettes or scenarios in measuring managerial and organizational level tendencies comprehensively. Fredrickson (1984) used written strategic scenarios to measure the comprehensiveness of managerial decision-making. Fredrickson (1984) argued that scenarios aid in specifying a relevant context in which strategic decisions can be studied. Secondly, the scenarios help in providing a standardized stimulus to all respondents whereas general questionnaires are more prone to differences in interpretations and therefore have increased tendency of having greater potential for measurement error. Although my entire survey was not scenario-based, the use of strategic vignettes to measure knowledgeable practice was necessitated because the concept tries to capture the situated use of knowledge in the patterns of behaviors that I observed in Stage-1 of my study.

I used a seven-point semantic differential scale ranging from highly unlikely (1) to highly likely (7) as the response format for the items. Table -12 shows the strategic vignettes and scales for measuring adaptive action and generative inquiry in the three knowledge domains.

Table 12 - Measurement Scales and Items used for Knowledgeable Practice

Scenario 1 (For measuring KP in Marketing and Shop Floor Technology)

Prices of raw materials are increasing significantly. In a recent meeting your metal suppliers have informed you that they will be raising metal prices by an additional 10% over the next few weeks. While passing on surcharges to the customer has been a common ploy, your customers are becoming increasingly less patient with these increases and are giving examples of domestic and overseas companies who have absorbed the price increases and found new ways to maintain prices. **Given this situation, how likely will your company,** (Circle the appropriate number)

Adaptive Action – Shop Floor Technology • Adapt existing casting processes to increase production efficiencies • Modify your current metal-mix to ensure that the net prices to customers remain largely the same • Tweak current casting processes to find ways to absorb price increases	Final Survey Reliability Estimates .66 (Alpha with dropped bad item = .72)
Adaptive Action – Marketing • Absorb the price increases without passing them on to current customers • Reduce delivery times to compensate for the increase in prices • Extend credit periods to ensure that your current customers remain with your company	.62
Generative Inquiry – Shop Floor Technology • Involve employees to find brand new technical solutions to respond to the increase in raw material prices • Go beyond the immediate raw material challenges by testing new melting/refining ideas for the future • Utilize this situation to develop new casting skills to meet future opportunities	.87
Generative Inquiry – Marketing • Develop an in-depth understanding of current customers' businesses to offer them better overall service • Analyze industry trends to explore the your company's diversification into new metals • Encourage company-wide discussions about ways to attract new customers	.73

Scenario 2 (For measuring KP in Cost Management)
Your company has just received a request for quotation from a prospective customer. According to the purchase manager of customer, your foundry was contacted because of its reputation in the market and their belief that you will be able to handle the job at the right price. The job is technically complex but if the quotation is accepted then the order size will be a significant boost to your sales revenue in the coming years. The customer is known to be extremely price sensitive (they are also known to be looking at overseas suppliers for the same job) and quality conscious. **Given this situation, how likely would your company.** (Circle the appropriate number)

Generative Inquiry – Cost Management • Involve employees to find brand new technical solutions to respond to the increase in raw material prices • Go beyond the immediate raw material challenges by testing new melting/refining ideas for the future • Utilize this situation to develop new casting skills to meet future opportunities	Final Survey Reliability Estimates .92
Adaptive Action – Cost Management • Use this new job as a chance for upgrading your company's overall understanding of production costs • Use the quotation process as a way to gain better understanding of the entire company's efficiency levels • Utilize this situation as a platform for improving your company's overall costing system	.86

Reliability estimates of the scales were generally acceptable. However, the scale used for Adaptive Action (Shop-Floor technology) had a lower reliability than expected. Further analysis showed that by dropping one of the three items "Modify your current metal-mix to ensure that the net prices to customers remain largely the same", the scale reliability estimate increased to .72. This item was therefore dropped from further consideration. The Adaptive Action scale for marketing was low at .62 but acceptable for this kind of exploratory work (Nunnally, 1970).

9.3.4. – Innovation Outcomes- Firm Level

Firm Innovation. The scales I used for measuring firm-level innovation sought to capture both incremental and radical innovation levels. I utilized the recently developed incremental and innovative capability items from Subramaniam and Youndt (2005). However, based on pretests with industry insiders, I modified the language of these items to enhance their representativeness and relevance to the metalcasting industry. Table 12 shows the scales used for measuring firm level innovation. Cronbach alpha reliability estimates for the incremental and radical innovation scale were .77 and .84 respectively.

9.3.5. Firm Knowledge Assets Measures

Firm-level Human Capital. I measured firm level human capital by using 3 of the five items used by Subramaniam and Youndt (2005). Table 12 lists the scale used for measuring human capital. Cronbach alpha for this scale was .82.

Social Capital. I developed two different measurement approaches for tapping the notion of social capital for this study. As mentioned earlier, the metalcasting industry is made up largely

of small to medium-sized privately held firms. These firms often do not have large R&D departments. Therefore, external networking, especially at the institutional level (i.e. with industry trade associations, large suppliers, research agencies etc.) is a critical source of knowledge for incumbents, regardless of whether they use those sources or not. I therefore, developed a firm-level scale to measure a firm's level of participation in industry-level knowledge dissemination and sharing events such as trade association meetings, technology exhibitions, and training workshops organized by key suppliers, as a proxy for social capital. Table 13 shows the scale used for measuring firm-level social capital. Cronbach's alpha reliability estimates for the Firm-level social capital scale was .86.

The other approach to measure social capital was to tap the construct at the level of the key survey informants (CEO/President and other TMT members). McEvily (1997, 1999) used self-reports of ego networks to generate a list of five contacts per respondent. In McEvily's study (1997), which focused on small job-shop manufacturers, the author treated the CEO/top executives' ego networks as a measure of the firm's overall network. Finkelstein and Hambrick (1996) suggested that in small firms, the effect of managerial traits manifest themselves more strongly in small and medium-sized firms than in large firms (p: 108). Taking this premise, I developed three measures to operationalize executive social capital as an indirect measure of social capital.

I asked every respondent to consider three persons who are not employees in their organizations from whom they seek strategic advice. Then for each source, I asked the respondents to provide the absolute number of conversations they have in a year (as a measure of strength of each tie, based on frequency of interaction). This was followed by two 5 point

semantic differential scales (1- low to 5 high) where the respondent was asked to rate the quality of information and the timeliness of information that was available from each source.

Table 13 - Measurement Scales and Items used for Performance, Innovation, and Knowledge Assets (Human Capital, Firm level Social Capital)

Construct	Response Format
Firm Performance • Return on Investment • Foundry Scrap Rate (Industry Specific) • Sales growth rate • Manhours per ton (casting) (Industry Specific) • New Quote Success Rate (Industry Specific) • New Customer Gaining Rate	Relative to your most direct competitors, estimate your company's *performance* over the past two years:- 5 point S.D. scale (1-Much worse than competition to 5-Much better than competition)
Firm Innovation (I.I.- Incremental, R.I – Radical) • Improvements that lead to increases in production yields (I.I.) • Improvements that reduced the net cost of castings for existing customers (I.I.) • Improvements that increased your company's share in existing markets (I.I.) • Improvements that enabled your company to enter into new markets (R.I.) • Improvements that enabled your company to be among the first ones to embrace new technologies. (R.I.) • Improvements that helped your company to take on radically new casting jobs (R.I.)	Rate your company's *success* in generating the following *activities* in the last two years relative to your most direct competitors. 5 point S.D. scale (1-Much worse than competition to 5-Much better than competition)
Firm-Level Human Capital • Our employees are highly skilled • Our employees are widely considered to be better than those of our competitors • Our employees are creative and bright	Please rate to what extent you agree with the following statements regarding your *company's employees* 5 point Likert Scale (1 –Strongly Disagree, 2-Somewhat Disagree, 3-Not sure, 4-Somewhat Agree, 5- Strongly Agree)
Firm Level Social Capital • Foundry Trade Association Meetings • Participation in Foundry Technology exhibitions and conferences • Participation in training workshops organized by key suppliers	Relative to your company's direct competitors please rate your company's level of participation (annually) in the following areas. 5 point S.D. scale (1-Much worse than competition to 5-Much better than competition)

Finally, I asked the respondents to classify the source, along 9 categories of contacts that are most commonly used in foundries. These 9 categories are: Supplier, Customer, Consultant, University Contacts, Lawyer, Banker, Competitor, Friend/Family, and Other Foundry Executive. Therefore, I was able to develop four separate measures that each tapped into the strength of relationship, quality and timeliness of information, and diversity of ties from this measure (please see survey instrument, Appendix D for greater detail).

As mentioned in the previous chapter, I considered the technological complexity of the firm (Cronbach's alpha .87) as a third type knowledge asset that it possesses, I measured technological complexity by using two separate scales 1) Level of automation in core casting processes, i.e. Molding, Melting, Cleaning, and Finishing equipment, and 2) Product Complexity (Cronbach's alpha .84) - The complexity of the foundry's castings. Table 14 shows these scales.

9.3.6. Demographic Indicators

Based on past research in the upper echelons tradition, I gathered the following demographic information from my respondents – Year of birth, Highest level of Education, Functional experience in Shop-Floor Production, Sales and Marketing, Accounting and Finance, Metallurgy, and Others (requested to specify), firm tenure, industry tenure, and no. of foundries worked prior to working in the current foundry.

9.3.7. Contextual Variables

I also developed measures to account for contextual/organizational factors that can influence executive scanning and knowledgeable practice. These factors are the following

a) Firm Performance**.** There has been some debate about the use of self-reports for measuring firm performance. However, researchers have shown that self-reports of performance measures tend to correlate strongly with objective measures (Priem et al., 1999). Furthermore, as most of the firms in the metalcasting industry are small to medium-sized, privately-held firms, the availability of objective and valid performance measures is hard to obtain. Therefore, I chose to measure firm performance by using items suggested by Dess and Robinson (1984), as well as generating new performance items based on the indicators supplied to me by my informants. This ensured that the performance measures were relevant to the respondents and valid for the industry as a whole. In the survey, I asked the respondents to rate their company's performance over the past two years on a five-point semantic differential scale, ranging from "much worse than competition" to "much better than competition." Table 13 shows the scale for measuring firm performance.

b) Firm Strategy- Past research has shown that a firm's strategy influences executives' scanning behaviors to a certain extent (Hambrick 1982). Furthermore, a firm's strategy might also influence the executive knowledge schemes, as strategy, to some extent, represents the collective orientation of the company vis-à-vis its environment and, therefore, is likely to influence the choice of resources (in this case, knowledge). Snow and Hrebiniak (1980) found that firm strategy influences the nature of competencies that a firm develops. Therefore, I chose to use firm strategy as a control variable in this study. I utilized the Miles and Snow (1978) typology of strategic types to operationalize firm strategy and measured it through the paragraph approach used by Hambrick (1979, 1982) and Snow and Hrebiniak (1980). This approach is based on providing descriptive paragraphs (each representing the four strategy types) to the respondents

for selecting the best fit for their firms. I modified the descriptive paragraphs slightly to make them relevant to the metalcasting industry. These descriptors are:-

Defender. This type of company attempts to locate and maintain a secure niche in a relatively stable castings and services area. The company tends to offer a more limited range of products and services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often this type of company is not at the forefront of developments in the industry—it tends to ignore industry changes that have no direct influence on current areas of operation and concentrates instead on doing the best job possible in a limited area.

Reactor. This type of company does not appear to have a consistent product-market orientation. The company is not as aggressive in maintaining established casting jobs and markets as some of its competitors, nor is it willing to take risks as other competitors. Rather the company responds to those areas where it is forced to by external pressures.

Prospector. This type of company typically operates within a broad market segment which changes periodically. The company values being "first in" in new castings and market areas even if not all these efforts prove to be profitable. The company responds rapidly to early signals concerning areas of opportunity, and these responses often lead to a new round of competitive actions. However, this type of company may not maintain market strength in all of the areas it enters.

Analyzer. This type of company attempts to maintain a stable, limited line of castings or services, while at the same time moving out quickly to follow a carefully selected set of the more promising developments in the industry. The organization is seldom "first in" with new castings or services. However, by carefully monitoring the actions of competitors, the organization is frequently "second in" with a more cost-efficient product or service.

Respondents were asked to select the descriptor that best fit their company currently, three years in the past, and three years in the future.

c) Firm Size and Age – I obtained firm size data from the American Foundry Society's foundry directory which lists the number of employees of its member foundries (from which the sample was derived). The size variable had a large positive skew (as most firms in the sample were small firms). I mitigated the skewness of the size variable through log transformation with base 10.

Table 14 - Measurement Scales and Items used for Performance, Innovation, and Knowledge Assets (Human Capital, Firm level Social Capital)

Construct	Response Format
Technological Complexity (Automation) • Melting Equipment • Molding Equipment • Cleaning Equipment • Finishing Equipment	Please rate your company's *level of automation* in each of the following departments using the following scale, as compared to your most direct competitors:- 5 point S.D. scale (1-Highly Manual to 5-Highly Automated)
Technological Complexity (Product Complexity) • Most of our castings have complex design specifications • Most of our castings require close dimensional tolerances • Most of our castings have multiple cores	Please describe your company's castings along the following dimensions:- 5 point S.D. scale (1-To a small extent to 5-To a Great Extent)

9.4. Construct Validity

To assess discriminant and convergent validity of the key scales, I carried out a series of exploratory factor analyses. Discriminant validity is a measure how well a scale differentiates an underlying latent construct from other constructs, and convergent validity assesses how well the member items of the scale load together to form a cogent underlying factor. Although there are several constructs involved in this study, I am presenting here the validity assessments for only those constructs that were developed as specific scales. Therefore, items measuring scanning intensity and proactiveness, and firm performance, which were not meant to be scales, have not been considered for validity assessments.

9.4.1. Construct Validity of EKS Dimensions

I used a principal factors extraction method with squared multiple correlations as prior communality estimates. I used Principal Factors Extraction method with oblique rotation (direct oblimin) and Kaiser normalization to test for discriminant and convergent validity for each of the EKS dimension scales. Principal factor extraction method has an advantage of not presupposing normality assumptions of the items (Fabirgar, Wegener, McCallum, & Strahan, 1999). An oblique rotation is preferred when there is an a priori understanding that the underlying latent constructs might be correlated with each other, instead of being orthogonal. The EKS dimensions do influence each other and, therefore, an orthogonal rotation was not suitable. Table – 15 shows the rotated pattern matrix of the EKS items

Although there is some debate about using the thumb-rule of eigenvalue>1 as the heuristic for determining the number of factors, I used this method along with a visual appraisal of the scree plots to ascertain the existence of 5 factors (each corresponding to an EKS subdimension). The analysis of the rotated pattern matrix suggested the emergence of five clean factors with low cross loadings (in spite of the knowledge ascendancy scale having relatively low reliability estimates) as shown in Table 15.

9.4.2. Construct Validity for the Knowledgeable Practice Scales

Using the same extraction method and factor determination heuristics as above, I checked the underlying factor structure of the Knowledgeable Practice scales. I had no reason to assume that Adaptive Action and Generative Inquiry occur completely independent of each other (calling for an orthogonal treatment in the EFA rotation procedure). I used oblique rotation to discern the

existence two clear factors per knowledge domain corresponding, respectively, to adaptive action and generative inquiry. Table-16 shows the three pattern matrices (one for each knowledge domain). The only noteworthy development in this analysis was the lower than .40 factor loading of the second item of Adaptive Action (Shop-Floor Technology). As mentioned earlier, this item was dropped from proposition testing.

