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More than Just the Smartest Guys in the Room: Intellectual Capital Assets in Knowledge-Intensive Firms

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MORE THAN JUST THE SMARTEST GUYS IN THE ROOM: INTELLECTUAL CAPITAL ASSETS IN KNOWLEDGE-INTENSIVE FIRMS

A Dissertation Presented

by

CHRISTOPHER R. MEYER

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

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ABSTRACT

MORE THAN JUST THE SMARTEST GUYS IN THE ROOM: INTELLECTUAL CAPITAL ASSETS IN KNOWLEDGE-INTENSIVE FIRMS

MAY, 2012

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Knowledge-intensive firms are a growing and increasingly important part of our economy. They compete by bringing their knowledge resources to bear on their customers’ challenging problems. Such knowledge resources can reside in workers, routines and work processes, stored data and knowledge, and relationships. Scholarship on these important firms, though, has focused largely on their workers’ knowledge and skill, i.e., their human capital. This is in spite of the fact that the other forms of knowledge - organizational capital and social capital - both play important roles in firms. Additionally, there has been little research into the role of strategies in these firms.

The research questions of this paper are designed to address these substantial gaps in our understanding of these firms. First, I examine the development and use of the full set of knowledge resources. I argue that organizational capital consists of both procedural and declarative organizational capital, and that all of these forms of intellectual capital play unique roles. Second, the paper suggests that the key strategic
driver for such firms is how uncertainty impacts their ability to develop and use intellectual capital assets. Specifically, I examine the uncertainty that is brought into the firm by its customer interactions. The paper hypothesizes that the relationship between customer interaction uncertainty and organizational capital, as well as their relationships to human and social capital, will drive the performance of these firms.

These questions are examined using both survey and archival data from 94 financial service organizations using linear regression and Hierarchical Linear Modeling. I find support for several of the hypotheses. Customer interaction uncertainty is positively associated with human and declarative organizational capital. Further, human and procedural organizational capital interact to impact performance, as do human capital and declarative organizational capital.
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CHAPTER 1
INTRODUCTION

As the global economy has shifted from industrial to information-driven scholars and practitioners have noted the rise in importance of knowledge-intensive firms (Childs and McGrath, 2001). These firms – examples of which include financial services, consulting, law, and engineering - compete using a well-educated workforce and a work process that is built around the development, application, and retention of knowledge assets (Starbuck, 1992; Alvesson, 2000; von Nordenflycht, 2010). They are an increasingly important segment of the economy (Lowendahl, 2005) that stimulates and diffuses knowledge and innovation (Muller and Zenker, 2001).

The primary manner by which knowledge-intensive firms create value is through the resolution of problems and challenging issues for their customers. Management consultants, for example, are employed by clients because, “consultants’ knowledge about analytical procedures and change offers a variety of services and tasks that clients cannot perform on their own” (Gluckler and Armbruster, 2003: 269). Architects and financial advisors are other examples of firms that solve complex customer problems via their specialized knowledge – these organizations, too, create outcomes for their clients that the clients themselves cannot create (Jones, Hesterly, Fladmoe-Lindquist, and Borgatti, 1998). At their best, knowledge-intensive firms can help create a competitive advantage for their client (Smedlund, 2008).
These firms address their customer’ needs and challenges by using their knowledge resources (McGrath, 2005; Hardagon and Bechky, 2006). Firms can use their own knowledge to solve problems or they can outsource such problem solving to other knowledge-intensive firms (Nickerson and Zenger, 2004). “Most of the work done by accounting units, hospitals, software companies, or financial service providers requires the repeated use of highly developed skills on relatively similar, though complex, problems” (Quinn, Anderson, and Finkelstein, 1996: 71). These firms present unique management challenges, in large part due to their reliance on highly skilled, knowledgeable workers (Mintzberg, 1980).

Scholars have argued that knowledge-intensive firms’ reliance on human capital is what sets them apart from industrial firms (Teece, 2003). While human capital is undoubtedly important to KIFs, exceptional and valuable knowledge can also reside in the relationships that the firm has, as well as in the firm’s routines and other forms of organizational assets such as written research, databases and analytical tools (Starbuck, 1992; Spender, 1996). However, research on knowledge-intensive firms has predominantly focused on a firm’s human capital – the knowledge and skill of its workers. This is somewhat understandable since workers are the most visible form of knowledge assets in these firms and their largest expense item (Sheehan, 2005). Additionally, human capital is where all organizational knowledge originates (Felin and Hesterly, 2007). Nonetheless, human capital is only one form of organizational knowledge that can provide competitive advantage to a firm. Consistent with Starbuck’s view, intellectual capital scholars have suggested two other types of knowledge that firms can possess: organizational capital and social capital (Stewart, 1997; Bontis, 1998).
Social capital is the value that an organization has in its relationships (Coleman, 1988; Bontis, 1998). Social capital helps a firm’s workers to interact in a ways that foster the sharing of knowledge (Grant, 1996b), and a firm’s social capital, in terms of the external relationships its employees have, can also help them develop new and useful knowledge (Reed, Lubatkin, and Srinivasan, 2006). This is a critical part of knowledge development and deployment for firms (Nonaka, 1994; Nahapiet and Ghoshal, 1998; Subramaniam and Youndt, 2005).

Organizational capital is knowledge that has been recorded and stored by the firm. It can be stored in a wide variety of ways, such as documented processes, procedures, “ways of working”, data in databases, and other forms of written knowledge (Youndt and Snell, 2004). Organizational capital is human capital that has been converted into an asset that the organization possesses instead of the individual. For firms, one advantage that organizational capital has relative to human capital is that it is divisible. This means that organizational capital can be used simultaneously by multiple actors without diminishing its value. Humans, of course, are not divisible. Thus human capital can create limits for the growth of the firm (e.g., Penrose, 1959). Another advantage of organizational capital is that it is the one form of knowledge that the firm actually owns (Subramaniam and Youndt, 2005). Workers can leave the firm, but organizational capital stays with the firm regardless of who works there.

Given these positive attributes of organizational and social capital, it is surprising that the bulk of the research to date on KIFs has focused on human capital. This substantial gap in the KIF literature is the basis of the first research question of this project: we need to better understand the use of all types of intellectual capital in KIFs.
Thus, I intend to study not just human capital, but also to examine the development and deployment of all three of these forms of intellectual capital in knowledge-intensive firms.

