KNOWLEDGEABLE PRACTICE: CAPTURING THE CONTEXTUAL USE OF KNOWLEDGE AS A STRATEGIC RESOURCE

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ABSTRACT

A series of recent academic as well as practitioner oriented ideas and movements 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. In this paper, I present a two stage mixed-methods study explore the roots of these elemental differences in the socio-cognitive schemas, "executive knowledge schemes", of top managers of firms competing in a single mature industry- the U.S. Metalcasting Industry. I find that senior executives of incumbent firms, show remarkable variation in their interpretations of knowledge, especially in its strategic context and these differences not only influence their scanning behaviors, but also how their firm's adapt and regenerate knowledge. My research 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.

1 INTRODUCTION

Since its earliest formulations, the Knowledge Based View of competitive advantage (KBV) has viewed firms as superior mechanisms of knowledge "application" (Grant, 1996). Little work, however, has followed that has tried to identify the micro-level practices and social processes which undergird the application of knowledge in organizations. Scholars in the KBV tradition have sought to operationalize in terms of patents, managerial education levels etc. (see Smith, Collins, & Clark, 2005) or best practices and their objective characteristics such as tacitness, complexity etc. (Kogut & Zander, 1992; Simonin, 1999; Szulanski, 2000). Although these conceptions of knowledge have advanced my understanding of competitive advantage, this study addresses an apparent lack of my understanding of the social processes by which knowledge *becomes* a competitive resource. In this study, I develop and empirically measure the concept of *knowledgeable practice*, which I define as the ability of the firm to reflect upon, apply, and adapt knowledge through the activities of its members. The concept emerged from a larger two-stage study of a single, mature industry in the U.S. (the metalcasting industry) spanning over a period of two years. A primary motivation for adopting this design is a recent call to utilize more in-depth investigations of the actual sources of competitive advantage rather than depending solely (or even mainly) on secondary sources of data (Rouse & Daellenbach, 1999). Research aimed at discerning how some firms manage to create and maintain superior resources, even when operating in largely similar factor markets, needs to

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adopt a more involved approach that takes the researcher deep into the focal organizations to generate in-depth knowledge and insights about value creating processes and tendencies. The structure of this paper is as follows. I first present Stage-1 of my research which generated the grounded theoretical framework. I then present Stage-2 of my research which is a large sample survey-based study of the propositions that emerged from Stage-1.

Although the knowledge based view (hereafter KBV), which holds knowledge as the primary competitive resource for firms has extended my 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 application. This view has yet to focus on the intricacies of how organizational knowledge is *created* and *applied* 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.

2 RESEARCH DOMAIN – THE METALCASTING INDUSTRY

Influenced by above-mentioned suggestions, I selected one industry, the US metalcasting industry (i.e., metal foundries[†]) for my study, in which I would engage with a representative sample of firms through in-depth interviews with their top and upper middle level managers. The metalcasting industry is one of the more mature industries in the US. It 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 molds to create metal castings that form components, which might be used in areas ranging from the most basic door hinges to the most advanced aircraft components. 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 less institutionalized) and therefore, the sources of difference amongst firms emerge from how managers of those firms understand and use the common knowledge differently. Nevertheless, this 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.

3 STAGE-1- INTERPRETIVE STUDY

3.1 Research Procedures and Data Sources

3.1.1. Research design. The primary focus of Stage-1 was the generation of grounded-theory as there is a shortage of extant theory in understanding the relationships between

[†] I use the term "metalcasting" and "foundry" interchangeably in this paper.

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. 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. 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).

3.1.2. 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 53 interviews with foundry CEOs, senior and upper middle level foundry managers of 22 foundries, university foundry experts, and foundry trade association representatives. Besides these, I also organized 2 focus group discussions with foundry CEOs and senior managers during metalcasting trade association meetings.

3.1.3. Archival and other sources. In addition to the interview data, I also collected archival data in the form of published news and magazine articles, research articles published in the American Foundry Society's primary journal, and attended several trade association meetings.