Table – 15 - Pattern Matrix Showing Factor Loadings for EKS Dimensions[7]

	Factor				
	1	2	3	4	5
Knowledge of production technology is critical for a companys success in the foundry industry.	-.008	-.001	**-.864**	-.025	.012
Having better knowledge of production technology is very important for a companys superior performance in the foundry industry.	.001	.004	**-.774**	.010	-.002
The higher a person is in the company the better is his/her knowledge of production technology.	.068	.098	.039	**.855**	.129
Without the guidance of higher level managers it is difficult for lower level employees to do work effectively in production technology.	-.087	-.082	-.008	**.440**	-.082
I am confident of my skills in production technology.	-.055	.053	-.006	-.053	-**.788**
Compared to my counterparts in competing companies I have better skills in production technology.	.248	-.048	-.062	.080	-**.459**
Most companies find it easy to get production technology know-how from industry sources.	-.045	**.746**	-.032	-.078	-.052
It is generally easy for companies to acquire useful know-how and information in production technology from foundry industry sources.	.016	**.876**	.034	.079	.011
It would be hard for a competitor to develop the level of expertise that our company has in production technology.	**.840**	-.003	-.079	.031	-.001
It will not be easy for a competitor to imitate the know-how and skills that our company possesses in production technology.	**.810**	-.049	.080	-.096	-.037

[7] EFA for the executive knowledge schemes was done separately for each of the three knowledge domains. Displayed here is the pattern matrix from the EFA in the shop-floor technology domain. The patterns in the other two domains were by and large similar.

Table- 16 – Knowledgeable Practice Pattern Matrix (Shop Floor Technology)

	Factor	
	1	2
Adapt existing casting processes to increase production efficiencies.	.061	.583
Modify your current metal-mix to ensure that the net prices to customers remain largely the same.	.059	.354
Tweak current casting processes to find ways to absorb price increases.	-.111	.995
Involve employees to find brand new technical solutions to respond to the increase in raw material prices.	.669	.078
Go beyond the immediate raw material challenges by testing new melting/refining ideas for the future.	.932	-.079
Utilize this situation to develop new casting skills to meet future opportunities.	.864	.060

Pattern Matrix (Sales and Marketing)

	Factor	
	1	2
Develop an in-depth understanding of current customers businesses to offer them better overall service.	.669	.130
Analyze industry trends to explore your company's diversification into new metals.	.660	.007
Encourage company-wide discussions about ways to attract new customers.	.751	-.098
Absorb the price increases without passing them on to current customers.	-.110	.532
Reduce delivery times to compensate for the increase in prices.	.133	.593
Extend credit periods to ensure that your current customers remain with your company.	.044	.551

Pattern Matrix(Cost Management)

	Factor	
	1	2
Analyze the casting design carefully to find out places where you can reduce production costs.	-.030	.831
Do a detailed cost analysis to find out ways to reduce production costs.	-.049	.863
Try out creative ways to solve the complex design challenges of the casting in the most efficient way.	.118	.755
Use this new job as a chance for upgrading your company's overall understanding of production costs.	.878	-.005
Use the quotation process as a way to gain better understanding of the entire company's efficiency levels.	.899	.031
Utilize this situation as a platform for improving your companys overall costing system.	.896	-.016

9.4.3. Construct Validity of Firm-Level Innovation

The EFA results for the innovation scales posed an unexpected challenge. I found that one of the items meant to measure radical innovation had very high cross loading (shown in bold in the displayed matrix) on the factor corresponding to the incremental innovation items. This suggested that this item was not an ideal measure of radical innovation and was, therefore, dropped from further analysis. Table-17 shows the pattern matrix for the innovation items.

Table 17 – Innovation Scales - Pattern Matrix

	Factor	
	1	2
Improvements that lead to increases in production yields.	.687	-.055
Improvements that reduced the net cost of castings for existing customers.	.728	.047
Improvements that increased your company's share in existing markets.	.787	.022
Improvements that enabled your company to enter into new markets.	**.504**[8]	**-.324**
Improvements that enabled your company to be among the first ones to embrace new technologies.	.197	-.667
Improvements that helped your company to take on radically new casting jobs.	-.072	-.954

EFA analysis of the firm performance indicators suggested the existence of two factors that roughly corresponded to performance, those based on efficiency and those based on effectiveness. The second factor had only two indicators "New Quote Success Rate" and "New Customer Gaining Rate", whereas the remaining indicators loaded on to the first factor. I then created two composite performance variables, Perf-1 and Perf-2 based on the item loadings and aggregating their respective values for each case.

[8] Because of high cross loadings, this item was dropped from further analysis.

The EFA results for other measures such as level of automation, product complexity, external participation (firm-level social capital), and firm level human capital were acceptable with the predicted number of factors emerging and low cross loadings across factors.

In summary, most of the measures displayed high discriminant and convergent validity including the ones that showed lower than desirable reliabilities. This allowed me proceed with the next step of the analysis – testing the propositions laid out in Chapters 7 and 8.

9.5. Assessing the Propositions

In this section I assess the propositions that form the grounded theory framework that emerged from Stage-1 of this dissertation (as well as those generated after consulting the literature relevant to the emergent findings). I assessed the propositions three times, that is, once for each knowledge domain, to see if the relationships changed drastically across domains. I began by testing the propositions linking executive knowledge schemes and scanning behavior. I then tested the propositions linking the executive knowledge schemes with firm-level knowledgeable practice.

After carrying out these linear regressions[9], I utilized a structural equations modeling procedure for testing the overall model that relates executive knowledge schemes with scanning behavior and firm-level knowledgeable practice. I used the AMOS 6.0 program to test the SEM models, which I explain below shortly.

9.5.1. Executive Knowledge Scheme's Influence on Scanning Behavior

[9] See Appendix F for descriptives and correlations.

I began by creating composite scanning measures from the items used to measure scanning intensity and proactiveness. For example, scanning intensity in sales and marketing was calculated as the average of the ratings on those items that measured scanning in this domain.

I controlled for managerial demographics, firm size, and prior firm performance because of their potential influence on managerial scanning behavior. I tested the models based on the CEO data where, for those 40 firms in which multiple informants responded, the firm-level attributes were averaged across the respondents. Thus, the effective sample size for these models was 173 (see Appendix F for correlation tables). Reiterated below are the propositions that were assessed in these models.

P1: Executives are likely to scan more in those knowledge domains that they consider critical for success.
P2: Executives are likely to scan more in those domains where they perceive that knowledge is easily available from industry sources. *P2a: Executives are likely to scan less in those domains where they perceive that knowledge is easily available from industry sources.*
P3: Executives are likely to scan more in those knowledge domains where they perceive their firm's knowledge and skills to be more inimitable.
P4: Executives are likely to scan more in those domains in which they have higher confidence in their own knowledge. *P4a: Executives are likely to scan less in those domains in which they have higher knowledge confidence*
P5: Perceptions of greater knowledge ascendancy in a knowledge domain are likely to drive executives to scan more in that domain.

Tables 18a and 18b show the results of OLS regressions with scanning intensity and scanning proactiveness as the dependent variables. For each of the knowledge domains, I ran two regression models, the base model with only the control variables, followed by the main model containing both the control and predictor (knowledge scheme) variables.

As is evident, the regression results varied somewhat across the three knowledge domains and between the scanning intensity and proactiveness models overall. Nonetheless, in every model, one or more executive knowledge scheme dimensions had a significant relationship with

the dependent variable. For instance, in the sales and marketing regression with scanning intensity as the D.V., knowledge criticality had a significant positive relationship with scanning intensity, knowledge inimitability had a weakly significant relationship, and knowledge ascendancy had a significant negative relationship[10]. Therefore, for this regression I found strong support for P1, weaker but significant support for P3, and interestingly (and unexpectedly) a significant opposite relationship between knowledge ascendancy and scanning intensity (contrary to P5).

The shop-floor technology model with scanning intensity as the DV, showed similar trends but this time the knowledge confidence dimension showed a significant positive relationship (supporting P4 and not the alternative proposition, P4a). The same trend was seen in the cost management model. However, it is noteworthy that knowledge confidence was the only variable to show a significant relationship in the cost management model.

In the second set of regressions with scanning proactiveness as the D.V, I found a similar trend overall. However, there were some differences. Knowledge Confidence was a strong predictor of scanning proactiveness in all three of the knowledge domains (supporting P4). In the shop floor technology model, knowledge availability significantly predicted scanning proactiveness in the technology area, supporting P2. Knowledge ascendancy maintained its negative relationship with scanning and had a weakly significant relationship in the cost management domain. In summary, there was evidence of general support for the five propositions that sought link executive knowledge schemes with scanning behavior. It is noteworthy here that in all the full models (which included both control and predictor variables), the control variables' influences became generally non-significant, and this tendency was further

[10] The low reliability of the ascendancy scale cautions the reader to take this result as tentative.

supported by significant F-statistic changes between the base and full models. This suggests that as a whole, the executive knowledge schemes do strongly influence both scanning intensity and scanning proactiveness.

Table 18a- Results of OLS Multiple Regressions with "Scanning Intensity" as DV

	Sales and Marketing				Shop-Floor Technology				Cost Management			
	Model-1 (Base)		Model 2		Model-1 (Base)		Model 2		Model 1 (Base)		Model 2	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	0.99	0.71	1.277	1.44	0.78	0.81	-1.35	1.13	1.09	0.70	-.460	-1.19
Firm Size (Log10)	0.03	0.15	.005	0.14	0.09	1.21	0.04	0.56	0.22	0.14	0.22	0.14
Performance1	0.33*	0.14	0.24	0.14	0.15†	1.76	0.06	0.72	0.30*	0.14	0.04	0.15
Performance2	0.30*	0.11	0.22	0.11	0.10	1.16	0.05	0.57	-0.01	0.11	-0.03	0.10
Age	-.002	0.07	-.004	.007	0.11	1.49	0.10	1.30	0.02*	.007	0.01*	.007
Education	0.08	0.09	0.06	1.44	-0.08	-1.10	-0.11	1.44	0.14	0.09	0.05	0.09
Knowledge Criticality			0.19*	0.11			0.40*	0.17			0.14	0.16
Knowledge Inimitability			0.18†	0.97			0.23*	0.10			0.12	0.10
Knowledge Availability			-0.06	0.09			0.08	0.11			0.13	0.09
Knowledge Confidence			0.10	0.12			0.31*	0.15			0.48**	0.14
Knowledge Ascendancy			-0.29*	.112			-0.17	0.11			-0.10	0.09
R-squared	**.13**		**.21**		**.07**		**.18**		**0.10**		**0.21**	
Sample Size	173		173		173		173		173		173	
R-squared change	.13***		.08*		.07*		.11**		.10*		.11**	

***p<.001
** p<.01
* p<.05
†p<.10

Table 18b- Results of OLS Multiple Regressions with "Scanning Proactiveness" as DV

	Sales and Marketing				Shop-Floor Technology				Cost Management			
	Model-1 (Base)		Model 2		Model-1 (Base)		Model 2		Model 1 (Base)		Model 2	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	-0.70	0.89	-2.17	1.07	0.21	0.88	-3.24	1.223	0.72	0.86	0.49	1.29
Firm Size (Log10)	0.57*	0.18	0.47*	.0.18	0.30	0.18	0.29	0.18	0.14	0.18	0.15	0.17
Performance1	0.21*	0.17	.005	0.17	0.11	0.17	0.08	0.18	0..36*	0.17	0.15	0.18
Performance2	0.38*	0.14	0.23†	0.14	0.41*	0.14	0.40*	0.13	0.21	0.13	0.20	0.13
Age	0.01	.009	0.01	.009	0.01	.009	0.01	.009	.009	.009	.007	.009
Education	0.16	0.11	0.15	.10	0.10	0.11	0.14	.105	0.26*	0.11	0.19†	0.09
Knowledge Criticality			0.43*	0.13			0.22	0.18			0.07	0.89
Knowledge Inimitability			-.026	0.12			-0.12	0.10			0.03	0.12
Knowledge Availability			.089	0.12			0.37*	0.12			0.02	0.11
Knowledge Confidence			0.47**	0.15			0.48*	0.16			0.47*	0.17
Knowledge Ascendancy			-0.16	-0.14			-.004	0.12			-0.24†	0.12
R-squared	**.16**		**.27**		**.11**		**.22**		**0.12**		**0.19**	
Sample Size	173		173		173		173		173		173	
R-squared change	.16***		.11***		.11**		.11**		.12**		.07*	

***p<.001
** p<.01
* p<.05
†p<.10

9.5.2 Executive's Knowledge Scheme's Influence on Firm Level Knowledgeable Practice

The next set of regressions were meant to assess propositions 7 to 10 which are reiterated below:-

P6: Executive perceptions of increased criticality of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type. *P6a: Executive perceptions of increased criticality of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.*
P7: Executive perceptions of increased inimitability of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type. *P7a: Executive perceptions of increased inimitability of a given knowledge domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.*
P8: Executive perceptions of increased availability of knowledge in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.
P9: Executive perceptions of knowledge confidence in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the adaptive action type. *P9a: Executive perceptions of knowledge confidence in a given domain are likely to increase the tendency of the firm's knowledgeable practice to be of the generative inquiry type.*
P10: Executive perceptions of increased knowledge ascendancy in a given domain are likely to reduce the tendency of the firm's knowledgeable practice (both adaptive action and generative inquiry).

As knowledgeable practice is a firm-level dependent variable, I chose the firm-level control variables for their possible influence on knowledgeable practice. I chose firm-size, level of automation, product complexity and prior performance as the control variables. In a fashion similar to the earlier two sets of regressions, I compared the base and full models (with the executive knowledge schemes variables) in each of the three knowledge domains.

Tables 19a and 19b show the results of the regressions, each with Generative Inquiry and Adaptive Action as dependent variables.

Table 19a- Results of OLS Multiple Regressions with "Generative Inquiry" as DV

	Shop-Floor Technology				Sales and Marketing				Cost Management			
	Model-1 (Base)		Model 2		Model-1 (Base)		Model 2		Model 1 (Base)		Model 2	
Variables	***β***	**S.E.**	*β*	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	-.002	0.76	-.005	1.36	1.73	0.68	-0.21	0.97	2.03	0.80	.812	1.49
Firm Size (Log10)	-.306	0.22	-0.34*	0.22	-0.17	0.19	-0.24	0.19	-0.46*	0.23	-0.50*	0.24
Performance1	0.21	0.21	0.18	0.22	0.15	0.18	0.07	0.19	0.23	0.21	0.20	0.24
Performance2	0.35*	0.16	0.32*	0.16	0.20	0.14	0.17	0.14	0.04	0.16	0.03	0.17
Knowledge Criticality			0.56*	0.22			0.43*	0.14			.059	0.26
Knowledge Inimitability			0.16	0.13			-0.08	0.13			-.115	0.16
Knowledge Availability			-.036	0.14			0.21†	0.13			.157	0.15
Knowledge Confidence			-0.19	0.19			0.06	0.15			.195	0.21
Knowledge Ascendancy			-0.16	0.13			-.017	0.14			.033	0.15
R-squared	**.13**		**.18**		**.13**		**.19**		**0.12**		**0.13**	
Sample Size	173		173		173		173		173		173	
R-squared change	.13***		.06**		.13**		.06*		.12**		.01	

***p<.001
** p<.01
* p<.05
†p<.10

Table 19a- Results of OLS Multiple Regressions with "Adaptive Action" as DV

	Shop-Floor Technology				Sales and Marketing				Cost Management			
	Model-1 (Base)		Model 2		Model-1 (Base)		Model 2		Model 1 (Base)		Model 2	
Variables	***β***	**S.E.**	*β*	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	0.94	.778	0.43	1.41	1.73	0.68	2.07	.90	3.90	0.62	2.31	1.14
Firm Size (Log10)	0.02	.222	.004	0.23	-0.17	0.19	-0.16	0.18	-0.21	0.18	-0.26	0.18
Performance1	0.47*	.210	0.58*	0.22	0.15	0.18	0.08	0.17	-0.01	0.17	-0.09	0.18
Performance2	-.005	.163	.001	0.17	0.20	0.14	0.05	0.13	0.15	0.13	0.16	0.13
Knowledge Criticality			0.17	0.22			0.12	0.13			0.42*	0.20
Knowledge Inimitability			-0.17	0.13			0.13	0.12			-0.04	0.12
Knowledge Availability			0.04	0.14			0.17	0.12			0.02	0.17
Knowledge Confidence			-0.08	0.20			-0.39*	0.14			0.08	0.16
Knowledge Ascendancy			0.02	0.14			-0.01	0.13			-0.06	0.17
R-squared	**.15**		**.17**		**.01**		**.06**		**.14**		**.17**	
Sample Size	173		173		173		173		173		173	
R-squared change	.25***		.02		.01		.05		.14**		.03	

***p<.001
** p<.01
* p<.05
†p<.10

As seen in Tables 19a and 19b, overall the executive knowledge schemes turned out to be weak predictors of both types of knowledgeable practice. This was not only evident from the few occasions where the knowledge-scheme variables had significant relationships, but also clear in low R-squared values and non-significant R-squared changes. The control variables, level of automation and product complexity, emerged as consistently significant factors that influence generative inquiry (showing a positive relationship). The only instances where significant relationships existed between knowledge-scheme dimensions and knowledgeable practice were that knowledge criticality and knowledge availability both had significant positive relationships with generative inquiry in the sales and marketing domain and (thus offering partial support for propositions P6a and P8.