There is a second major gap in our knowledge of KIFs as well, which is that little work has been done with regard to strategies in these firms. While scholars clearly recognize that they add value by solving client problems, research has not progressed beyond that point to examine strategic variables that may impact the resources and performance of KIFs. This is clearly an important omission in KIF scholarship. This gap forms the basis of the second research question of the paper: the use of strategy in KIFs. In order to address this second gap I utilize the strategic variable customer interaction uncertainty (Argote, 1982, Gittell, 2002, Skaggs and Huffman, 2003). Customer interaction uncertainty is defined as the diversity of demand that the firm will accommodate and the extent to which the firm allows its customers to interact during the firm’s work process (Larsson and Bowen, 1989). Given that knowledge is deployed by organizations in order to counter uncertainty (Galbraith, 1974), this should be an appropriate strategic variable for KIFs.

Thus, the paper develops and tests a model for how these firms build and use organizational, social, and human capital assets based on the uncertainty that they face in the form of customer interaction uncertainty. I suggest that this type of uncertainty impacts its ability to develop organizational capital, which in turn drives the development and use of other types of intellectual capital. The study looks at the fit between customer interaction uncertainty and the firm’s various intellectual capital resources. The model suggests how customer interaction uncertainty impacts the development and use of
organizational, social, and human capital, as well as how those assets interact to impact firm performance. I then test this model using a sample of business units in the financial services industry.

This manuscript proceeds by examining the theoretical foundations of how intellectual capital is developed and operates in knowledge-intensive service firms. I review knowledge as the basis for competitive advantage in firms and how it is used to counter uncertainty. After a discussion of knowledge-intensive firms the hypotheses of the project are described. The paper continues with a discussion of the sample, the operationalization of variables, and the methods used for analyzing the data. The results of the analysis are described, and the paper finishes with a discussion of the results, including implications for researchers and practitioners, as well as limitations and directions for further research.

In examining these questions about the full set of intellectual capital resources and the strategic use of customer interaction uncertainty in KIFs I hope to answer the call for work that increases our understanding of how knowledge-intensive firms manage their productive resources (e.g., Lowendahl, 2005). The simple possession of a potentially valuable resource is unlikely to provide a firm a sustained competitive advantage (Amit and Schoemaker, 1993; Winter, 2003). In accordance with this notion, I suggest that strategic management of knowledge-intensive firms will involve much more than simply having the smartest guys in the room.
CHAPTER 2

THEORETICAL FOUNDATIONS

This paper is grounded in the knowledge-based view of the firm (Grant, 1996a), wherein it is argued that knowledge forms the basis for how firms compete and why they exist. First, I give an overview of knowledge as the basis for competitive advantage and then discuss what knowledge is used for: contending with uncertainty. Next I introduce and discuss intellectual capital and its three components: human, organizational, and social capital. Lastly, this chapter continues with a discussion of the specific context: knowledge-intensive firms.

2.1 Knowledge as the Basis for Competitive Advantage Within Firms

Scholars have long argued that knowledge is critical to firms’ performance. Schumpeter (1935) noted that what was important for the understanding of an industry was not its capital stock, but rather its investment in new technologies and ideas. He was concerned with where and how knowledge pushed firms forward. Hayek (1945) argued that the use of knowledge within firms allowed them to change and adapt in order to survive. In his arguments against a centrally planned economy, he also argued for the need to have knowledge dispersed among individuals and individual firms. This would allow firms to make the decisions necessary to prosper. Hayek also emphasized that knowledge must be specific to the time and place where the firm operates – it must be knowledge that is current and practical. Uncertainty and dynamism also figured heavily in Hayek’s work, as he found it “worth stressing that economic problems arise always
and only in consequence of change” (1945:525). This clear, simple assertion that firms require unique, dynamic knowledge in order to prosper in changing environments drives much of the scholarly work in Strategic Management: knowledge is how firms cope with uncertainty and a changing world (Spender, 1996; Teece, Pisano, and Shuen, 1997).

Penrose’s seminal work was also substantially concerned with the application of knowledge within firms (1959). She argued that the knowledge, skill, and expertise within a firm are the key to its growth and profitability. Speaking with regard to the services that can be gained from a given resource, she notes, “More services become available, previously unused services become employed and employed services become unused as knowledge increases.” (1959:76). She then presages the convergence of the resource-based view (Barney, 1991) and the knowledge-based view (Grant, 1996a) and summarizes the argument in a nutshell, stating, “not only are the significance of resources to a firm and the productive services they can yield functions of knowledge, but… entrepreneurs are fully aware of this” (1959:77).

Of course, contemporary scholars have noted that knowledge has come to dominate the strategic management of successful firms. “True strategic focus means developing a selected set of knowledge factors, databases, and service skills – of particular importance to customers” (Quinn, 1992: 60). Grant’s (1996a) article coined the term “the knowledge-based view” and contained two pre-eminent ideas. The first was his assertion that knowledge emanates from the individual – knowledge begins in an individual human being. Grant’s second key idea is that knowledge is a productive force. Grant states firmly that the purpose of knowledge is the production of valuable goods and services, and not the generation of knowledge itself. The core managerial challenge for
firms is “devising mechanisms for integrating individuals' specialized knowledge” (Grant, 1996a:114). Doing so for the purpose of improved organizational performance is the essence of the productive management of knowledge resources (Bontis, 1998).

As scholars have emphasized the importance of capabilities, knowledge has remained at the forefront of how firms must compete. Knowledge integration is the foundation of organizational capabilities (Grant, 1996b). Further, a firm’s capabilities must be dynamic in order for it to succeed (Teece, et al, 1997; Eisenhardt and Martin, 2000; Winter, 2003). This idea echoes Hayek’s notions of the need for knowledge when there is uncertainty and change afoot, because managers often suffer “the emotional inability to cope with uncertainty” (Eisenhardt and Martin, 2000:1112). Winter (2003) likewise contrasts dynamic capabilities with zero-order, or basic capabilities. In order for firms to succeed their capabilities cannot remain static, but must grow and change. For this to be accomplished, Winter asserts that, “knowledge advances cumulatively” (2003:994). While the purpose of firms vis-a-vis knowledge is to produce useful goods and services, in order to succeed a firm’s knowledge must grow and develop. In summary, then, this rich stream of literature argues that knowledge is critical for organizational success, is what is needed to cope with uncertainty and change, and is a resource that should both grow and produce profits for a firm.