3.2 Analytical Approach

As I collected the interview 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). 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). 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. 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 us 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 us to develop a theoretical framework that linked the various phenomena that emerged from the data.

4 STAGE-1 FINDINGS

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*. My interviews suggested a focus on how knowledge is actually applied in the

organization. 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-1 shows the data structure of knowledgeable practice

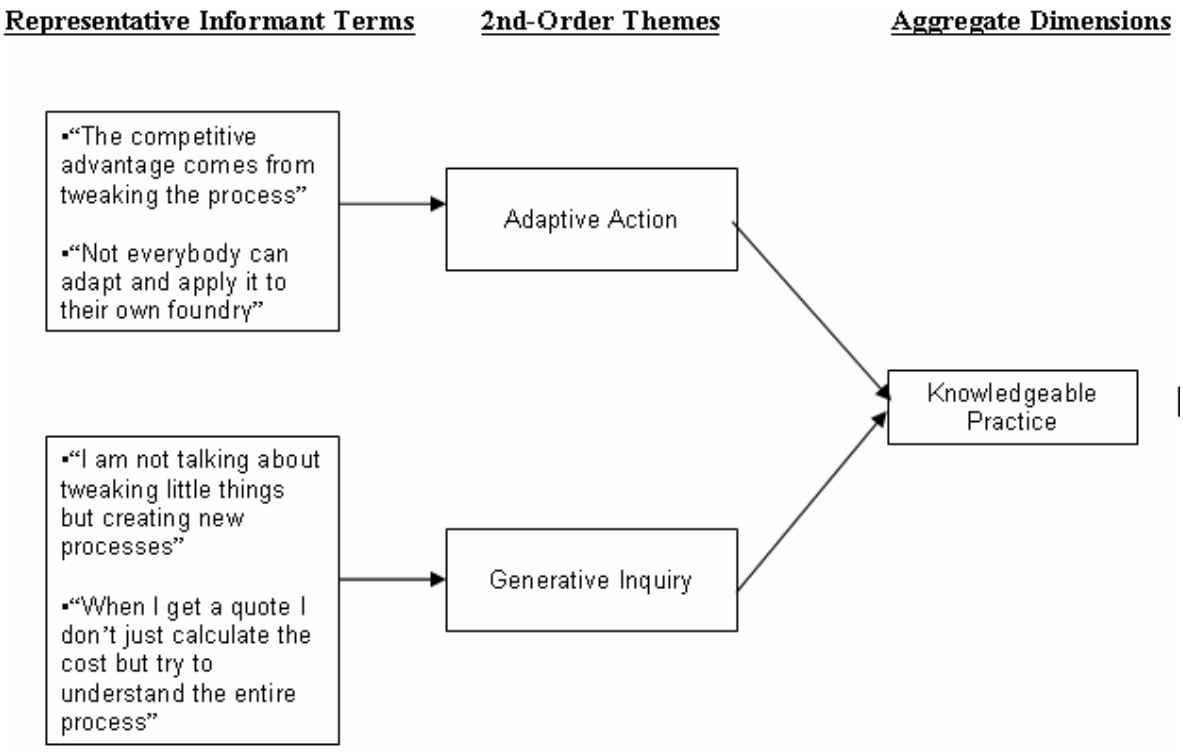

Figure – 1 -Data Structure for Knowledgeable Practice

The first, which I term *adaptive action*, captures those behaviors of a focal foundry that confer an ability to apply knowledge to improve and adapt its 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. 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, I don't have any work because I don't have anything rigged as per specifications. I said, come on. I went to the pattern shop and I got scrap metal and got masking tape. I just took the tape and blocks of wood together and made it the width and height that suited my jobs. Chuck didn't learn that in college. He told us the book does not say that is what you are supposed to do. I said, but now I're going to teach you education. You learned from the prof for four years. Now I're going to teach what he didn't teach you. That's hands-on."