Knowledge Confidence had a significant negative effect on adaptive action in the sales and marketing domain, thus providing contrary evidence to proposition P9. However, this negative significant relationship did not accompany a significant positive relationship between Knowledge Confidence and generative inquiry in the same domain.

In general, then, I found reasonably strong support for the relationships among executive knowledge schemes and scanning behavior on the one hand, and the grounds for a more extensive search for the relationship between executive knowledge schemes and firm-level knowledgeable practice.. Overall, executive knowledge schemes, it appears, tend to influence scanning behaviors more strongly than they influence firm-level knowledgeable practice. Therefore, in general, propositions 6 to 10 did not receive strong support in the analyses.

9.5.3. Executive Scanning Behaviors influence on Knowledgeable Practice

Proposition 11 suggests that increased levels of scanning intensity and proactiveness will be associated with greater levels of knowledgeable practice at the firm level. To test assess the viability of this relationship, I began by analyzing a zero-order correlation matrix between scanning and knowledgeable practice variables in all the three domains, one at a time. Tables 20a, b, and c show the correlation matrices between scanning and knowledgeable practice variables in each of the three domains

Table -20a- Scanning and Knowledgeable Practice - Correlations (Shop-Floor Technology)

	Generative Inquiry	Adaptive Action
Generative Inquiry	1	.341***
Scanning Intensity	.286***	.139†
Scanning Proactiveness	.218(**)	.216(**)

***p<.001
** p<.01
* p<.05
†p<.10

As evident from Table 20a, in the shop-floor technology domain, scanning behavior had a significant association with firm-level knowledgeable practice. In the sales and marketing domain (please see Table 20b), the relationships were, by and large similar, although neither of the scanning variables had any significant association with adaptive action. In the cost management domain, I found a similar trend, which enabled me to predict the existence of

stronger associations between executive scanning behaviors and firm level knowledgeable action.

Table -20b- Scanning and Knowledgeable Practice - Correlations (Sales and Marketing)

	Generative Inquiry	Scanning Intensity	Scanning Proactiveness	Adaptive Action
Generative Inquiry	1			
	173			
Scanning Intensity	.373(***)	1		
	.000			
	173	173		
Scanning Proactiveness	.277(***)	.423(***)	1	
	.000	.000		
	173	173	173	
Adaptive Action	.154(*)	.001	.004	1
	.043	.990	.954	
	173	173	173	173

Table -20c- Scanning and Knowledgeable Practice - Correlations (Cost Management)

	Generative Inquiry	Scanning Intensity	Scanning Proactiveness	Adaptive Action
Generative Inquiry	1			
	173			
Scanning Intensity	.090	1		
	.238			
	173	173		
Scanning Proactiveness	.167(*)	.338(***)	1	
	.028	.000		
	173	173	173	
Adaptive Action	.471(***)	.211(**)	.221(**)	1
	.000	.005	.003	
	173	173	173	173

To summarize the results so far, I have found that executive knowledge schemes tend to influence executive scanning behaviors significantly. However, the same cannot be said about the direct influence of knowledge schemes on firm-level knowledgeable practice. On the other hand, executive scanning does seem to be associated strongly with knowledgeable practice. These results led me to look at this triumvirate, that is, executive knowledge schemes, scanning behaviors, and knowledgeable practice from a slightly different perspective. These results seem to indicate a two-step relationship, one between knowledge schemes and scanning, and another between scanning and knowledgeable practice.

In the next section, I test these relationships in the form of combined models, by using path analysis.

9.6. Executive Knowledge Schemes, Scanning Behavior, and Knowledgeable Practice – Pathways.

To assess the overall theoretical connection between the three concepts, I utilized a path analysis approach using the AMOS 6.0 statistical application software. I analyzed the relationships separately for each of the three domains. Path analysis is a precursor to the structural equations modeling and hence shares a common analytical logic. However, the latter is a more advanced form as it allows model fitting using latent (unobserved) variables which are measured through multiple items. Proponents of structural equations modeling suggest the use of a minimum of three items per latent construct as ideal for analysis. As my knowledge schemes scales had two items each, I chose to use a path analytic approach using only the observed variables.

In both path analysis and structural equations models, the task of the researcher is to fine tune a model to the point where its "fit indices" are strong enough to suggest that a) the model fits the data better than previous versions of the model and b) the model, by and large, represent the population dynamics. To assess fit of a model, several indices have been devised and recommended. The model Chi-square is by the far the most important statistic and when the model chi-square is small and non-significant, it represents a model whose "badness of fit" is non-significant. Therefore the first indicator is the chi-square statistic. In addition, there are some goodness-of-fit indices that show how well the model fits the data either in a absolute fashion (where indices like the Standardized Root Mean Square Residual (less than 0.10 represents a good fit), the Root Mean Square Estimate of Approximation (lower than 0.08 represents a good fit), the goodness of fit index (GFI, over 0.90 is considered indicative of a good fit) and the Comparative Fit Index (CFI) which should ideally be close to or greater than 0.95.

In this analysis, my aim was to test the emerging notion from the previous analyses to discern whether there is a causal path connecting executive knowledge schemes, scanning behaviors, and knowledgeable practice at the firm level. Although, this is clearly a cross-sectional study, a path analysis approach, even though it is not a "true" representative of a causal relationship (Duncan, 1966), does offer a viable method to find meaningful theoretical connections, both direct and indirect, among several sets of independent and dependent variables. Path analysis is essentially a series of regression analyses done simultaneously across the groups of variables whose causal directions are pre-specified by the researcher.

For path analysis, the aim is to calculate the direct and indirect effects/relationships that multiple sets of endogenous (independent and mediating) variables have with the exogenous (dependent) variables. In my model, I had two sets of variables, executive knowledge schemes

and scanning behaviors, which were the independent and intervening variables in predicting the level and type of knowledgeable practice.

I carried out three path analysis procedures, one for each knowledge domain. I used the two indicators of firm performance as control variables in the models. The models in all the knowledge domains emerged as having strong fit indices after accounting for a few error terms of the independent variables being correlated with each other. The covariances of error terms, at worst, suggest slight multicollinearity in the knowledge scheme variables, but do not affect the overall prediction of the model. The fit indices for all the three models represented good fit, which indicated that the models could be used for subsequent path analysis as will be discussed below. Table 21 lists the fit indices of the three models, one for each knowledge domain.

Table - Fit Indices for Path Analysis Models

Model	χ^2	df	p-value	SRMR	RMSEA	GFI	CFI
Shop-floor Technology	36.83	31	.22	.07	.03	.96	.98
Sales and Marketing	41.57	32	.12	.07	.04	.96	.96
Cost Management	46.57	36	.11	.08	.04	.95	.95

Next, I analyzed the direct and indirect relationships between the three meta-concepts, that is, executive knowledge schemes, scanning behaviors, and firm level knowledgeable practice. Table 21 lists the direct and indirect affects with generative inquiry and adaptive action as the dependent variables. The comparison of direct and indirect effects show that in both the shop-floor technology and marketing domains, knowledge scheme dimensions have strong direct effects on the scanning variables. Scanning variables, in turn display significant direct effects on knowledgeable practice. Furthermore, most knowledge scheme dimensions have indirect

relationships with both generative inquiry and adaptive action (the two components of knowledgeable practice).

Table-21- Direct and Indirect Effects Compared

	Shop-Floor Tech		Sales and Mktg.		Cost Mgmt.	
Variables	**Direct Effect**	**Indirect Effect**	**Direct Effect**	**Indirect Effect**	**Direct Effect**	**Indirect Effect**
Generative Inquiry (DV)						
Scanning Intensity	.23*	.00	.36***	.00	.00	.00
Scanning Proactiveness	.15†	.00	.13†	.00	.17†	.00
Knowledge Criticality	.00	.16	.00	.11	.00	.00
Knowledge Inimitability	.24*	.06	.00	.08	.00	.00
Knowledge Availability	.00	.09	.00	.00	.00	.00
Knowledge Confidence	.00	.14	.00	.06	.21	.00
Knowledge Ascendancy	.00	-.05	.00	-.08	.00	.00
Adaptive Action (DV)						
Scanning Intensity	.00	.00	.00	.00	.16*	.00
Scanning Proactiveness	.21*	.00	.00	.00	.15*	.00
Knowledge Criticality	.00	.07	.00	.00	.40*	.00
Knowledge Inimitability	.00	.00	.00	.00	.00	.00
Knowledge Availability	.00	.08	.00	.00	.00	.00
Knowledge Confidence	.00	.09	-.25*	.00	.00	.00
Knowledge Ascendancy	.00	.00	.00	.00	.00	.00
Scanning Intensity (DV)						
Knowledge Criticality	.22*	.00	.17†	.00	.00	.00
Knowledge Inimitability	.22*	.00	.21*	.00	.00	.00
Knowledge Availability	.10*	.00	.00	.00	.00	.00
Knowledge Confidence	.18*	.00	.00	.00	.50***	.00
Knowledge Ascendancy	-.13†	.00	-.23*	.00	.00	.00
Scanning Proactiveness (DV)						
Knowledge Criticality	.34*	.00	.41***	.00	.00	.00
Knowledge Inimitability	.00	.00	.00	.00	.00	.00
Knowledge Availability	.35*	.00	.00	.00	.00	.00
Knowledge Confidence	.21*	.00	.50***	.00	.00	.00
Knowledge Ascendancy	.00	.00	.00	.00	-.17	.00

The trends in these two knowledge domains, however, were not completely reflected in the cost management domain. Specifically, generative inquiry in the cost management area did not have any direct or indirect relationships barring a weakly significant positive relationship influence of Knowledge Confidence. However, Adaptive Action in cost management did have practice, and that path is through executive scanning behaviors. Therefore, these findings together lend support to proposition 11, which proposed that increased levels of scanning proactiveness and intensity would be linked with increased tendencies of firm-level knowledgeable practice. The path analysis results provide strong indication for such a trend. Figures- 10 a, b, and c show the actual pathways (only statistically significant) between executive knowledge schemes, scanning behaviors, and knowledgeable practice. In these figures, I show only the statistically significant paths and leave out the performance control variables for conceptual clarity.

Figure-10a- Final Path Model (Shop-floor Technology Domain)

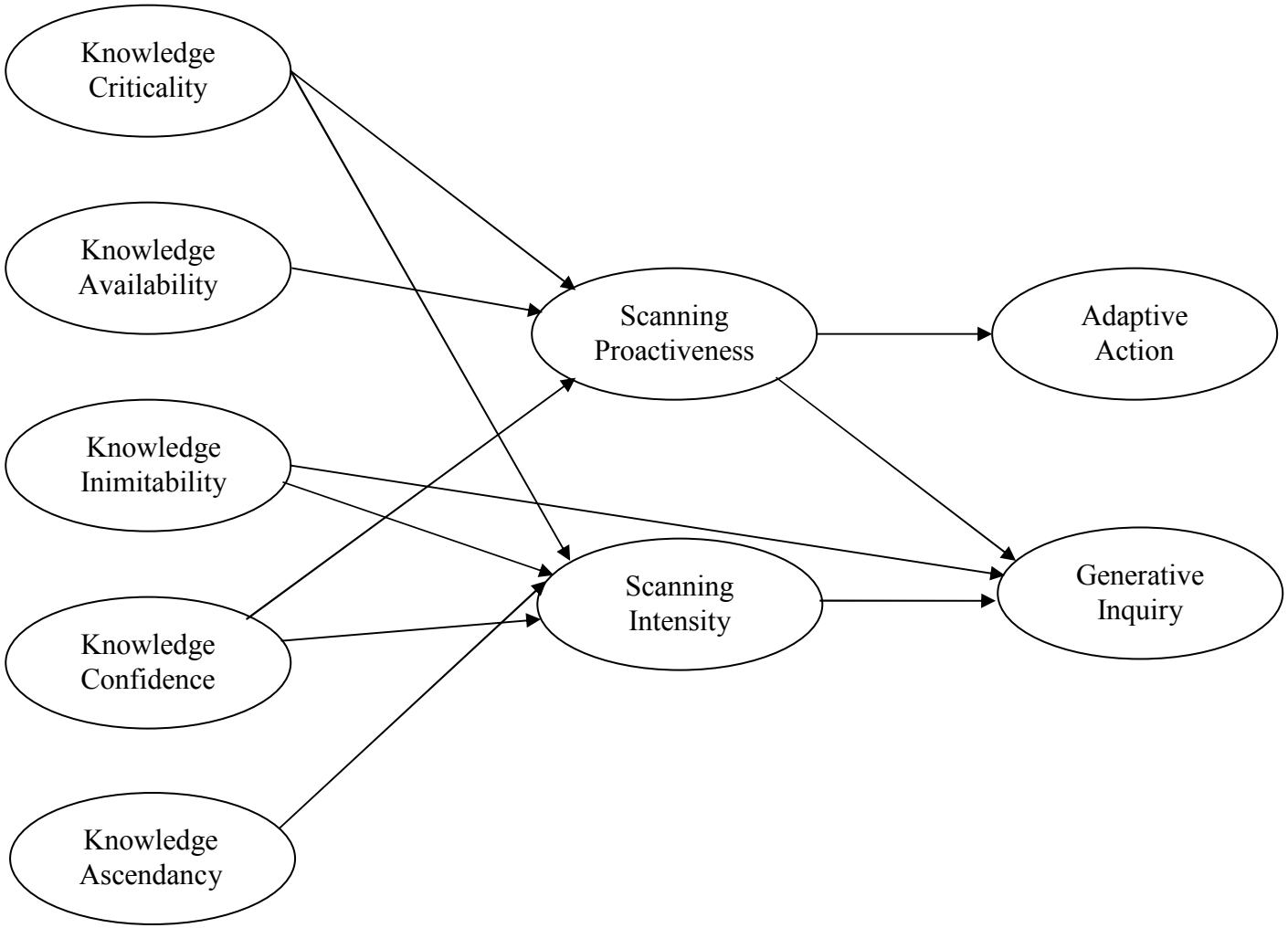


Figure-10b- Final Path Model (Sales and Marketing Domain)