2.1.1 Knowledge and Uncertainty

Organizational knowledge scholarship often discusses knowledge as a resource to be applied to uncertainty. Penrose wrote: “Hence one of the most important ways of reducing subjective uncertainty about the future course of events is surely to obtain more
information” (1959:59). Thompson (1967) also wrote of firms’ use of knowledge in his work concerned with the organizational challenges brought by uncertainty. A key prescription that he offered was to buffer the ‘technical core’, the primary value creating engine for the firm, from uncertainty. This is done in part by having boundary-spanning units, such as sales and customer service units, process uncertainty. Thompson also noted that the knowledge and skill that can deal with uncertainty creates prestige within a firm for those that possess it. Galbraith (1974) used the idea of information processing to link organizational structure and strategies under conditions of uncertainty to the use and sharing of knowledge. As uncertainty increases, he argues, “the organization must adopt integrating mechanisms which increase its information processing capabilities” (1974:29).

Research continues in this vein. For example, scholars have found that different types of environmental uncertainty require different knowledge-based capabilities (Desarbo, Di Benedetto, Song, and Sinha, 2005) and that firms use networks of knowledgeable individuals to deal with uncertainty (Nerkar and Paruchuri, 2005).

Spender and Scherer (2007) explicitly link knowledge and uncertainty and suggest that uncertainty is actually “knowledge absence”. They note that, “we cannot recognize uncertainty as knowledge-absence remote from a context we know enough about to notice the absence” (2007:16). Uncertainty and knowledge are so closely linked that in order to recognize uncertainty we must know what we don’t know.

Given this strong link and its importance for the successful operation of firms, we would like to understand how knowledge actually works to counter uncertainty. Galbraith contributes a critical insight with regard to productively deploying knowledge
where he notes that firms can do one of two things to cope with uncertainty. They can create plans and guides for decision-making or they can grant individuals discretion. This is analogous to Thompson’s (1967) computational and judgmental decision making. Shostack (1987) makes the same distinction between two forms of knowledge deployment for service firms operating under uncertainty, referring to them as complex (i.e., based on procedures and written processes) or divergent (discretionary). Milliken (1987) reviewed varying conceptions of uncertainty from economics, information processing, and management, and arrived at similar conclusions: in response to uncertainty, firms can seek to establish plans and procedures or they may choose to simply exercise discretion and judgment.

Importantly, at least for this paper, Galbraith argues that each of these methods can cope with uncertainty, but greater levels of uncertainty require greater use of judgmental decision processes. I argue that this distinction will be the key to understanding how KIFs approach knowledge development and deployment. These two alternatives for contending with uncertainty are reflected in two of the forms of intellectual capital, which are discussed in the next section.

2.1.2 Forms of Knowledge Within Organizations: Intellectual Capital

Intellectual capital is defined as the productive knowledge assets of a firm (Stewart, 1997; Edvinsson, 1997; Bontis, 1998). Scholars generally classify intellectual capital resources as human, organizational, and social capital (Youndt and Snell, 2004; Reed, Lubatkin, and Srinivasan, 2006). This classification takes away some of the abstraction involved in the study of knowledge by categorizing knowledge resources
according to where they reside and treating them as firm assets (Edvinsson, 1997). Doing so has fostered a large body of productive scholarship on the application of knowledge within firms. Most importantly, research has shown that these three elements of intellectual capital do in fact contribute to performance improvements in firms (Youndt and Snell, 2004)

2.1.2.1 Human Capital

Human capital consists of the knowledge, skill, and productive abilities that reside within the individuals that work in a firm. The idea comes from the work of Shultz (1961) and Becker (1964). Becker studied individual educational performance, but the concept has been widely used in organizational literature. Human capital is owned by the employee, but used by the firm. The worker rents his or her human capital to the firm (Youndt and Snell, 2004) by agreeing to work there. Scholars argue that all organizational knowledge, regardless of its ultimate form, begins in individuals as human capital (Simon, 1991; Spender, 1996; Felin and Hesterley, 2007). It is also a critical and central element in knowledge-intensive firms (Mintzberg, 1980; Empson, 2001).

Firms are able to obtain human capital (or increase their stock of it) in one of two ways. A firm can go into the market for workers and hire knowledgeable, skilled workers, or they can develop human capital internally with the use of training, mentoring, and knowledge sharing (Swart and Kinnie, 2010). This internal development of human capital takes time, of course, but it is the most direct way of ensuring that the human capital for the firm is well acquainted with the firm’s practices (Hitt, et al, 2001).
Empirically, the impact of human capital has been seen by scholars in numerous ways. Firms with high turnover suffer a reduced ability to build their knowledge (Hatch and Dyer, 2004), for example, and the loss of human capital can overcome the cost benefits or reduced salaries when firms downsize (Nixon, Hitt, Lee, and Jeong, 2004). Thus, while human capital is actually owned and controlled by the firm’s employees, its deployment has profound organizational impacts.

### 2.1.2.2 Social Capital

Like human capital, social capital is dependent on the particular set of workers in an organization. Social capital is the value and knowledge that accrue to the firm based on the relationships that the firm has (Bontis, 1998; Youndt and Snell, 2004). Such relationships are valuable in that they foster the exchange of ideas and facilitate the development and diffusion of knowledge (Spender, 1996). Social capital accrues based on both internal and external (i.e., with customers, suppliers, regulators, etc.) relationships (Youndt and Snell, 2004, Reed, Lubatkin, and Srinivasan, 2006).

Bourdieu coined the term social capital, defining it as “the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition” (1985: 248). Coleman (1988) looked at social capital as an extension of Becker’s (1964) work on human capital. Empirically, Coleman looked at educational outcomes. However, he also noted that the concept of social capital could apply to organizational and economic contexts. He saw social capital as a missing link in explaining human action, bringing together the norms of social influence and the ‘engine of action’ of economics. Grant
(1996a) wrote similarly of how knowledge management integrates the social and the economic, arguing that management’s primary purpose is to integrate elements of the firm in order to foster the social interaction necessary to develop productive knowledge.