The other component of knowledgeable practice, which I term *generative inquiry,* concerns those actions or behavioral tendencies to reflect upon, improve, and expand the collective understanding of its members. The emphasis here is less on solving a particular problem at hand and more on going beyond the bounds of that problem to generate collective understanding and insights at a more conceptual level. In my interviews, I found a wide variance between foundries in the quality and effort that the organization put into sharing, educating, and listening to ideas from employees. The following vignette gives an example of generative inquiry,

> "When you get a new job, you got to dig right into it and take everything you know, everything you've done in the past, and try to find similar things that you've done and apply it to that. You go out and you make one. You cut the part up and you look inside, you check your wall thicknesses, you look for internal shrinks, and then go on… until you get to the point where you figure you "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 itself 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.

In the next section I present the second-order findings from Stage-1 wherein I develop the essential grounded theory framework in the form of testable propositions relating EKSs, executive scanning and firm-level knowledgeable practice.

5 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. Therefore, I propose that

P1: Knowledgeable Practice will mediate the relationship between the quality of a firm's knowledge assets and its innovation levels.

The above propositions, which emerged from the analysis of the data that I collected in Phase-2 of my research, 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 sections, 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.

6 STAGE-2-GENERALIZATION OF GROUNDED THEORY

6.1 Research Design.

In this stage, 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. The mailing of paper surveys was done over three rounds. I used multiple respondents to obtain a TMT level perspective on the phenomena and relationships being studied.

6.2 Sampling Strategy.

Surveys were sent to a total of 583 foundries in 6 key North-Eastern and Mid-Atlantic States. 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%. The average size of the foundries that responded was 106 employees. 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. 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).

6.3 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 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) argued that scenarios aid in specifying a relevant context in which strategic decisions can be studied. Table 1 shows the vignettes and scales developed for this construct.

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).

6.4 Innovation Outcomes- Firm Level

Firm Innovation. The scales I used for measuring firm-level innovation sought to capture both incremental and radical innovation levels (see Table 2). 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. Cronbach alpha reliability estimates for the incremental and radical innovation scale were .77 and .84 respectively.

6.5 Firm Knowledge Assets Measures

6.5.1.Firm-level Human Capital. I measured firm level human capital by using 3 of the five items used by Subramaniam and Youndt (2005). Table 2 lists the scale used for measuring human capital. Cronbach alpha for this scale was .82.

6.5.2.Technological Complexity. 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 2 shows these scales.

6.6 Control Variables

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

6.6.1. 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 (Dess & Robinson, 1984). 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 us by my informants. This ensured that the performance measures were relevant to the respondents and valid for the industry as a whole.

Table -1 -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

Table-2- Measurement Scales and Items used for Performance, Innovation, and Knowledge Assets (Technological Complexity and Human 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 • My employees are highly skilled • My employees are widely considered to be better than those of my competitors • My 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)
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 my castings have complex design specifications • Most of my castings require close dimensional tolerances • Most of my 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)

6.6.2. 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.

6.7 Construct Validity

To assess discriminant and convergent validity of the key constructs, I carried out a series of exploratory factor analyses. 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. 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-3 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. This item was dropped from proposition testing.

7 ASSESSING THE PROPOSITIONS

7.1 Knowledgeable Practice- A New Link between Knowledge Assets and Innovation

In proposition 1, I predicted that knowledgeable practice would mediate the relationship between knowledge assets (firm-level human 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. The findings suggest that generative inquiry, fully mediates the relationship between human capital and radical innovation and partially mediates the relationship between technological complexity and radical innovation (please see Tables 4 and 5 for detailed mediation tests results).

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.

Table-3-Knowledgeable Practice Factor Pattern Matrices

(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

(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

(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 company's overall costing system.	.896	-.016

Table -4- 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

8 DISCUSSION

8.1 Knowledgeable Practice – A new way to understand Knowledge

The knowledgeable practice concept finds support in the pragmatic philosophical works of Dewey (1933) 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.

Table 5 – 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.

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 (1992; 1995), 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 (Schön, 1995). 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.

8.2 Limitations

All research has inherent limitations and this research 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 us 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.

8.3 Conclusion

In understanding how knowledge becomes a critical competitive resource, my study develops a potentially new way to understand and measure the social processes that undergird the situated use of knowledge as a resource. I 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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