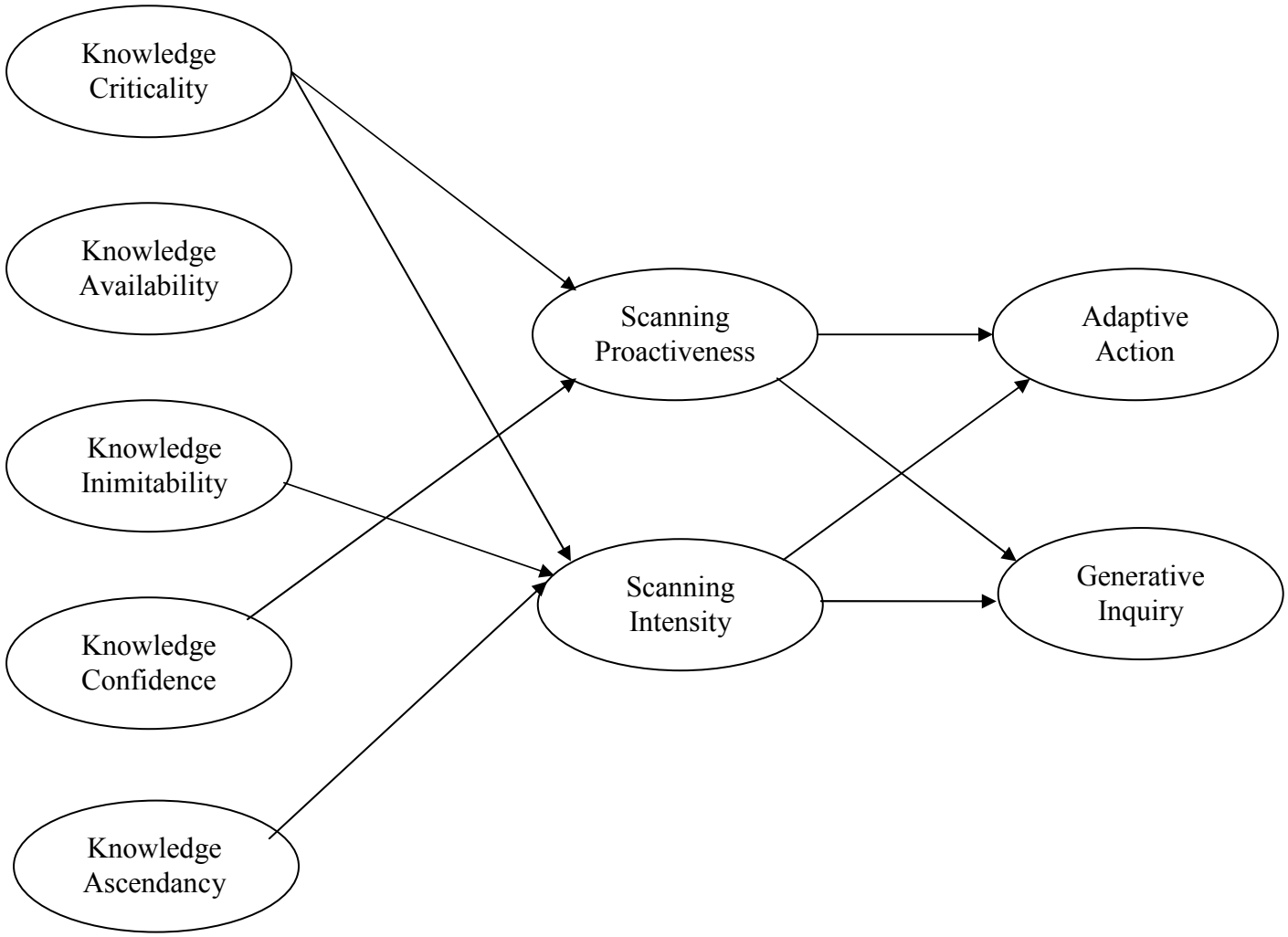
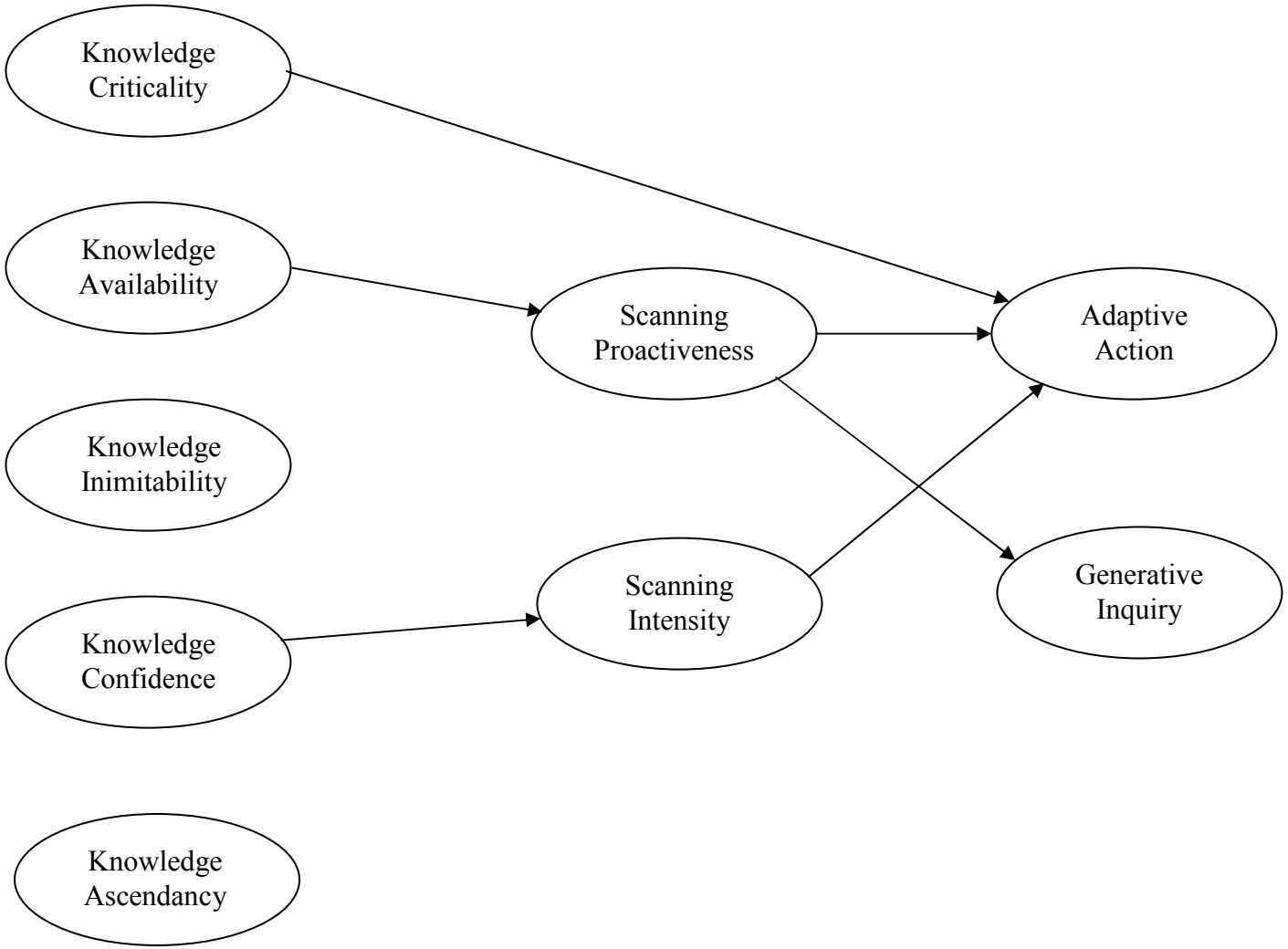


Figure-10c- Final Path Model (Cost Management Domain)



9.7. Executive Demographics and Knowledge Schemes

Proposition 12 suggested that managerial demographics are likely to influence executive knowledge schemes. I generated this proposition by consulting the extant literature on managerial traits and characteristics, especially in the upper echelons perspective based studies. It has been argued that managerial demographics capture the hard to empirically study the underlying cognitions (Finkelstein & Hambrick, 1996; Hambrick & Mason, 1984).

I proceeded to test proposition 12 through a correlational analysis, as I had no apriori relationships. For each of the three knowledge domains, I correlated an executive's functional experience, firm tenure, industry tenure, age, education level, and number of other foundries worked in, with the knowledge scheme variables. Tables 22, a, b, and c show the zero-order correlation tables for each of the three domains.

Table- 22a- Correlations between EKS & Executive Demographics (Shop-Floor Technology Domain)

	Knowledge Criticality	Knowledge Ascendancy	Knowledge Confidence	Knowledge Availability	Knowledge Inimitability
Industry Tenure	0.04	0.02	0.14	0.09	0.01
Firm Tenure	0.01	-0.04	0.17*	0.06	0.07
Other foundries worked in	-0.02	0.06	-0.02	0.16	-0.01
Education	-0.21**	0.13	0.06	0.06	0.10
Age	-0.08	-0.10	0.06	-0.05	-0.01
Functional Experience	0.05	0.00	0.01	0.12	-0.07

** p<.01
* p<.05

Table- 22b- Correlations between EKS & Executive Demographics (Sales and Marketing Domain)

	Knowledge Criticality	Knowledge Ascendancy	Knowledge Confidence	Knowledge Availability	Knowledge Inimitability
Industry Tenure	-0.01	-0.02	0.03	-0.01	0.03
Firm Tenure	-0.13	-0.07	-0.16*	0.07	-0.13
Other foundries worked in	0.15	0.06	0.21**	-0.10	0.11
Education	0.00	0.12	0.12	-0.08	0.14
Age	-0.13	-0.01	0.00	0.02	-0.01
Functional Experience	0.02	-0.22*	0.21*	0.11	-0.01

** p<.01
* p<.05

Table- 22c- Correlations between EKS & Executive Demographics (Cost Management Domain)

	Knowledge Criticality	Knowledge Ascendancy	Knowledge Confidence	Knowledge Availability	Knowledge Inimitability
Industry Tenure	-0.01	-0.11	-0.08	-0.03	0.04
Firm Tenure	-0.10	-0.02	-0.14	0.00	0.01
Other foundries worked in	0.15	-0.02	0.11	-0.05	0.05
Education	0.04	0.21**	0.32**	-0.04	0.10
Age	-0.11	0.01	-0.01	0.00	0.00
Functional Experience	-0.05	-0.22*	0.03	0.09	0.03

** p<.01
* p<.05

Overall, the correlational analysis suggested limited association between demographic variables and executive knowledge schemes. Across the three models, education, functional experience, and firm tenure came out as an important correlates but their associations were not consistent in all the three models.

9.8. Executive Demographics and Scanning Behaviors

Proposition 13 suggests that managerial demographics are likely to influence their scanning behaviors. To assess this argument, I carried out two sets of OLS regressions, the first involved regressing scanning intensity on the key demographic indicators and the second regressing scanning proactiveness on the same indicators. I analyzed these relationships in each of the three domains. Tables 23a and 23b show the results of the regression analysis

Table 23a - Executive Demographics and Scanning Intensity- OLS Regressions

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	1.53	0.98	2.25	0.74	1.20	0.78
Firm Tenure	0.03	0.02	.001	0.02	.004	0.02
Industry Tenure	-0.03	0.03	-.001	0.02	.003	0.02
Other foundry Experience	0.20	0.13	0.11	0.09	.004	0.12
Education	0.27	0.20	0.23†	0.13	0.35*	0.14
Age	.002	0.03	.005	0.02	0.03	0.02
Functional Experience	-.003	0.02	.002	0.01	-.004	0.01
R-squared	**.04**		**.07**		**.17**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 23b- Executive Demographics and Scanning Proactiveness- OLS Regressions

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	2.54	0.78	2.07	0.85	2.76	0.91
Firm Tenure	0.02	0.02	0.01	0.02	0.03	0.02
Industry Tenure	0.03	0.02	0.01	0.02	-0.02	0.03
Other foundry Experience	0.10	0.10	0.21*	0.10	0.17	0.14
Education	0.29*	0.14	0.36*	0.15	0.25	0.16
Age	-0.02	0.02	-0.01	0.02	0.01	0.02
Functional Experience	.000	0.01	0.02	0.01	-0.01	0.01
R-squared	**.09**		**.15**		**.07**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Analysis of the regression models with scanning intensity and proactiveness as two predicted variables suggest a minimal association with managerial demographics, barring the education variable, which was found to have consistently positive association with both scanning intensity and proactiveness.

9.9. Knowledge Assets, Knowledgeable Practice, Firm Innovation

In propositions 14-16, I proposed that knowledgeable practice would mediate the relationship between knowledge assets (firm-level human capital, social capital, and technological complexity) and the firm's ability to create both incremental and radical innovation. To test these propositions, I began by creating two composite firm-level variables, which I called "average generative inquiry" (AGI) and "average adaptive action" (AAA) as the overall indicators of knowledgeable practice averaged across the three domains.

Using these composite measures, I ran three separate mediational models (OLS regression based) following Baron and Kenny's (1986) guidelines for testing mediation. These authors propose that to test if variable z mediates the relationship with the independent variable x and the dependent variable y, the following steps should be followed:

- The dependent variable is regressed on to the independent variable
- The mediator variable is regressed on the independent variable,
- The independent and the mediator variables together are made to predict the dependent variable.

In the case of a full mediation, the effect that x has on y after the entry of z becomes non-significant. Based on these criteria, I tested the mediational effects on a set of four knowledge asset indicators – human capital, social capital[11], level of automation, and product complexity using two dependent variables – radical and incremental innovation. Tables 24 a and b show the results of the mediation tests.

[11] Social capital was measures at two levels, firm and individual executive. In my analyses I found that the individual social capital indicators had non-significant relationships with both the mediators, thus violating Baron and Kenny's (1986) second requirement for mediation as discussed above. I therefore used only the firm level indicator of social capital, which measured a firm's participation in external knowledge sources.

Table 24a– Results of Mediation Tests for Predicting Radical Innovation (D.V.)

I.V.	M.V.	β of I.V. without M.V.	β of I.V. with M.V. Present	β of M.V. with I.V. present	Ratio of Indirect/ Direct Effects	Sobel's Test Statistic	p-value	Mediation
Human Capital	Generative Inquiry	0.31**	0.10	.39**	2.02	3.68**	.000	Full
Social Capital	Generative Inquiry	0.30**	0.16*	.38**	0.91	2.96**	.003	Partial
Level of Automation	Generative Inquiry	0.34**	0.18*	0.36**	0.93	3.90**	.000	Partial
Product Complexity	Generative Inquiry	0.41**	0.27**	0.33**	0.55	4.00**	.000	Partial
Human Capital	Adaptive Action	0.31**	0.27**	0.23**	0.14	1.55	.120	Minimal
Social Capital	Adaptive+ Action	0.30**	0.28**	0.24**	0.10	1.21	.225	Minimal
Level of Automation	Adaptive Action	0.34**	0.30**	0.17*	0.16	1.81	.061	Minimal
Product Complexity	Adaptive Action	0.41**	0.38**	0.16*	0.09	1.74	.081	Minimal

** p<.01
* p<.05
†p<.10

+ In this case, the I.V. had a non-significant regression coefficient when the M.V. was regressed on it, thus, violating the Baron and Kenny's (1986) second requirement for mediation

Table 24b – Results Mediation Tests for Predicting Incremental Innovation (D.V.)