Social capital has thus been featured extensively in the management literature, where scholars regard it as fundamental to the management and development of knowledge resources (Spender, 1996; Nahapiet and Ghoshal, 1998). Nonaka (1994) views the transfer of tacit knowledge from one individual to another as a process of socialization, and Nahapiet and Ghoshal (1998) describe knowledge growth as taking place due to two social processes: combination and exchange. Empirically, it has been shown to improve such areas as dynamic capabilities (Blyer and Coff, 2003) and firm survival (Fischer and Pollock, 2004).

Social capital is not only a tool to help transform individualized knowledge into collective knowledge (e.g., Nonaka, 1994), but it is also an important part of the diffusion of organizational knowledge. It allows for the spread of best practices and for the interaction among workers with different skills and different knowledge bases.

2.1.2.3 Organizational Capital

Organizational capital is the one form of capital that a firm can be sure of retaining regardless of who works there. This sets it apart from human and social capital (though there are certainly elements of external social capital that the firm retains apart from which particular individuals are employed there). It is not individualized knowledge or knowledge embedded in relationships, but rather is recorded knowledge that can be stored or moved (Youndt and Snell, 2004). It can exist in a number of forms,
ranging from data stored in databases to written process instructions and “how we do things here.” In addition to improving firm performance, organizational capital has been shown to aid innovative capabilities (Subramaniam and Youndt, 2005), survivability (Black and Lynch, 2005) and the ability to transfer knowledge (Zander and Kogut, 1995).

Organizational capital has a different locus of action than human or social capital. For example, where human and social capital interact to foster radical innovation, organizational capital has been shown to aid incremental innovation (Subramaniam and Youndt, 2005). Organizational capital can make human work processes more effective by directing the efforts of workers (Black and Lynch, 2005). Unlike human capital, which utilizes discretion and judgment and therefore can foster unique, creative outputs, organizational capital may hinder creativity by limiting the scope of work (e.g., Haas and Hansen, 2005). With human work processes it provides direction and can be used for redundant tasks. In this way it can assist employees’ “quest for optimum intellectual performance” (Bontis, 1998:66).

Organizational capital can be sub-divided into procedural and declarative knowledge (Kogut and Zander, 1992). It can thus consist of knowledge that embodies procedures, processes, and ways of working (i.e., procedural organizational capital), or it may be knowledge about something (i.e., declarative organizational capital). Procedural organizational capital could be a training manual that describes in detail how a worker should perform a specific service, while declarative organizational capital could consist of written research about a topic or stored data. Thus, organizational capital can have two different purposes (Ofek and Sarvary, 2001) - to instruct how to do something, or to instruct about something.
Organizational capital is distinct from human and social capital in another way as well: it has properties of a public good. The idea of knowledge as a public good comes from the work of Samuelson (1954). This pioneering research also contributed to the understanding of intangible assets. A public good is defined as a resource that can be used by multiple actors without diminishing its value. There are two characteristics of a public good. One, such a resource is non-rivalrous, meaning that its use by one actor has no effect on its value or use by another actor. The second quality is that public goods are non-excludable, i.e., truly ‘public’ in that anyone can use them. Firms don’t want their knowledge to be literally public, of course. They want it to be limited externally to those that will pay for it. (However, this is an important consideration with knowledge. Knowledge that is easily transferred is also easily copied or appropriated [Kogut and Zander, 1992]). Internally, though, firms do want knowledge to be transferred and shared.

Conversely, in terms of knowledge as a public good, there are limits to the productivity that organizations can gain from personalized, or tacit knowledge (Polanyi, 1962). It cannot be shared broadly and widely, as it is dependent on the presence of the individual. In this vein, Wasko, Tiegland and Faraj (2006) note that, “Knowledge that is tacit (or implicit) is excludable since any communication depends on the voluntary participation by the owner of the knowledge and owners often have incentives to withhold their knowledge.” Having described this difference in the firm’s ability to control human and organizational capital they go on further to state that, “Failure to share tacit knowledge is clearly a serious problem in knowledge-intensive firms” (2006:965).
It is therefore extremely important for scholars and practitioners to consider how organizational capital is developed and used. Organizational knowledge always originates in individuals, so organizational capital is knowledge that has been developed from human capital. Even highly individualized knowledge can potentially be transferred to other workers and explicated, such that it is divisible organizational knowledge (Nonaka, 1994). However, the development of procedural organizational capital depends on some element of regularity or routine (Perrow, 1967). The more heterogeneous the work processes in an organization are, the more difficult it is to create procedural organizational capital out of them (Bénézech, et al, 2001). Additionally, there is some knowledge and skill that is so deeply personalized that it cannot be transferred (Polyani, 1962; Tsoukas and Vladimirou, 2001). Thus, though organizational capital is the preferable form of knowledge due to its divisibility (Casson, Dark, and Gulamhussen, 2009), firms may not be able to create all the organizational capital that they would like. Some knowledge may need to stay within the firm’s workers.

As noted, there are two ways in which knowledge can deal with uncertainty: by giving discretion to humans or by encoding decision processes into plans, procedures, and processes (Thompson, 1967; Galbraith, 1974; Shostack, 1987). In the parlance of how scholars have described intellectual capital, i.e., human, organizational, and social capital, this is analogous to determining whether to counter uncertainty with the use of human capital or organizational capital. It is important to understand what drives such a determination, and this is a major part of one of the key research questions of the project, i.e., whether or not firms should be ambivalent about the use of one or the other generic type of knowledge. This paper suggests that there are reasons for the use of each type of
knowledge that can cope with uncertainty. Because it is both divisible and controlled by
the firm, organizational capital would be preferable to human capital. Human capital is
deployed by individuals at a particular place and time, but organizational capital can be
used anytime and anywhere without rivalry. Organizational capital is easily and
efficiently replicated for use by a large number of actors, but humans and human capital
are non-divisible. There is an important caveat, though, that must be added. Since the
development of organizational capital is dependent on some level of consistency or
routinization, where it can be developed, organizational capital is preferable to human
capital. This is discussed and developed further in the hypotheses of the paper.

No group of firms should understand the challenges of managing knowledge more
than those that exist primarily to help clients with uncertainty: i.e., knowledge-intensive
firms (von Nordenflycht, 2010). These firms’ main reason for being is to help customers
with difficult problems (Nachum, 1999). Since knowledge is what is required to cope
with uncertainty, they have knowledge as their primary asset. Therefore, they are the
specific area of study in this paper, and a discussion of them follows in the next section.

2.2 Knowledge-Intensive Firms

In his seminal paper on knowledge-intensive firms Starbuck (1992) describes
them as firms with knowledge as their key production input, in the same way that capital-
intensive firms or labor-intensive firms would have capital or labor, respectively, as their
key input. Starbuck goes on to further define these firms as having specialized or
“esoteric” (1992:716) knowledge, as opposed to widely distributed knowledge.
Knowledge-intensive firms (KIFs) “revolve around the use of intellectual and analytical
tasks, and are typically seen as requiring an extensive theoretical education and experience to be carried out successfully” (Alvesson, 2004:1).

There are two primary reasons to study KIFs. First, these firms constitute an important sector in modern economies. The interaction of these firms with their clients “stimulates the generation and diffusion of knowledge within innovation systems, at both national and regional levels” (Muller and Zenker, 2001:1501). KIFs are a critical element of economic and technological progress – they impact firms, industries, and entire economic systems (Demarest, 1997). Whether they do so directly, as research-driven organizations such as bio-tech or aerospace firms, or indirectly, as consulting and engineering firms, they are a key component to the development and diffusion of new ideas, practices, and technologies (Johannessen, Olsen, and Olaisen, 1999).

Second, scholars have called for a greater understanding of knowledge-intensive firms because they offer lessons that can be applied to firms in general (Boland and Tenkasi, 1995; Lowendahl, 2005). These firms need to be studied because “knowledge-intensive dynamics of scale and scope induce mechanisms for the retention of wealth that are different from the dynamics of mass production” (Cooke and Leydesdorff, 2006:9). A knowledge-intensive firm is a very different animal than the industrial firm that was traditionally the focus of management scholarship (Mintzberg, 1980). The nature of their work “creates complex managerial dilemmas around how to balance autonomy with control and uncertainty and flexibility with efficiency” (Robertson and Swan, 2003: 831). In a time where knowledge is the primary basis for firms’ competitive advantage, these firms are especially important to study and understand. As Lowendahl states, “It is
imperative that we turn our research and theory development to extreme knowledge based organizations” (Lowendahl, 2005.ix).

Starbuck (1992) argues that knowledge-intensive firms are defined as having exceptional, unusual knowledge as a key resource over and above common knowledge. He also notes that this knowledge doesn’t necessarily have to reside in a firm’s workers, but can also be recorded, stored, and retained by the firm as routines, procedures, research, data, or quantitative tools. Examples of these firms are seen in consulting, engineering, financial services, research centers, education, and similar industries.

Von Nordenflycht (2010), in establishing his taxonomy of knowledge-intensive firms, defines them as having some combination of three traits: they make extensive use of knowledge, have little need for financial capital, and possess a professionalized workforce. Based on this he also argues that being a KIF is not an either/or proposition, but rather there is a continuum of KIFness, so to speak.

For the sake of clarity, it should be noted that Von Nordenflycht (2010) and others use the terms knowledge-intensive firm and professional service firm interchangeably. Both terms are actually in the title of von Nordenflycht’s (2010) paper, for example. I argue that it would be more correct to consider PSFs as a subset of knowledge-intensive firms. Starbuck (1992) included manufacturers in his definition of KIFs, and certainly businesses such as bio-technology, aerospace, and others would be considered knowledge-intensive according to Starbuck’s definition. Scholars often primarily view knowledge-intensive firms in a service context, though, noting that, “they are less capital-intensive than companies in the manufacturing industries and more learning-intensive than those operating in other service industries” (Ditillo, 2004: 404).
Professional service firms can include firms that provide services in accounting, consulting, engineering, architecture, finance and investment, healthcare, and more.

Insofar as PSF research focuses on the management of knowledge resources, it is applicable to knowledge-intensive firms in general. Where its subject is professionalization or the use of different organizational forms (e.g., Mintzberg, 1980; Greenwood, Hinings, and Brown, 1990; Empson and Chapman, 2006), it speaks to PSFs specifically. For this research project, which seeks to understand the management of knowledge resources, scholarship on PSFs can be quite informative. Except for when I discuss sampling later in the dissertation, I use the term knowledge-intensive firm as it is more germane to the research questions of this paper, which is the development and use of knowledge assets.

Knowledge-intensive firms have been the subject of substantial research, much of which has been concerned with their unique attributes as organizations (Greenwood, et al, 2005). Scholars have examined the use of the partnership form (Greenwood and Suddaby, 2006; Empson and Chapman, 2006), the importance of knowledge asymmetries (Nayyar, 1990; Sharma, 1997), and the need for offering workers’ autonomy instead of bureaucracy (Mills and Posner, 1982). Mintzberg (1980) encapsulates much of this in his characterization of ‘professional bureaucracies’, which he argues involves few control systems, little hierarchy, and jobs that are highly specialized but with low levels of formalization.

Much of the KIF research has also focused on the management of human capital, which scholars argue is their core resource (e.g., Empson, 2001a). I will address this specifically in a later portion of this section. First, however, I will discuss uncertainty
that comes from the customer interaction in firms. This section then concludes with a brief overview of previous research regarding human capital usage in KIFs.

2.2.1 Customer Interaction Uncertainty in Knowledge-Intensive Firms

As noted, knowledge and uncertainty go together – knowledge is needed in order to cope with uncertainty (Galbraith, 1974). For any firm that offers products and services that are not completely commoditized, customers provide a source of input uncertainty (Siehl, Bowen, and Pearson, 1992). In any case where the customer has some sort of interaction with the firm and the output of the production process is impacted by that interaction, customer-induced uncertainty will be a factor. In order to successfully provide value to their customers, firms must be able to contend with the uncertainty that comes from their interaction with customers (Larsson and Bowen, 1989).

Knowledge-intensive firms often have close relationships with customers (Lovelock, 1984). They create a “highly customized and complex service that involves a great deal of uncertainty and risk” (Jones, Hesterly, Fladmoe-Lundquist, and Borgatti, 1998). For these firms, “ambiguity, uncertainty, and interdeterminacy may be the 'natural' state of affairs” (Robertson and Swan, 2003:848). KIFs take on the complex, difficult problems of their customers and apply highly developed, specialized knowledge in order to solve them (Nachum, 1999; McGrath, 2005).