I.V.	M.V.	β of I.V. without M.V.	β of I.V. with M.V. Present	β of M.V. with I.V. present	Ratio of Indirect/ Direct Effects	Sobel's Test Statistic	p-value	Mediation
Human Capital	Generative Inquiry	0.28**	0.18*	.19**	0.58	3.41**	.000	Partial
Social Capital	Generative Inquiry	0.19**	0.12*	.20**	0.67	2.86**	.004	Partial
Level of Automation	Generative Inquiry	0.28**	0.20**	0.17**	0.38	3.52**	.000	Partial
Product Complexity	Generative Inquiry	0.18**	0.09*	0.20**	0.99	3.78**	.000	Partial
Human Capital	Adaptive Action	0.28**	0.26**	0.12*	0.08	1.46	.142	Minimal
Social Capital	Adaptive+ Action	0.19**	0.18**	0.13**	0.09	1.81	.236	Minimal
Level of Automation	Adaptive Action	0.28**	0.27**	0.06	0.07	1.22	.221	Minimal
Product Complexity	Adaptive Action	0.18**	0.15**	0.11*	0.15	1.75	.080	Minimal

** p<.01
* p<.05
†p<.10

+ In this case, the I.V. had a non-significant regression coefficient when the M.V. was regressed on it, thus, violating the Baron and Kenny's (1986) second requirement for mediation

9.10. Summary of Results

The results from Stage-2 call for not only, a fine-tuning of the specific relationships among the constituent elements of knowledge schemes, scanning behavior, and knowledgeable practice, but also suggest a broader re-appraisal of the relationships between the three meta-concepts. While the analyses provide clear support to the insights that emerged from Stage-1 that executive knowledge schemes influence scanning behaviors, they also indicate that their relationships with firm-level knowledgeable practice is actuated through scanning behavior, and at best, has only a weak direct effect. I discuss this insight in detail shortly.

Notwithstanding the below par reliability estimates of the Knowledge Ascendancy scale in the final survey[12], all the observed scales displayed acceptable psychometric properties. Furthermore, the observation that the relationships were not the *same* across the three knowledge domains provides grounds for concluding that common methods variance was not a problem and more importantly, the dynamics of the relationships between the three meta-concepts *vary* to some extent across knowledge domains. This was also further confirmed in the adequate convergent and discriminant validity indicators, which provide confidence about the process by which the emergent concepts in Stage-1 were converted into measurable scales for Stage-2.

In the ensuing sections, I discuss the results in detail, focusing specifically on the relationships between executive knowledge schemes and scanning behaviors on one hand and between scanning behaviors and knowledgeable practice on the other. I also discuss the strong support obtained for the mediational role of knowledgeable practice, in the relationships between

[12] Although this is the case, the pre-test reliability estimates were acceptable, which gives reasons for presuming that with further research the scale can be made stronger.

a firm's tangible knowledge-based assets and their influence on the ability of the firm to innovate.

9.11 Discussion of Findings from Stage-2 of the Study

9.11.1. How Executive Knowledge Schemes Influence Executive Scanning Behavior

The analysis of the Stage-2 data provides compelling support for the argument that executive knowledge schemes influence the amount and nature of scanning activities that a focal manager engages in. In general, propositions 1 to 5 found significant support across the knowledge domains. In a related but divergent vein, the analysis at times showed that the association between knowledge schemes and scanning behaviors was not the same for scanning intensity and proactiveness, and at times, the individual sub-dimensions had opposing relationships with the two aspects of scanning. I discuss each of these here forth.

Knowledge Criticality and Scanning. As seen in Tables 18a and 18b, the knowledge criticality sub-dimension showed a significant positive association with both scanning intensity and proactiveness. This confirms the overall finding that the knowledge domains that a focal executive evaluates as extremely important for survival and success in the foundry industry are also the domains where s/he is likely to scan the most[13].

Knowledge Availability and Scanning. Propositions 2 and 2a suggested the possibility that perceptions of availability of knowledge from external sources in a given domain will influence the scanning behaviors in that domain. Overall, in the scanning intensity model, the associations were non-significant. In the scanning proactiveness model, knowledge availability had a positive

[13] It will be useful to note here that the first-order correlations among the knowledge criticality values in the three knowledge domains were in the low .20s. This suggests not only that executives differ significantly in their evaluations of what knowledge domain is critical but also confirms that the knowledge scheme scales were able to discern variance between knowledge domains (even within the same respondent).

significant association with scanning proactiveness in the shop-floor technology domain suggesting support for proposition P2. Although not overwhelming, the significant positive relationship (at least in one domain) provides support to the observation that managers tend to scan more proactively in those areas where they perceive *more* (and not less) knowledge is available from external sources. In domains with high knowledge availability it is possible that the manager perceives that if knowledge is relatively easy to acquire, then all competitors can do the same without expending much effort. Therefore, to generate *competitive advantage,* in the light of this easy availability, it becomes necessary to engage in aggressive proactive scanning in order to get the better knowledge, faster, than the competition.

This finding is counterintuitive to extant knowledge about executive scanning. Past studies have found that perceptions of increased environmental uncertainty lead to greater scanning among executives (Elenkov, 1997; Garg et al., 2003). Uncertainty is related to a lack of useful information and therefore the logic is that executives scan more to get more information in times of uncertainty. However, I find that perceptions of increased knowledge availability lead to greater scanning. The reason for this diametrically opposite finding is that the knowledge availability scale seems to be tapping into a "socio-cognitive" belief (that is, a belief with reference to other competitors), instead of just the focal executives own understanding of an environmental sector. Therefore, when executives realize that it is easy for their competitors to gain knowledge in a given domain, they scan harder to get better quality knowledge in that domain.

Knowledge Inimitability and Scanning. Proposition 3 suggested that when an executive perceives her/his firm's expertise and skills in a given knowledge domain as inimitable, those beliefs are likely to enhance the amount and nature of scanning that executive engages in that

domain. The analysis confirmed this association but only in the case of scanning intensity and not proactiveness. Those knowledge domains where the executive perceives that her/his firm's knowledge-based advantages cannot be easily appropriated by competitors, also tend to be the ones where s/he scans more in terms of intensity. However, the finding that perceptions of knowledge inimitability did not have a significant association with scanning proactiveness needs some thought. It might be so that perceptions of knowledge inimitability lead to "reinforcement" scanning where the executive seeks to maintain the advantage by keeping a strict "vigil" on that domain. This suggests an influence of path dependency in scanning—executives scan those domains where they perceive their firm's advantages to be more durable (not easily appropriated away by the competition).

On the other hand, proactive scanning is a behavior where a focal manager aggressively looks for information (perhaps in an effort to get better *quality* and more *useful* information) in a knowledge domain. The regression coefficients of knowledge schemes on scanning proactiveness (albeit non-significant) show a negative directionality in both sales and marketing. This tentatively suggests that whereas perceptions of high inimitability do significantly enhance the amount of scanning in a given domain, they paradoxically, reduce the proactiveness of scanning in that area.

Knowledge Confidence and Scanning. This was the sub-dimension that had the most consistent and strongest results in terms of its influence on executive scanning behavior. It might very well be the case, that this sub-dimension, which is oriented towards the "self" is a cognitively proximate set of beliefs than the other elements of executive knowledge schemes, which are directed at the firm level. Proposition 4 posited that greater knowledge confidence in a given knowledge domain will enhance scanning in that area. It was amply supported in the models

using both scanning intensity and proactiveness. In terms of absolute strengths of association, the same was greater and more consistent in the scanning proactiveness models than in the intensity model (where in the sales and marketing domain, the relationship was non-significant).

Knowledge Ascendancy and Scanning. Given the exploratory nature of this research, I chose to persevere with the knowledge ascendancy scale in spite of its weak reliability estimates. The results for this element's association for scanning were unexpected. Based on the Stage-1 findings, I proposed a positive relationship between knowledge ascendancy and the intensity and proactiveness of scanning that the executive engages in, because the evidence suggested that such executives tended to take a greater load of the "intellectual" work in the organization. Surprisingly, the results in Stage-2 are consistently opposite to this prediction in all knowledge domains, and for both scanning intensity and proactiveness. In the sales and marketing domain, knowledge ascendancy had a significant negative association with scanning intensity and a negative but weakly significant association with scanning proactiveness in the cost management area.

How can one explain this anomaly? Perhaps, it is possible that the knowledge ascendancy scale is capturing deeper cognitive processes than what it was meant to be. It might be so that taking on the "intellectual" load in the organization (that is, nihilifying the intellectual skills of lower level employees) is also accompanied by a belief that as most of the expertise resides in the upper-echelons in the organization, there is little to no need for engaging in external scanning. If this is indeed the case then knowledge ascendancy scale is tapping into a more "self" driven cognitive process that perhaps has to do with managerial hubris (Hiller and Hambrick, 2005). This should also reflect in stronger associations with the knowledge confidence scale.

Further analysis, however, suggested that the knowledge ascendancy measure and knowledge confidence measure had weak and non-significant correlations, thus reducing the likelihood that the knowledge ascendancy scale is reflecting a deeper cognitive belief such as hubris.

A different explanation can be that the activity of scanning means different things to different executives. By this I imply that there might be some senior executives, who view scanning as a middle-level management activity. In other words, senior executives might delegate the scanning and information search activities to middle and lower level employees, while keeping with themselves the task of "processing" the scanned information. The scanning literature by and large has not differentiated scanning activities by hierarchical level and has paid scant attention to what happens to the information once it is scanned *into* the organization. It might be so that senior executives who perceive that the lower echelons as relatively less able in information *processing*, delegate greater responsibility for information *sourcing* to them. In some of the foundries that I had visited during stage-1, I found some limited evidence of this tendency. For instance, a western PA-based foundry's president had an overall negative perception about his company's future in the foundry industry. While he was still active in the foundry's day-to-day operations, he had more or less delegated the task of customer liaison, attending trade association meetings, and dealing with equipment and raw materials suppliers, to his foundry operations manager. The focal president used to spend more of his time dealing with sudden problems that would occur in the shop floor or with existing customers.

9.11.2. Executive Knowledge Schemes and Firm-level Knowledgeable Practice

While the analysis of the Stage-2 data did show significant relationships between knowledge schemes and scanning behavior, the same was not prevalent in their association with firm-level knowledgeable practice (Tables 19a and 19b). This led me to consider the possibility that there might be an indirect association between knowledge schemes and knowledgeable practice, one which is actuated[14] largely through an executive's scanning behaviors. The results of the path analyses in all three domains provide strong evidence to come to this conclusion.

This indirect relationship implies that executive scanning plays a much broader role in influencing the organizational context than has previously been theorized and empirically studied. My findings suggest that executive scanning behaviors play an important role in *signaling* to the rest of the organization, what the senior management feels is important in terms of the ways in which knowledge is to be adapted, transformed, and utilized in the organization. Second, the findings also suggest that managerial cognition in general and beliefs about knowledge in particular, become important influencers of firm-level knowledgeable practice *only* when those beliefs are reflected in manifest scanning behaviors.

At this stage, it will be useful to do a more fine-grained analysis of the influence of scanning behaviors on knowledgeable practice. Although, overall, the direct effects (please refer to table 21) were much stronger than indirect effects, they were not homogenous across the three knowledge domains. In the area of shop floor technology, scanning proactiveness was found to have a stronger and more significant relationship with adaptive action as compared to generative

[14] Although this might suggest the scanning behaviors *mediate* the relationship between executive knowledge schemes and knowledgeable practice, it doesn't seem to be the case because for a mediational model to work, the independent variable must have a significant association with *both,* the mediating and dependent variables. In this case, the former association existed but the latter did not. This precludes me from claiming that "scanning behaviors" *mediate* the relationship between executive knowledge schemes and firm-level knowledgeable practice.

inquiry. In the same vein, scanning intensity was strongly related to generative inquiry but had no direct relationship with adaptive action. In the sales and marketing knowledge domain, scanning intensity had a highly significant and strong positive relationship with generative inquiry as compared to the weakly significant influence of scanning proactiveness. Finally in the cost management area, only scanning proactiveness had a weakly significant relationship with generative inquiry, whereas scanning intensity had a significant positive relationship with adaptive action. What might be the reason behind such differences?

To find a potential explanation to this question, I carried out a supplemental analysis that involved the use of paired sample t-tests[15] to ascertain if there were significant differences in the sample in the levels of adaptive action and generative inquiry in each of the three domains. Results from this analysis showed that while this was indeed the case, each domain had a different story to tell. In the shop-floor technology area, there was significant difference in the mean values of generative inquiry and adaptive action, however the magnitude of this difference was close to half a standard deviation, with adaptive action levels being higher overall. In the sales and marketing domain, generative inquiry was much more prevalent with the absolute mean difference being larger than one standard deviation. Conversely in the cost management domain, the adaptive action level was more than one standard deviation higher than the level of generative inquiry. This pattern, although at a gross sample level, suggested a possible angle to interpret the results linking scanning behaviors with knowledgeable practice. In shop-floor technology, where the difference in occurrence of generative inquiry and adaptive action is not that pronounced, scanning behaviors seem to influence both. In sales and marketing, adaptive action occurs a lot less on average as compared to generative inquiry, which perhaps explains

[15] Paired sample t-tests allow the comparison of means of two variables within a given sample to test for significant differences between them.

why scanning behaviors (specifically scanning intensity) seem to influence only generative inquiry. The opposite case holds for cost management domain.

To summarize, an intriguing finding from stage-2 is that the relationship between executive knowledge schemes and firm-level knowledgeable practice is not a direct one but is made possible through the manifestation of scanning behaviors. An important conclusion is that executive scanning comes across as much more important organizational phenomenon than just a senior-management information search activity. The findings suggest the need for further theorizing about the signaling role of executive scanning behaviors that defines the context for the use of knowledge as a resource at the firm level and in the process lead to the formation of competitive advantage.

9.11.3. Knowledgeable Practice- A New Link between Knowledge Assets and Innovation

Of some non-trivial importance is the reasonably strong support for the mediational influence of knowledgeable practice on firm innovation. The findings suggest that generative inquiry, which I defined earlier as those actions or behavioral tendencies that reflect upon, stretch, and go beyond what the firm already knows about a specific problem situation, fully mediates the relationship between human capital and radical innovation and partially mediates the relationships of firm-level social capital and technological complexity with radical innovation. This implies in simple terms that mere possession of skilled employees, extra-firm connections (social capital), and complex technical equipment does not by itself result in innovation. The ability to consistently transform the organizations' collective knowledge by going beyond and expanding the understanding obtained from daily operational and strategic

situations is essential for *converting* what the organization knows into tangible competitive outcomes.

While the generative inquiry component of knowledgeable practice proved to be an important mediator, the same was not found for adaptive action, which I defined as those patterns of behavior where existing knowledge is adapted to find new and creative ways to respond to a problem situation. Adaptive action, then, comes across as a distinctive mode of knowledgeable practice in firms but it does not provide the bases for sustained firm innovation as generative inquiry does.

In summary, stage-2 of this dissertation offered not only support for some of the propositions that emerged from stage-1 but also threw up some tellingly novel insights that enrich and fine-tune the emergent grounded theory model. Overall, I do find support for the fundamental premise that managerial beliefs about knowledge influence the ways in which firms use knowledge. The premise, however, is now more complicated and detailed not only in terms of the pertinent *content* of beliefs about knowledge, but also perhaps more importantly, the *processes* by which those beliefs manifest in firm-level tendencies of knowledgeable practice. The emergence of executive scanning as an essential interlocutor between managerial cognition and firm level behaviors offers the potential for broadening the role of executive scanning than has been accorded to it yet.

In the final chapter that follows, I endeavor to put the whole story together and lay the foundations for a new theoretical framework to understand how managers matter in the realm of knowledge-based competitive advantage.

Chapter-10

FROM COMMON TO UNCOMMON KNOWLEDGE- AN INFORMED DISCUSSION AND GROUNDS FOR FURTHER RESEARCH

In this dissertation, I set out with the broad research agenda about the influence of managerial choice on resources, especially knowledge as a key strategic resource. While managers (mostly senior-level), have been an important foci of some theoretical approaches in strategic management (c.f. Hambrick & Mason, 1984; Mintzberg, 1983; Prahalad & Bettis, 1986; Thomas et al., 1993), somehow, the key theories of competitive advantage such as the industrial-organization driven structure-conduct-performance paradigm (Porter, 1980) and the more recent, resource-based view (Barney, 1991) have yet to account for managerial choice within their theoretical frameworks. Whereas the I/O view of competitive advantage renders the manager's choices as one of selecting the right strategy, given the industry's structural dynamics, the resource based views managers essentially as a "resource" that along with other resources, somehow, determines the sustainability of a firm's competitive advantage.

Both these perspectives while implicitly assuming human/entrepreneurial agency, fail to offer a comprehensive understanding of how top executives of firms influence the formation and sustenance of competitive advantage. This omission offers stark contrast to the plethora of business books, some of which chronicle the lives of successful managers and how they single-handedly changed the fortunes of their companies (c.f. Morita, Shimomura, Smith, & Reingold, 1988; Sculley & Byrne, 1987).

I based this dissertation on an effort to discern how managers influence the choice and evaluation of strategic resources, specifically, knowledge as a strategic resource. In recent years

the knowledge-based view has gained significant importance in strategic management as a perspective that theorizes about the conditions in which knowledge becomes the primary competitive resource (Grant, 1996). The dominant position of the KBV has been that firms are superior to markets in combining the diverse knowledge of individual organizational members and the mechanisms by which such combinations are accomplished often reside in the modes of coordination and control of activities, organizational routines, and social cooperation among members. While the KBV has offered important insights about these higher-order organizing mechanisms, we know precious little about the factors that influence the differential choice of these mechanisms, which in turn lead to the broader question—what are the factors that make knowledge a basis for inter-firm heterogeneity?

The emergence of the three meta-concepts in Stage-1 of this dissertation, that is, Executive Knowledge Schemes, Executive Scanning Behaviors, and Firm-Level Knowledgeable Practice, potentially offer the ingredients for extending the theoretical scope of the KBV. In the following sections, I look at each of the three at a time to bring forth their theoretical relevance to the problems identified above.

10.1. Executive Knowledge Schemes

Although a rich and varied body of research exists that conceptualizes the nature and scope of managerial cognition and its implications of strategic behavior and outcomes, precious little has been done to *contextualize* cognition, that is, empirically surface managerial beliefs and interpretations that pertain to the issues at hand (notable exceptions being, Thomas et al., 1993; notable exceptions being, Thomas et al., 1994; Tripsas & Gavetti, 2000). The study of managerial cognition has largely focused on personality-based traits such as locus of control

(Miller & Toulouse, 1986), tolerance to ambiguity (Gupta & Govindarajan, 1984) or the use of demographic proxies that nonetheless tap general cognition rather than managerial beliefs about specific issues at hand. While this research has clearly brought managers to the center stage of strategic management, there is a need to take cognition from the general to the specific, that is, to conceive and measure cognition as it is actually played out in the complexities of organizational and competitive milieu.

The Executive Knowledge Schemes and their constituent dimensions represent contextualized managerial cognition about knowledge and its strategic implications. These schemes are to a large extent industry specific, and as seen here, they operate with some degree of variability across different knowledge domains. Nonetheless, they offer a framework to dimensionalize and measure managerial cognition about resources—thus providing a potential avenue to extend the theoretical bounds of the resource and knowledge based views of strategy.

The overarching finding from the dissertation is that managers across firms operating in largely similar objective environments do vary significantly in their beliefs and interpretations about resources (here, knowledge as a resource). This observation should help bring managers firmly into the center of the resource and knowledge based frameworks, not just as *another* resource, but more importantly, *active* shapers of resources. For instance, I found that the CEOs across my sample differed in their evaluations about the criticality of knowledge domains. That is, some CEOs see shop-floor technology as more critical whereas others see sales and marketing, and some others cost management. This simplistic finding offers strong evidence that the choice and interpretation of what is important as a resource is an outcome of managerial cognitive processes.

In conclusion the Executive Knowledge Schemes framework offers a novel approach to tap managerial cognition about resources, a task that has not been carried out earlier.[16] A second aspect knowledge schemes that emerged from this study is their strong influence on executive scanning behaviors. I dwell on the importance of this finding next.

10.2. Executive Scanning Behaviors- New Grounds

Notwithstanding the existence of a well-developed body of research on executive scanning, the findings from this dissertation offer the potential to break new ground first, on the *drivers* of managerial scanning , and second, on the ways in which scanning is conceived and empirically studied as an activity.

The strong empirical support for the propositions that executive knowledge schemes influence scanning behaviors, offers new insights about the factors that lead to difference in scanning emphases among managers. The conclusion, in simple terms is, *the ways in which managers perceive and understand knowledge also influences how they search for knowledge.*

As observed earlier, managerial scanning has been seen as a primary managerial activity that is aimed at organizational adaptation to the environment (Hambrick 1982; Daft and Weick, 1984). Nonetheless, despite calls by early researchers (Aguilar, 1967, Hambrick, 1979, 1982) surprisingly little has been done to look into the *actual* activities/behaviors that managers engage in while scanning their external and internal environments. The focus largely has been on using generic measures of scanning *amount* either in the form of number of hours or frequency of search.

[16] Appendix G provides exploratory analyses testing the role of demographic indicators as antecedents of Executive Knowledge Schemes.

The concept of scanning proactiveness sheds new light on the specific behaviors that undergird managerial scanning. Furthermore, it was found that scanning intensity and proactiveness worked differently at times from each other in terms of how executive knowledge schemes were associated with them and how the two in turn, associated with knowledgeable practice at the firm-level. The notion of scanning proactiveness offers a new approach to conceptualize and empirically study managerial scanning.

10.3. Knowledgeable Practice – A New Way to understand Knowledge

The emergence of "knowledgeable practice" as a way to understand and conceptualize how knowledge is applied, adapted, and enhanced in day-to-day activities offers a fresh angle to approach the foundations of knowledge as a key competitive resource. Although, since its earliest formulations, the KBV has viewed firms as superior mechanisms of knowledge "application" (Grant, 1996), little theoretical and empirical work has followed that has actually sought to focus on the micro-level practices and tendencies which undergird the application of knowledge in organizations. Conceptually, this approach requires a cautious departure from the current ways in which knowledge has been studied as a primary competitive resource. Most of the empirical work on knowledge as a key strategic resource has focused on the "quantity" and "quality" of knowledge that is "possessed" by a firm.

Scholars have sought to operationalize knowledge in the form of "knowledge stocks," in terms of patents, technologies, managerial expertise and experience etc. (see Smith, Collins, & Clark, 2005), tangible best practices and their objective characteristics such as tacitness, complexity etc (Kogut & Zander, 1992; Simonin, 1999; Szulanski, 2000). This view treats knowledge primarily as an economic resource alongside other factors of production such as capital and labor. Although the "possession" based conception of knowledge has significantly

advanced our understanding of competitive advantage, the findings from this dissertation suggests that this view needs to be complemented by conceiving of knowledge more in terms of what a firm "does" rather than what it "owns". Knowledge, in this view ought to be seen less as an object that the firm possesses and more as an active and emergent property that inheres in organizational members' day to day activities. [17]

10.4. Implications for Future Research

This dissertation offers potentially novel insights on how managers closely influence the evaluation, interpretation, choice, and application of knowledge in firms. The general finding that executives, even within the same industry, show wide disparities in their understanding of knowledge as a strategic resource, calls for increased research on the intersections between managerial cognition and organizational resources and capabilities. This thesis breaks new ground in the understanding of the role of managers in the creation of competitive advantage.

Future research can utilize the concept of executive knowledge schemes to study a whole host of factors such as knowledge transfer, barriers to strategic change, and failure of organizations to learn in the event of major environmental upheavals. The business landscape is replete with examples of firms that continue to take wrong decisions in spite of signals from the external environment. It is likely that executive knowledge schemes not only act as sieves but perhaps more importantly, active shapers of information and knowledge that makes the organization function in particular ways.

[17] Appendix G contains additional analyses testing the influence of Knowledge Practice on Firm Performance.

In studies of knowledge transfer, executive knowledge schemes can be utilized to understand why the same "best practices" when transferred to different sub-units of subsidiaries, end up having different results. The knowledge schemes play an active role in how focal executives of the recipient units make sense of the best practice, which in turn influences the ways in which it is adopted (and adapted in the firm).

The concept of scanning proactiveness opens a new vista for re-vitalizing research on managerial scanning. The emergence of scanning proactiveness as an aspect of scanning that is different from the *amount* of scanning beckons researchers to look at the specific activities that managers engage in when searching for information in a domain. Scanning proactiveness can be one answer to the somewhat mixed findings about the drivers of executive scanning. For example, Hambrick (1982) found that firms pursuing different strategies did not differ in the amount of scanning in a given sector. However, it is eminently possible that there might be systematic differences between executives in terms of the specific activities by which they search, regardless of how much they search.

10.5. Limitations

All research has inherent limitations and this thesis is no exception. The two biggest limitations of this study are 1) its focus on a single industry, and b) its predominantly cross-sectional design. As far as the first limitation is concerned, the choice of a single industry has allowed me to gain an in-depth understanding of the drivers of competitive heterogeneity, a feat which would be hard to attain in a large multi-industry study. The second limitation can be surmounted by carrying out repeated surveys of foundries after a period of time. Nonetheless for the present study, the cross-sectional nature of the survey data (although aptly supported by the

qualitative insights) bears a mark of caution in interpreting the causative models tested in this study.

10.6. Conclusion

Research on the origins of competitive advantage is beginning to conceptualize the role played by managerial cognition. In understanding how knowledge becomes a critical competitive resource, my study reveals not only the role of managerial cognition, but also develops a potentially new way to understand and measure the social processes that undergird the situated use of knowledge as a resource. Through this study I have sought to lay some groundwork for further investigation into the social nature of organizational knowledge and capabilities. We as a field have already theorized that knowledge is a critical resource in modern day organizations. I believe my study has helped to uncover some of the specific pathways by which knowledge *becomes* a resource.

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APPENDIX A

INTERVIEW PROTOCOL FOR THE METALCASTING EXPERT PANEL – PHASE 1

(Firm Experts – CEO's and Top Managers)

PERSONAL INFORMATION

1. How long have you been involved with the metalcasting industry?
2. How long have you been involved with your current organization?
3. What responsibilities and functions have you held in this firm?
4. How long has your organization been in operation?

PERCEPTIONS ABOUT THE METALCASTING INDUSTRY

1. How would you describe the current environment and situation in the metalcasting industry?
2. What are the current trends in the industry?

PERCEPTIONS ABOUT SOURCES OF COMPETITIVE ADVANTAGE

1. In your opinion what critical factors are important for sustained success in this industry in the next five years?

2. What are some of the parameters by which you would define successful or sustained performance for your organization?

3. What in your opinion are the key strengths of your organization vis-a vis your competitors?

    i. Which assets are most important to your success?

    ii. Which organizational and management processes are most important to your success?

    iii. Which of these are distinctive or unique to your organization?

    iv. Is there a consensus in your firm about the importance of these resources and processes to your success?

INTERVIEW PROTOCOL (B) FOR THE METALCASTING EXPERTS

(For Non-Firm Experts –that is persons who are not working in a metalcasting firm currently but are nevertheless involved with the industry)

INDUSTRY EXPERIENCE INFORMATION

1. What have been your specific roles in the metalcasting industry till date ?
2. How many firms in this industry do you deal with or follow? How do you stay abreast of them?

PERCEPTIONS ABOUT THE METALCASTING INDUSTRY

3. How would you describe the current environment in the metalcasting industry?
4. How would you describe current trends in the industry?

PERCEPTIONS ABOUT SOURCES OF COMPETITIVE ADVANTAGE

5. In you opinion, what critical factors will be important for sustained success in this industry in the next five years?

6. What are the key resources that differentiate between high and low performing firms in this industry? In particular, please comment on the relative importance of the following:-
    a. Assets – technology, quality, capital, service etc.
    b. Organizational and Management processes

7. What are the necessary knowledge bases and skills required to operate successfully perform at a high level in the metalcasting industry?

    i. How diffused/widespread are these skills/knowledge bases?
    ii. Where are these knowledge bases/skills located in the industry?
    iii. How easy/difficult is it to access/develop these knowledge bases and skills?

8. In your dealings with metalcasting firms, have you found differences in the ways firms view this industry, develop strategies, and behave? If yes, what are those differences? If no, why not?
9. Can you name some firms that are breaking out of the pack right now? How did these firms do so?
10. Recount some of the major innovations that have impacted this industry in the recent past.

APPENDIX B

INTERVIEW PROTOCOL FOR THE METALCASTING SENIOR EXECUTIVES-PHASE-2

1. Background information: -

   a. Information about the firm,

   b. Information about the executive – functional experience, experience in the industry, experience with the firm

2. Brief introduction of the research project: I am analyzing the drivers of innovation and performance in the foundries. For this, firms such as yours might be facing the need to revitalize themselves to face the impending competition from overseas manufacturers.

   a. So, how does a foundry such as yours create competitive advantage? What are some of the factors that separate better performing foundries from others?

   b. For these factors what is the role of know-how and expertise?

   c. So, how do you make sense of innovation in the foundry business? Can you share some instances where you saw innovation occurring in your company? Please explain

   d. What areas of knowledge and skills are important for innovation and success to occur?

   e. Where does this knowledge reside – inside or outside the firm? In what form?

   f. How does your firm create new knowledge? Where is this knowledge created? At what level?

   g. How often do you as a top manager of your firm feel that the knowledge base of your firms needs to be updated, changed, or modified? How do you carry out this process? Who carries out this process? Do you feel the need to control this process? If so, how do you control it? If not, why not.

3. Do you think the other top managers of your team would tend to share your views?

   h. What is the level of agreement in your TMT

   i. Who makes the final decisions in your organization?

APPENDIX-C: COVER LETTER FOR PHASE-4 SURVEY

MM/DD/YY

Mr/Ms. ABC
CEO/President, XYZ Company

The Foundry Leadership Project

Dear Mr./Ms. ABC,

I am writing to request your help in an important research project that we are conducting for the U.S. Foundry Industry with the full support of four foundry industry trade associations. Penn State University, as a part of its Metalcasting Best Practices initiative, is attempting to provide US foundry CEOs with information about how best to meet management challenges and help American foundries succeed in a highly competitive international arena.

Your company is one of a number of key foundries we have identified for this project, so it is especially important that you participate in the project with us. We are enclosing three survey questionnaires, one that we request you to complete, and two others for a senior management members (whom you designate) to complete, and send back in the enclosed return envelopes. The survey should take less than 30 minutes. Your participation, although voluntary, will go a long way in ensuring that this project provides some clear cut and dependable answers to the strategic challenges that US foundries are facing.

There are no risks in participating in this project beyond what we all experience in everyday life. We assure your **complete confidentiality** in this survey. Under no circumstances will individual or company identifying information be divulged in any reports that come out of this project. All data will be treated only in an aggregate form.

In appreciation of your help, we will provide you with a detailed summary of the results of this project that will present you successful management practices in the foundry industry. In addition, our research team will contribute five dollars to the Foundry Education Foundation for each returned survey, so your participation will be supporting a directly-relevant foundry education initiative.

We recognize that the time taken to respond to any survey is an inconvenience, but we believe this one is not only well worth your time, but is likely to be important to the future success of American foundries, including your own. We really need your help and we will try to provide helpful information to you in return.

We would appreciate it if you could return your completed survey to us within a week. We thank you in advance for your time and assistance. Please feel free to contact us for any clarifications at 814-865-9310/814-883-5366.