Since the outputs for these firms are often bespoke or unique, the inputs to the production process will be extremely important. Therefore, KIF work involves “high concern with customization and creativity in solving problems”, in addition to “high interdependence on the part of practitioners and between practitioners and their clients”
Thus, customer-induced uncertainty will be something that knowledge-intensive firms must deal with on an ongoing basis as a part of their core work. Further, as KIFs interact with their customers in order to enact their services, the nature of the work as problem solvers will create uncertainty in their interactions with their clients. Over time, if a KIF has repeated interactions with customers, and/or they deal with similar issues more than once, some uncertainty in the interaction will be reduced, of course. However, the nature of the firms is such that clients will be likely to bring new challenges to a KIF, and new clients will also be coming in. Thus, even though uncertainty over a given client may be reduced after the first set of interactions, we can expect that KIFs will deal with substantial uncertainty in their customer interactions as a general rule.

Customer interaction uncertainty has been discussed primarily in the services literature (e.g., Jones, 1987; Gittell, 2002; Skaggs and Huffman, 2003) but is an input uncertainty for any firm. It has been a topic of greater interest in service scholarship because services are typically co-produced in the presence of customers (Normann, 1984). However, customer-induced uncertainty should have a substantial impact on any firm whose work is built directly around customer needs. It would be expected to have a particularly important impact on knowledge-intensive firms, given that their reason for being is to solve customer’s difficult and challenging issues (Nachum, 1999).

Customer interaction uncertainty is defined as the diversity of the customer’s demands and the extent to which the customer participates in the production of the product or service (Larsson and Bowen, 1989; Tansik and Chase, 1988). Where a firm seeks to accommodate a very wide range of customer demands, they clearly have greater
uncertainty about what their work with the customer will involve. In such cases substantial information will need to be exchanged with the customer simply to understand what it is that the firm is going to be asked to do. This is especially the case for KIFs, as they exist to address complex client issues. Firms that allow extensive interactions with their clients during the provision of their service likewise face more uncertainty, simply due to the variance of human activity (Tsoukas and Chia, 2002). Thus, a firm that allows for a broad range of customer demands and close, active participation in the work process is allowing high levels of customer interaction uncertainty. Conversely, customer interaction uncertainty is lower where customers must operate in the way the firm wants them to, the output is restricted to a narrower set of offerings, and/or the customer’s participation is limited.

The uncertainty that comes into the production process from customers is both determined and deterministic. While some industries have greater interactions with customers than others, firms also have agency with regard to customer-induced uncertainty (Larsson and Bowen, 1989). They determine how much uncertainty customers will be allowed bring to their process (Argote, 1982; Gittell, 2002; Skaggs and Huffman, 2003). This is a crucial distinction. Customer induced uncertainty is not simply a source of uncertainty that is to be avoided or buffered (e.g., Thompson, 1967). Instead, “The nature of customer-induced uncertainty is taken as a strategic variable rather than as the target of an attempt to affect an organization design to eliminate it” (Tansik, 1990:59). This is quite different from an uncertainty such as regulatory change, which would affect all firms in an industry equally. Rather, each firm decides how much customer interaction uncertainty to let into their process. A firm can allow a high level of
customer interaction uncertainty, accommodating a wide range of customer needs, or allow very little and thereby limit their offering and the extent of the customer interaction. Skaggs and Huffman (2003) give the example of tax preparation services. A tax preparation firm allowing maximal uncertainty would take any customer’s shoebox full of receipts and bank statements. A firm choosing to accept less uncertainty may limit themselves to only clients that do not own businesses and it may also require the customers to provide information in a strictly prescribed format. In either case, the work will be uniquely produced for that client. However, the extent of uncertainty that customers are allowed to bring into the process is quite different. In order for firms to perform well, this strategic choice must be mated with the appropriate resources (Skaggs and Huffman, 2003), including human capital (Skaggs and Youndt, 2004).

This strategic choice and alignment is important with knowledge-intensive firms in particular, given their closeness to customers (Lovelock, 1984). They must establish a clear domain for customer interaction uncertainty. For example, Gadrey and Gallouj (1998) describe the level of interaction with customers needed in consulting projects and note that firms that build their work around very clearly defined constraints have much less client interaction than those that choose to engage in “sparring” with clients. In the latter case, firms’ interaction with clients is consistent and ongoing throughout the engagement, whereas in the former, the firm primarily has their customer interaction during the beginning of the engagement in order to gather information and requirements. There are a series of tradeoffs based on this strategic decision about customer interaction. Limiting the offering is more efficient, as it reduces setup and marketing costs, for example, but it also reduces the opportunity set and makes it more difficult for a firm to
differentiate itself (Nooteboom, Zwart, and Bijmolt, 1992). Thus the level of customer interaction uncertainty the firm allows will impact its entire set of business processes.

In summary, customers are a major source of uncertainty for firms (Bowen and Larsson, 1989) and knowledge-intensive firms need to have particularly close relationships with customers (Lovelock, 1984; McGrath, 2005). Thus, the importance of uncertainty that customers bring will be at its greatest in knowledge-intensive firms. That being said, it is a strategic variable that they can determine and alter.

Customer interaction uncertainty will be a particularly important issue for knowledge-intensive firms. Because the issues that KIFs are hired in order to resolve are not simple, the interactions that KIFs have with their customers will involve uncertainty. Customers do not need to retain a KIF for issues that are straightforward or solved by using standard, simple resources. The issues themselves will require interaction with the KIF in order to be resolved. The level of customer interaction uncertainty may vary – some customer problems will be extremely complex and will require extensive interaction and some will not require as much. However, the nature of KIFs will require that they contend with some level of customer interaction uncertainty – it will be a substantive part of their business and their service production process.

This is a key driver of the very nature of KIFs – knowledge resources. The uncertainty that KIFs must contend with, which stems directly from customers’ needs, is the reason why their core asset is knowledge. Without uncertainty to cope with, there would be no need for the substantial knowledge resources that are the hallmark of KIFs (Starbuck, 1992).
With this understanding of the reason for knowledge in KIFs and for the very existence of KIFs, I now turn to a discussion of knowledge resources in KIFs. Scholars have written extensively about the deployment of knowledge in KIFs, though largely only with regard to human capital. This literature is briefly reviewed in the next section.

2.2.2 Human Capital in Knowledge-Intensive Firms

Management of human capital resources is considered the preeminent issue for knowledge-intensive firms (Malos and Campion, 2000; Empson, 2001; Lowendahl, 2005; von Nordenflycht, 2010). Human capital has been shown to improve survivability (Pennings, Lee, and van Witteloostuijnhas, 1998), worker commitment (Galunic and Anderson, 2000), and the ability to offer additional products (Døving and P. N. Goederham, 2008). Even so, it must be managed carefully – empirical studies have not simply shown positive, linear relationships between human capital and performance in knowledge-intensive firms (e.g., Hitt, et al, 2001). Nonetheless, human capital is the resource that KIFs focus on most intently (Marquis and Lounsbury, 2007).

For organizations such as accounting and law firms the direct returns from human capital in the form of billable hours provide the income stream (Ogan, 1976). For knowledge-intensive firms, “a firm’s ability to generate rents depends largely on its employees’ competencies (knowledge, skills and attitudes) in tracing work-related problems, diagnosing backgrounds and designing, implementing and evaluating successful solutions” (Doorewaard and Meihuizen, 2006:39).

Human skill and knowledge must be a part of any study of knowledge-intensive firms. Even so, scholars have suggested and found support for non-linear, more nuanced
relationships between human capital and performance in these organizations. Hitt, et al (2001), for example, in their study of law firms found a curvilinear relationship between human capital and performance, based on the costs of high human capital employees. In a later study Hitt and his colleagues (2006) found that human capital worked best when paired with social capital, and Kor and Leblebici (2005) found that KIFs can over-extend by expanding too quickly with highly leveraged human capital. These findings illustrate that the strategic management of human capital in KIFs is not a simple task. Firms cannot just blindly add or leverage human capital assets.

Numerous other researchers have examined human capital in these firms (see Empson, 2001, for example). The other two forms of intellectual capital - organizational and social capital, though, have received comparatively little attention from scholars, in spite of the fact that they both have been shown to impact performance in firms (Youndt and Snell, 2004). In particular, since organizational capital is the type of knowledge that the firm owns directly (Morris, 2001) and it is one of the ways a firm can cope with uncertainty (Galbraith, 1974; Shostack, 1987). Thus, our understanding of the use of knowledge in knowledge-intensive firms has a surprising and substantial gap, as previous scholarship has primarily emphasized only human capital in KIFs. Yet, social capital is a key part of organizational knowledge development, and organizational capital is not only one of the ways that organizations can cope with uncertainty, it has some clear advantages over human capital. This gap is addressed by the first of my research questions.

In developing the model, I bring these components of intellectual capital into the study of KIFs by focusing on two key issues. First, what drives the use of organizational
capital? This paper argues that the answer to this question is that the use of human or organizational capital is not an arbitrary choice for managers. Given that knowledge exists to counter uncertainty, the choice should be based on the extent of the uncertainty that the firm wants to contend with. The use of organizational, social, and human capital should stem from the strategic choice that a firm makes with regard to customer-induced uncertainty. Second, we would like to know what organizational capital does and how it interacts with other forms of intellectual capital assets, human and social capital. I will argue that the use of customer interaction uncertainty will drive the development and deployment of these different knowledge assets (the second research question of the paper). On the basis of the ideas previously discussed in this chapter I suggest a series of hypotheses that attempt to answer these questions. These hypotheses are outlined in the next chapter of the proposal.
CHAPTER 3
HYPOTHESES

3.1 Overview of the Model

The model for this project follows the format adopted by many strategic management papers. It looks at a strategic contingency, how that contingency impacts valuable resources, and then how they impact the performance of firms. This is consistent with the idea of strategy, resources, and performance (Venkatraman, 1989; Barney, 1991; Amit and Schoemaker, 1993). Knowledge-intensive firms are no different from other firms in this regard: performance is based on the mix of strategy, (knowledge) resources, and a value-creating process that uses those resources (Løwendahl, Revang, and Fosstenløkken, 2001).

Such models have been applied to intellectual capital resources. Scholars have found, for example, that different human resource strategies require different patterns of human, organizational, and social capital in order to benefit performance (Youndt and Snell, 2004), and that industry choice impacts the way these assets work to generate performance gains (Reed, Lubatkin, and Srinivasan, 2006).

To summarize, my model begins by hypothesizing that the strategy selected by a KIF with regard to the amount of customer interaction uncertainty will drive the development and allocation of intellectual capital resources. I suggest that higher levels of CIU will be associated with higher levels of declarative organizational capital, but with lower levels of procedural organizational capital. I also hypothesize that human capital and social capital will be negatively associated with procedural organizational capital.
Further, I hypothesize that the firms that allocate human, organizational, and social capital as per the theories outlined will see increased performance as a result. Specifically, I hypothesize that three combinations of intellectual capital variables will interact to impact organizational performance: procedural organizational capital and human capital, declarative organizational capital and human capital; and social capital and human capital.

The full model can be seen in Figure 1. The discussion of hypotheses begins with the strategic variable - customer interaction uncertainty - and how it impacts intellectual capital variables. I then continue with the interaction of intellectual capital variables themselves and how they lead to performance in knowledge-intensive firms.

3.2 Hypotheses

This project answers the call for greater study of the strategy-conduct-performance paradigm within KIFs (Greenwood, et al, 2005; Wasserman, 2008). The strategic contingency in the model is the uncertainty that customers are allowed to bring into the transaction (Larsson and Bowen, 1989; Gittell, 2002; Skaggs and Huffman, 2003). Scholars have long recognized that customers bring uncertainty into work processes (e.g.; Jones, 1987; Larsson and Bowen, 1989; Tansik, 1990). “The diversity and unpredictability of consumers are a major source of uncertainty” (Bateson, 2002:111). Given that customers are diverse and unpredictable, firms must do two things. They must decide how much uncertainty they are going to allow, and then they must bring their knowledge to bear on this uncertainty. Knowledge-intensive firms, because much of their focus is on solving challenging, often unique problems for
customers (Doorewaard and Meihuizen, 2006, Macintosh, 2009), must establish a clear domain of customer-induced uncertainty to guide their organization and its workers. This is a core element of their strategy. Referring to KIFs, Løwendahl, Revang, and Fosstenløkken note that, “a strategically targeted portfolio of clients and projects allows for additive improvements of the knowledge base whereas, without such a focus, projects, knowledge development and recruiting are likely to be ad hoc” (2001:914).