Warm Regards,

Rajiv Nag
Project Director

Prof. Robert C. Voigt
FEF Key Professor, Penn State

Dennis A Gioia
Professor, Penn State

APPENDIX D
SURVEY INSTRUMENT FOR PHASE 4

The Foundry Leadership Project

This survey seeks your opinions about various aspects of foundry management and operations. Your responses are vital to help us better understand the key drivers of success in the foundry industry. **YOUR RESPONSES WILL REMAIN COMPLETELY CONFIDENTIAL.** Please answer all questions openly and to the best of your knowledge – no one other than the researcher will ever see your individual responses. If you have any questions and or suggestions about this survey, please contact:

Rajiv Nag
Department of Management and Organization
485-A Business Building
Smeal College of Business Administration
The Pennsylvania State University
University Park, PA, 16802, USA
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Pennsylvania State University

This section seeks your views on the role of know-how and information in the area of ***production technology*** **(processes involved in manufacturing castings)** in the foundry industry. Please circle the number that best represents your level of agreement with each statement.

Statements	Strongly Disagree ▼	Disagree ▼	Not Sure ▼	Agree ▼	Strongly Agree ▼
Knowledge of production technology is critical for a company's success in the foundry industry	1	2	3	4	5
Having better knowledge of production technology is very important for a company's superior performance in the foundry industry	1	2	3	4	5
The higher a person is in the company, the better is his/her knowledge of production technology	1	2	3	4	5
Without the guidance of higher level managers it is difficult for lower level employees to do work effectively in production technology.	1	2	3	4	5
I am confident of my skills in production technology	1	2	3	4	5
Compared to my counterparts in competing companies, I have better skills in production technology	1	2	3	4	5
Most companies in find it easy to get sales and marketing know-how from industry sources	1	2	3	4	5
It is generally easy for companies to acquire useful know-how and information in production technology from foundry industry sources	1	2	3	4	5
It would be hard for a competitor to develop the level of expertise that we have in production technology	1	2	3	4	5
It will not be easy for a competitor to imitate the know-how and skills that our company possesses in production technology	1	2	3	4	5

Please tell us how often you <u>actively seek useful information</u> in the following domain. Circle the number the best represents the level of search you carry out for each item:-

	Once a year	Few times a year	Monthly	Few times a week	Daily
Competitor information	1	2	3	4	5
Current customer information	1	2	3	4	5
Shop-floor technology information	1	2	3	4	5
Prospective customer information	1	2	3	4	5
Operating costs information	1	2	3	4	5
Quality control information	1	2	3	4	5

This section seeks your views on the role of know-how and information in the area of ***cost management*** in the foundry industry. Please circle the number that best represents your level of agreement with each statement.

Statements	Strongly Disagree ▼	Disagree ▼	Not Sure ▼	Agree ▼	Strongly Agree ▼
Knowledge of cost management is critical for a company's success in the foundry industry	1	2	3	4	5
Having better knowledge of cost management is very important for a company's superior performance in the foundry industry	1	2	3	4	5
The higher a person is in the company, the better is his/her knowledge of cost management	1	2	3	4	5
Without the guidance of higher level managers it is difficult for lower level employees to do work effectively in cost management.	1	2	3	4	5
I am confident of my skills in cost management	1	2	3	4	5
Compared to my counterparts in competing companies, I have better skills in cost management	1	2	3	4	5
Most companies in find it easy to get sales and marketing know-how from industry sources	1	2	3	4	5
It is generally easy for companies to acquire useful know-how and information in cost management from foundry industry sources	1	2	3	4	5
It would be hard for a competitor to develop the level of expertise that we have in cost management	1	2	3	4	5
It will not be easy for a competitor to imitate the know-how and skills that our company possesses in cost management	1	2	3	4	5

For the set of statements below rate the degree to which you carry out these *personal* activities in your foundry.

	Very Rarely				Very Frequently
I spend time at customers' premises	1	2	3	4	5
I attend most major trade shows on foundry production technology	1	2	3	4	5
I discuss market trends with executives in other foundries	1	2	3	4	5
I visit competitor foundries	1	2	3	4	5
I gather information about competitors' customers	1	2	3	4	5
I spend time analyzing my foundry's production costs	1	2	3	4	5
I personally compare costs with other foundries	1	2	3	4	5
I spend time with suppliers to understand technological trends	1	2	3	4	5

This section seeks your views on the role of know-how and information in the area of ***sales and marketing*** in the foundry industry. Please circle the number that best represents your level of agreement with each statement.

Statements	Strongly Disagree ▼	Disagree ▼	Not Sure ▼	Agree ▼	Strongly Agree ▼
Knowledge of sales and marketing is critical for a company's success in the foundry industry	1	2	3	4	5
Having better knowledge of sales and marketing is very important for a company's superior performance in the foundry industry	1	2	3	4	5
The higher a person is in the company, the better is his/her knowledge of sales and marketing	1	2	3	4	5
Without the guidance of higher level managers it is difficult for lower level employees to do work effectively in sales and marketing.	1	2	3	4	5
I am confident of my skills in sales and marketing	1	2	3	4	5
Compared to my counterparts in competing companies, I have better skills in sales and marketing	1	2	3	4	5
Most companies in find it easy to get sales and marketing know-how from industry sources	1	2	3	4	5
It is generally easy for companies to acquire useful know-how and information in sales and marketing from foundry industry sources	1	2	3	4	5
It would be hard for a competitor to develop the level of expertise that we have in sales and marketing	1	2	3	4	5
It will not be easy for a competitor to imitate the know-how and skills that our company possesses in sales and marketing	1	2	3	4	5

In the next section, we will be presenting you two short scenarios. These are situations that your company may or may not be facing currently. However, we would like you to assume that the scenario is a real one that your company is facing and answer the questions in terms of what **your company** is likely to do and **not you personally**.

Scenario-1

Prices of raw materials are increasing significantly. In a recent meeting your metal suppliers have informed you that they will be raising metal prices by an additional 10% over the next few weeks. While passing on surcharges to the customer has been a common ploy, your customers are becoming increasingly less patient with these increases and are giving examples of domestic and overseas companies who have absorbed the price increases and found new ways to maintain prices. **Given this situation, how likely will your company,** (Circle the appropriate number)

	Very Unlikely						**Very Likely**
Adapt existing casting processes to increase production efficiencies	1	2	3	4	5	6	7
Modify your current metal-mix to ensure that the net prices to customers remain largely the same	1	2	3	4	5	6	7
Tweak current casting processes to find ways to absorb price increases	1	2	3	4	5	6	7
Develop an in-depth understanding of current customers' businesses to offer them better overall service	1	2	3	4	5	6	7
Analyze industry trends to explore the your company's diversification into new metals	1	2	3	4	5	6	7
Encourage company-wide discussions about ways to attract new customers	1	2	3	4	5	6	7
Involve employees to find brand new technical solutions to respond to the increase in raw material prices	1	2	3	4	5	6	7
Go beyond the immediate raw material challenges by testing new melting/refining ideas for the future	1	2	3	4	5	6	7
Utilize this situation to develop new casting skills to meet future opportunities	1	2	3	4	5	6	7
Absorb the price increases without passing them on to current customers	1	2	3	4	5	6	7
Reduce delivery times to compensate for the increase in prices	1	2	3	4	5	6	7
Extend credit periods to ensure that your current customers remain with your company	1	2	3	4	5	6	7

Scenario-2

Your company has just received a request for quotation from a prospective customer. According to the purchase manager of customer, your foundry was contacted because of its reputation in the market and their belief that you will be able to handle the job at the right price. The job is technically complex but if the quotation is accepted then the order size will be a significant boost to your sales revenue in the coming years. The customer is known extremely price sensitive (they are also known to be looking at overseas suppliers for the same job) and quality. **Given this situation, how likely would your company.** (Circle the appropriate number)

	Very Unlikely						**Very Likely**
Analyze the casting design carefully to find out places where you can reduce production costs	1	2	3	4	5	6	7
Do a detailed cost analysis to find out ways to reduce production costs	1	2	3	4	5	6	7
Try out creative ways to solve the complex design challenges of the casting	1	2	3	4	5	6	7
Use this new job as a chance for upgrading your company's overall understanding of production costs	1	2	3	4	5	6	7
Use the quotation process as a way to gain better understanding of the entire company's efficiency levels	1	2	3	4	5	6	7
Utilize this situation as a platform for improving your company's overall costing system	1	2	3	4	5	6	7

Rate your company's *success* in generating the following *activities* in the last two years relative to your most direct competitors.

	Much Lower than Competition ▼	▼	▼	▼	Much Better than Competition ▼
Improvements that lead to increases in production yields	1	2	3	4	5
Improvements that reduced the net cost of castings for existing customers	1	2	3	4	5
Improvements that increased your company's share in existing markets	1	2	3	4	5
Improvements that enabled your company to enter into new markets	1	2	3	4	5
Improvements that enabled your company to be among the first ones to embrace new technologies.	1	2	3	4	5
Improvements that helped your company to take on radically new casting jobs	1	2	3	4	5

Relative to your most direct competitors, estimate your company's *performance* over the past two years

	Much Lower than Competition ▼	▼	▼	▼	Much Better than Competition ▼
Return on Investment	1	2	3	4	5
Foundry Scrap Rate	1	2	3	4	5
Sales growth rate	1	2	3	4	5
Manhours per ton (casting)	1	2	3	4	5
New Quote Success Rate	1	2	3	4	5
New Customer Gaining Rate	1	2	3	4	5
Employee Retention Rate	1	2	3	4	5

External Contacts

Please provide the following information about the **three most important people <u>outside</u> your company** from whom you seek advice and discuss strategic issues pertaining to the management of your company.

Source of Advice	No. of Conversations you have with this person in a year	Rate the **<u>Quality</u> of** the Information provided by this person. (1- Low to 5 High)	Rate the **<u>Timeliness</u>** of Information Provided by this person. (1- Low to 5 High)
A			
B			
C			

Now for each of the three persons that you have identified, describe the nature of your relationship with each one of them (please write the letter (A/B/C/) corresponding to each person in the space next to the most appropriate category.)

------- Supplier ---------- Customer --------- Consultant --------- University Contact

--------- Lawyer ---------- Banker ---------- Competitor --------Friend/Family --------- Other Foundry Executive

Relative to your company's direct competitors please rate your company's level of participation (annually) in the following areas.

	Much Lower than Competition ▼	▼	▼	▼	**Much Better than Competition** ▼
Foundry Trade Association Meetings	1	2	3	4	5
Participation in Foundry Technology exhibitions and conferences	1	2	3	4	5
Participation in training workshops organized by key suppliers	1	2	3	4	5

Please rate your company's *level of automation* in each of the following departments using the following scale, as compared to your most direct competitors

	Highly Manual ▼				Highly Automated ▼
Melting Equipment	1	2	3	4	5
Molding Equipment	1	2	3	4	5
Cleaning Equipment	1	2	3	4	5
Finishing Equipment	1	2	3	4	5

Please describe your company's castings along the following dimensions:-

	To a Small Extent ▼	▼	▼	▼	To a Great Extent ▼
Most of our castings have complex design specifications	1	2	3	4	5
Most of our castings require close dimensional tolerances	1	2	3	4	5
Most of our castings have multiple cores	1	2	3	4	5

Please rate to what extent you agree with the following statements regarding your *company's employees*

	Strongly Disagree ▼	Disagree ▼	Not Sure ▼	Agree ▼	Strongly Agree ▼
Our employees are highly skilled	1	2	3	4	5
Our employees are widely considered to be better than those of our competitors	1	2	3	4	5
Our employees are creative and bright	1	2	3	4	5

In this section, we provide you four descriptive paragraphs. Please fill in the circle next to the description that best fits your company as compared to other competitors. (Please consider your company as a whole and note that none of the four descriptors listed below is inherently "good" or "bad")

------ Type 1. This type of company attempts to locate and maintain a secure niche in a relatively stable castings and services area. The company tends to offer a more limited range of products and services than its competitors, and it tries to protect its domain by offering higher quality, superior service, lower prices, and so forth. Often this type of company is not at the forefront of developments in the industry—it tends to ignore industry changes that have no direct influence on current areas of operation and concentrates instead on doing the best job possible in a limited area.

------ Type 2. This type of company does not appear to have a consistent product-market orientation. The company is not as aggressive in maintaining established casting jobs and markets as some of its competitors, nor is it willing to take risks as other competitors. Rather the company responds to those areas where it is forced to by external pressures.

------ Type 3. This type of company typically operates within a broad market segment which changes periodically. The company values being "first in" in new castings and market areas even if not all these efforts prove to be profitable. The company responds rapidly to early signals concerning areas of opportunity, and these responses often lead to a new round of competitive actions. However, this type of company may not maintain market strength in all of the areas it enters.

------ Type 4. This type of company attempts to maintain a stable, limited line of castings or services, while at the same time moving out quickly to follow a carefully selected set of the more promising developments in the industry. The organization is seldom "first in" with new castings or services. However, by carefully monitoring the actions of competitors, the organization is frequently "second in" with a more cost-efficient product or service.

In the previous question, you selected a particular description for your company. Which descriptor (i.e. Type 1,2,3 or 4) best fits your company for the period.

Over the past 2 years _____

2 years in the future _____

In this section, you are requested to provide some basic information about yourself:-

a) How many years have you been in the present company…….years

b) How many years have you worked in the foundry industry……..years

c) Fill in the following information that pertains to your experience in each functional area

Function	**Number of Years Worked**
Shop-Floor Production	
Sales and Marketing	
Accounting and Finance	
Metallurgy	
Other (Please list)	

d) Besides your current company, how many foundries have you worked in your career so far……

e) Please provide your birth year……

f) List your post high-school educational degrees that you have attained so far

g) Approximately what percentage of your company's sales are from:

I. Job Shop Manufacturing……..%

II. Captive Shop Manufacturing (Sold to Internal customers)……%

h) How long has your company been in business……years

Additional Comments: Feel free to add comments, suggestions, or observations about your company and the foundry industry as a whole.

If you would like to receive a personal copy of the executive summary report of this study then please provide a business card with this survey in the attached reply envelope or provide the following information

Your Name:_____

Your Current Designation:_____

Your Address:_____

APPENDIX -E

TESTS FOR NON-RESPONSE BIASES

1) Tests based on firm size

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	T	df	Sig. (2-tailed)
Size	Equal variances assumed	5.961	.015	1.933	523	.055
	Equal variances not assumed			1.466	173.985	.145

2) Tests based on Metal Groups

Independent Samples Test

		Levene's Test for Equality of Variances				
		F	Sig.	T	df	Sig. (2-tailed)
Metal	Equal variances assumed	1.442	.230	.559	555	.576
	Equal variances not assumed			.554	315.331	.580

APPENDIX F

MEANS, STANDARD DEVIATIONS, AND CORRELATIONS

Variables	S.D.	Mean	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Age	10.64	54.50																									
Firm Size (Log10)	0.53	1.74	-0.13																								
Performance 1	0.61	3.52	-0.01	-0.03																							
Performance 2	0.76	3.34	0.02	-0.03	0.46***																						
Education	0.88	2.96	0.00	0.07	0.08	0.01																					
Scanning Intensity (Costs)	1.00	3.83	-0.08	0.10	0.20*	0.09	0.14																				
Scanning Intensity (Mkt)	1.03	3.35	-0.08	0.03	0.31***	0.32***	0.08	0.45***																			
Scanning Intensity (Tech)	1.10	2.96	-0.13	0.09	0.19*	0.16*	-0.07	0.40***	0.43***																		
Scanning Proactiveness (Tech)	1.26	3.61	-0.05	0.12	0.17*	0.27***	0.09	0.07	0.13	0.21*																	
Scanning Proactiveness (Mkt.)	1.30	3.53	-0.04	0.22*	0.21*	0.26***	0.14	0.19*	0.42***	0.16*	0.37***																
Scanning Proactiveness (Costs.)	1.26	4.16	-0.11	0.08	0.24**	0.19*	0.19*	0.34	0.30	0.24**	0.36***	0.38***															
Knowledge Availability (Tech.)	0.79	3.10	-0.08	-0.11	-0.04	-0.07	-0.20*	-0.11	-0.09	-0.02	0.15*	0.00	-0.09														
Knowledge Criticality (Tech.)	0.54	3.75	-0.10	0.16*	0.06	0.17*	0.13	0.12	0.16*	0.26**	0.20*	0.26***	0.09	-0.17*													
Knowledge Ascendancy(Tech.)	0.81	3.00	0.06	-0.08	0.02	0.11	0.06	-0.16*	-0.10	-0.04	0.07	-0.04	-0.17*	0.03	0.12												
Knowledge Confidence(Tech.)	0.62	3.67	-0.05	0.09	0.24*	0.16*	0.05	0.07	0.17*	0.28***	0.25**	0.09	0.04	-0.14	0.25**	0.15											
Knowledge Inimitability (Tech.)	0.97	3.17	-0.01	0.01	0.35***	0.25**	0.10	0.15	0.13	0.26**	0.04	0.09	-0.01	-0.24*	0.09	0.19*	0.36***										
Knowledge Criticality (Mkt.)	0.71	3.68	-0.13	0.10	0.13	0.18*	0.00	0.08	0.19*	0.07	0.21*	0.29***	0.19*	-0.02	0.27***	-0.02	0.15	0.00									
Knowledge Ascendancy(Mkt.)	0.69	3.59	-0.01	0.10	-0.02	0.04	0.12	-0.07	-0.11	-0.10	0.05	0.01	-0.10	0.11	0.08	0.44***	0.05	0.04	0.13								
Knowledge Confidence (Mkt.)	0.74	3.55	0.00	0.11	0.38***	0.36***	0.12	0.16*	0.25**	0.08	0.16*	0.38***	0.12	-0.07	0.16*	0.03	0.13	0.28***	0.16*	0.10							
Knowledge Availability (Mkt.)	0.77	2.75	0.02	-0.01	0.08	-0.07	-0.08	-0.12	-0.09	0.00	0.12	-0.01	0.02	0.42***	-0.16*	0.09	-0.10	-0.03	-0.12	-0.01	-0.05						
Knowledge Inimitability (Mkt.)	2.86	0.90	-0.01	0.10	0.22*	0.23*	0.14	0.09	0.24**	0.11	0.00	0.18*	0.08	-0.17*	0.06	0.15*	0.15*	0.28***	0.20*	0.23*	0.44***	-0.21*					
Knowledge Inimitability (Costs)	0.87	3.01	0.00	-0.03	0.38***	0.20*	0.10	0.21*	0.21*	0.08	0.01	0.20*	0.17*	-0.21*	-0.02	0.05	0.15*	0.43***	0.14	0.03	0.29***	-0.10	0.49***				
Knowledge Availability (Costs)	0.79	2.67	0.00	-0.08	-0.06	0.00	-0.04	0.00	-0.06	0.04	0.11	-0.01	-0.06	0.40***	-0.08	0.06	-0.01	-0.06	-0.07	0.09	-0.04	0.56***	-0.13	-0.18*			
Knowledge Confidence (Costs)	0.64	3.81	0.00	0.00	0.39***	0.20*	0.31***	0.37***	0.25*	0.07	0.13	0.24**	0.33***	-0.16*	0.18*	-0.09	0.24**	0.20*	0.09	-0.08	0.38***	-0.09	0.17*	0.42***	-0.15		
Knowledge Ascendancy(Costs)	0.75	3.84	0.01	0.01	-0.01	0.00	0.20*	-0.02	-0.12	-0.01	-0.09	-0.11	-0.11	0.00	0.07	0.43***	0.11	0.19*	0.10	0.48***	-0.08	0.10	0.05	0.08	0.07	0.05	
Knowledge Criticality (Costs)	0.56	3.80	-0.11	0.13	0.19*	0.06	0.04	0.17	0.16*	0.10	0.05	0.15	0.11	-0.04	0.38***	0.03	0.15	0.08	0.26***	0.02	0.03	-0.06	0.10	0.16*	-0.02	0.20*	0.09

***p<.0001
**p<.001
*p<.05

APPENDIX 6
EXPLORATORY SUPPLEMENTAL ANALYSES

DRIVERS OF EXECUTIVE BELIEFS ABOUT KNOWLEDGE (KNOWLEDGE SCHEMES) - DEMOGRAPHICS

Table 1a- Executive Demographics and Knowledge Availability

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	β	**S.E.**	β	**S.E.**	β	**S.E.**
Constant	-.208	.155	.007	.143	-.021	.147
Firm Tenure	-.145	.241	.029	.232	.222	.239
Experience (Shop-Floor)	-.266	.184	-.345†	.175	-.308†	.181
Experience (Sales &Mktg.)	.103	.257	.084	.240	-.124	.247
Experience (Cost Mgmt.)	.371	.346	.158	.297	.008	.306
Experience (Metallurgy)	-.183	.232	.078	.212	.287	.219
Other Company Experience	-.141	.212	-.148	.205	-.059	.211
Education	-.280†	.155	-.319*	.149	-.306†	.154
R-squared	**.12**		**.17**		**.19**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 1b- Executive Demographics and Knowledge Criticality

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	.007	.141	.016	.125	-.134	.147
Firm Tenure	.407†	.230	.061	.203	.052	.238
Experience (Shop-Floor)	.310†	.174	.234	.153	.230	.180
Experience (Sales &Mktg.)	-.490	.237	.399†	.209	-.173	.246
Experience (Cost Mgmt.)	-.027	.294	-.565*	.259	-.526†	.304
Experience (Metallurgy)	.002	.210	-.257	.185	.499*	.218
Other Company Experience	.438*	.202	.124	.178	.032	.210
Education	.335*	.148	.110	.130	.244	.153
R-squared	**.23**		**.27**		**.20**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 1c- Executive Demographics and Knowledge Inimitability

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	.013	.174	-.187	.142	-.108	.153
Firm Tenure	.390	.269	.238	.230	.368	.249
Experience (Shop-Floor)	.147	.205	.107	.174	.111	.188
Experience (Sales &Mktg.)	-.376	.287	.120	.238	.103	.257
Experience (Cost Mgmt.)	-.304	.387	-.319	.294	-.541†	.318
Experience (Metallurgy)	.291	.260	-.066	.210	.303	.228
Other Company Experience	.045	.237	.000	.203	.065	.219
Education	.178	.173	.188	.148	.182	.160
R-squared	**.14**		**.09**		**.12**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 1d- Executive Demographics and Knowledge Ascendancy

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	.106	.166	.055	.154	-.116	.152
Firm Tenure	-.099	.258	.157	.250	-.123	.246
Experience (Shop-Floor)	.000	.197	-.052	.189	.265	.186
Experience (Sales &Mktg.)	-.299	.275	-.157	.259	-.063	.255
Experience (Cost Mgmt.)	.253	.370	-.111	.320	-.252	.315
Experience (Metallurgy)	-.022	.249	-.032	.229	.039	.225
Other Company Experience	.071	.227	.177	.220	.144	.217
Education	-.092	.166	.157	.161	.264	.158
R-squared	**.05**		**.12**		**.17**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 1e- Executive Demographics and Knowledge Confidence

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	.038	.147	-.011	.148	-.095	.148
Firm Tenure	.461*	.228	.294	.240	.192	.240
Experience (Shop-Floor)	.346*	.174	.023	.181	-.016	.181
Experience (Sales &Mktg.)	-.270	.243	.404†	.248	.049	.248
Experience (Cost Mgmt.)	-.660*	.328	-.267	.307	-.165	.307
Experience (Metallurgy)	.255	.220	-.174	.219	.295	.219
Other Company Experience	.228	.201	.413*	.211	.396†	.211
Education	.191	.147	.308*	.154	.439*	.154
R-squared	**.25**		**.20**		**.26**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 2a- External Contacts and Knowledge Availability

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	3.768	.479	2.624	.474	2.486	.486
Tie Strength	-.194*	.082	-.035	.081	-.016	.083
Information Timeliness	-.006	.141	.121	.140	.094	.143
Information Quality	-.044	.150	-.062	.149	-.053	.153
Source Diversity	-.009	.588	-.048	.582	.297	.597
R-squared	**.04**		**.01**		**.01**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 2b- External Contacts and Knowledge Criticality

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	β	**S.E.**	β	**S.E.**	β	**S.E.**
Constant	4.420	.322	3.603	.431	4.246	.277
Tie Strength	-.051	.055	-.041	.073	.057	.047
Information Timeliness	-.072	.095	-.047	.127	-.013	.082
Information Quality	.166†	.101	.227†	.135	.109	.087
Source Diversity	-.712†	.396	-.063	.530	-.423	.340
R-squared	**.04**		**.02**		**.04**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 2c- External Contacts and Knowledge Inimitability

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	1.459	.576	2.037	.546	1.126	.503
Tie Strength	.159†	.098	.127	.093	.216*	.086
Information Timeliness	.072	.170	-.144	.161	-.127	.148
Information Quality	.175	.181	.248	.171	.420**	.158
Source Diversity	1.486*	.708	.395	.670	.775	.618
R-squared	**.07**		**.03**		**.11**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 2d- External Contacts and Knowledge Ascendancy

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	3.281	.492	3.595	.409	2.727	.445
Tie Strength	-.140†	.084	-.237**	.070	-.124†	.076
Information Timeliness	.024	.145	.086	.120	.041	.131
Information Quality	.080	.155	.018	.128	.259†	.140
Source Diversity	.230	.604	.628	.502	.913†	.547
R-squared	**.02**		**.07**		**.07**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 2e- External Contacts and Knowledge Ascendancy

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	β	**S.E.**	β	**S.E.**	β	**S.E.**
Constant	3.174	.380	2.919	.445	2.661	.380
Tie Strength	.011	.065	.027	.076	.019	.065
Information Timeliness	-.050	.112	-.062	.131	.051	.112
Information Quality	.132	.119	.136	.140	.176	.119
Source Diversity	.569	.466	1.097*	.546	.861†	.467
R-squared	**.02**		**.04**		**.06**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 3a- External Contacts and Scanning Intensity

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	3.174	.380	1.474	.605	2.039	.593
Tie Strength	1.169**	.688	.306**	.103	.291**	.101
Information Timeliness	.336	.117	-.129	.178	.062	.175
Information Quality	.227	.202	.350†	.190	.135	.186
Source Diversity	-.024	.216	.999	.743	1.374†	.728
R-squared	**.07**		**.09**		**.09**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 3b- External Contacts and Scanning Proactiveness

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	**β**	**S.E.**	**β**	**S.E.**	**β**	**S.E.**
Constant	1.413	.749	1.588	.770	1.812	.750
Tie Strength	.056	.128	.293*	.131	.242†	.128
Information Timeliness	.106	.220	.139	.226	.078	.221
Information Quality	.283	.235	.057	.242	.293	.235
Source Diversity	2.182**	.919	1.994*	.945	1.244	.920
R-squared	**.06**		**.07**		**.07**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 4a- External Contacts and Adaptive Action

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	***β***	**S.E.**	***β***	**S.E.**	***β***	**S.E.**
Constant	2.601	.916	2.081	.677	4.362	.732
Tie Strength	.288†	.156	.284*	.115	.111	.125
Information Timeliness	.264	.269	-.003	.199	.142	.215
Information Quality	-.008	.288	-.112	.213	.078	.230
Source Diversity	-.092	1.124	.753	.831	.347	.899
R-squared	**.04**		**.04**		**.02**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

Table 4b- External Contacts and Generative Inquiry

	Shop-Floor Technology		Sales and Marketing		Cost Management	
Variables	β	**S.E.**	β	**S.E.**	β	**S.E.**
Constant	1.797	.938	3.296	.794	2.833	.914
Tie Strength	.290†	.160	.206	.135	.067	.156
Information Timeliness	.040	.276	-.170	.234	.886**	.269
Information Quality	.104	.295	.140	.249	-.697*	.287
Source Diversity	2.615*	1.151	1.332	.975	1.300	1.122
R-squared	**.06**		**.03**		**.07**	
Sample Size	173		173		173	

***p<.001
** p<.01
* p<.05
†p<.10

5. ASSOCIATIONS WITH FIRM PERFORMANCE

Correlations

	ROI	SCRPRT	SALGRT	MANHRPTON	NEWQTRT	NEWCUSTRT	EMPRTNRT
ROI	1						
	167						
SCRPRT	.424(**)	1					
	.000						
	167	167					
SALGRT	.443(**)	.256(**)	1				
	.000	.001					
	166	166	166				
MANHRPTON	.438(**)	.300(**)	.343(**)	1			
	.000	.000	.000				
	163	163	162	163			
NEWQTRT	.300(**)	.301(**)	.300(**)	.342(**)	1		
	.000	.000	.000	.000			
	165	165	164	163	165		
NEWCUSTRT	.347(**)	.363(**)	.465(**)	.301(**)	.698(**)	1	
	.000	.000	.000	.000	.000		
	165	165	164	162	164		
EMPRTNRT	.158(*)	.270(**)	.114	.267(**)	.041	.080	1
	.041	.000	.143	.001	.604	.310	
	166	166	165	163	165	165	166

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

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

ROI – Return on Investment -1
SCRPRT – Scrap Rate -1
SALGRT – Sales Growth Rate -1
MANHRPTON – Manhours Per Ton - 1
NEWQTRT – New Quote Rate - 2
NEWCUSTRT – New Customer Rate -2
EMPRTNRT – Employee Retention Rate – 1

1- Efficiency-Based Performance
2- Market Effectiveness-Based Performance

5a. BELIEFS ABOUT KNOWLEDGE AND PERFORMANCE

For both types of performance, associations were found only for Knowledge Self-Efficacy and Knowledge Inimitability.

5b. KNOWLEDGEABLE PRACTICE AND PERFORMANCE

i) Efficiency-Based Performance

1. Shop Floor Technology

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	2.740	.158	.000
	Generative Inquiry	.101*	.032	.002
	Adaptive Action	.087*	.033	.010

2. Sales and Marketing

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	3.017	.181	.000
	Generative Inquiry	.122*	.038	.002
	Adaptive Action	-.010	.044	.827

3. Cost Management

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	3.017	.181	.000
	Generative Inquiry	.080*	.037	.029
	Adaptive Action	.038	.047	.422

ii) Market Effectiveness-Based Performance

4. Shop Floor Technology

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	2.666	.184	.000
	Generative Inquiry	.146***	.037	.000
	Adaptive Action	.033	.039	.400

5. Sales and Marketing

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	2.827	.208	.000
	Generative Inquiry	.137*	.044	.002
	Adaptive Action	-.013	.051	.803

6. Cost Management

Coefficients

		Unstandardized Coefficients		Sig.
		B	Std. Error	Beta
	(Constant)	3.017	.181	.000
	Generative Inquiry	.037	.042	.386
	Adaptive Action	.107*	.054	.049

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Publications (Including Conference Proceedings)

- Nag R., D.C. Hambrick, and M.J. Chen. (2006). The connection between strategic management and adjacent academic fields: A boundary-spanner view. *Academy of Management Best Paper Proceedings, AOM, Atlanta*.
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- Nag. R. (2001). Toward group learning as group learning. *Proceedings. 4th Organizational Learning & Knowledge Management Conference, University of Western Ontario, Canada*.

Scholarships and Grants

- Pennsylvania State University, Graduate Enhancement Scholarship – 2000-2003 ($5,000/yr)
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