Under ad hoc management knowledge resources will not be deployed efficiently and performance is likely to suffer. Thus, I suggest that the strategic choice with regard to customer interaction uncertainty will impact the intellectual capital resources that KIFs develop and use. As discussed, there are two broad ways that firms can deal with uncertainty: they can embed knowledge in people (i.e., human capital) and/or in processes (i.e., organizational capital). Because it is both non-rivalrous and the one form of knowledge that the firm actually owns, I begin the discussion with organizational capital.

Organizational capital is defined as the recorded knowledge that a firm retains regardless of who works at the firm. It is non-rivalrous, in that it can be re-used without diminishing its value (Casson, Dark, and Gulamhussen, 2009). Knowledge codification and sharing within the firm helps the firm provide value to clients by distributing knowledge at low cost among its service providers. This is extremely powerful for performance. Absent the costs of sharing and applying the knowledge, any external value it generates is pure profit. Morris describes the codification of knowledge in knowledge-intensive firms as how they “establish property rights over the process of
knowledge development and diffusion in order to secure a continuing income stream” (2001:821).

Organizational capital consists of two broad segments: procedural and declarative (Kogut and Zander, 1992). The former, described by Kogut and Zander as encompassing “know-how”, consists of codified procedures and processes, and ways of doing business that have been captured by the firm. Examples could be written manuals for processing bank loans, instructions for performing audits, or documented surgical procedures. Procedural organizational capital facilitates getting workers up to speed on performing their work, but it also provides a level of quality control and standardization of the product. It is a recorded embodiment of the work process, akin to Shostack’s (1987) ‘complex process’, with its set of specific steps that must be completed.

Shostack (1987) argues that a firm’s service process and the way that knowledge is deployed must go together with the firm’s strategy. This is due to the difficulty in creating procedural organizational capital. Institutionalizing processes and procedures is challenging and requires substantial routinization (Crossan, Lane, and White, 1999). A highly proscribed, codified process can only be developed where the firm places some limits on the alternatives that are available to customers (Bénézech, et al, 2001). This is because “customers’ actions can disrupt organizational routines” (Tansik, 1990:56). Routinization facilitates the capture and recording of process knowledge, whereas greater heterogeneity in the process hinders it (Perrow, 1967; Nelson and Winter, 1982). As an example, if a KIF were to have only one client with few needs, over time it would learn how to deal with that client’s needs. Uncertainty in the interaction would drop and the firm could routinize their work.
For a knowledge-intensive firm, whose role is to solve complicated problems, the desire to have highly codified processes requires a strategic trade-off: it necessitates restricting the firm’s opportunity set, because greater variance makes codification of processes more difficult. Firms that have chosen to allow greater customer interaction uncertainty into their processes will find creating procedural organizational capital to be more difficult. Thus, I suggest that high levels of procedural organizational capital will be associated with the commensurate strategy: allowing lower levels of customer interaction uncertainty.

**H1: Customer interaction uncertainty will be negatively associated with procedural organizational capital.**

I also suggest that declarative organizational capital will relate to customer interaction uncertainty. Where procedural knowledge instructs workers how to do something, declarative knowledge gives them knowledge about something (Kogut and Zander, 1992). A law firm’s law library is a large store of declarative knowledge. It describes cases that are instructive not in terms of how a case should be litigated, but by providing precedents that can be applied to a litigation process. Financial firms typically have a research department that produces declarative knowledge about a given company’s prospects, markets, and competitors. This knowledge could be used by financial advisors and portfolio managers as they provide services to their clients, but it wouldn’t tell them how to provide those services. Procedural and declarative organizational capital have very different purposes (Ofek and Sarvary, 2001).

Unlike procedural organizational capital, declarative organizational capital wouldn’t limit the scope of the firm’s offering. Since it is not knowledge about how to
do something it doesn’t specify and restrict process activities. Declarative knowledge is information about something (Kogut and Zander, 1992). Having more knowledge about their domain of activity would allow service providers to address a broader range of issues for clients. Declarative knowledge helps sales personnel, for example, identify client needs and the appropriate approach to address those needs (Szymanski, 1988). Shostack (1987) illustrates highly flexible, divergent work processes by using the ‘fan’ symbol from decision processing, with decisions being made at a singular point, and not in a sequence of specific steps. A greater breadth of declarative knowledge can help decision makers make choices while facing a wider range of possibilities.

It is also important to consider how declarative organizational capital is acquired and developed. Its development should be impacted by the way the firm has structured its productive activity, just as I have suggested that procedural organizational capital development is impacted by uncertainty. Declarative organizational capital would grow out of a need to deal with the relevant issues that it covers. However, a firm is unlikely to develop or acquire declarative knowledge about a topic without some exposure to that topic. All organizational knowledge begins as an individual’s knowledge based on his or her own experiences (Simon, 1991). Thus, a firm would find it extremely difficult to build its own declarative knowledge about an issue without some experience working to understand it. This experience would be unlikely to come without some customer need that drives the firm to try and address it. In this way, a greater range of customer issues entering the firm’s domain would drive development of more declarative knowledge in order to deal with them.
Declarative knowledge can be purchased, but KIFs are more apt to compete with firm-specific knowledge (Starbuck, 1992, Scott, 1998). Further, firms would be reluctant to invest in the purchase of declarative knowledge without some idea of how to use it. An organization that has made an attempt to solve a problem is better equipped to go out and find more information about the issue at hand. Conversely, organizations with limited views of the outside world are less likely to pursue new sources of knowledge in order to solve problems (Uzzi, 1997).

Therefore, since greater amounts of declarative knowledge would serve a firm in solving customer problems across a broader range of possibilities, and facing a wider range of issues would push a firm to develop more declarative knowledge, I hypothesize that declarative organizational capital will be associated with high levels of customer interaction uncertainty.

**H2: Customer interaction uncertainty will be positively associated with declarative organizational capital.**

The second key way (after the use of processes and procedures) that organizations can process uncertainty is via the deployment of human capital. Human workers can develop their skill and knowledge experientially, over long periods of time (Morris, 2001). Thus, the development of human capital is not dependent on regularity or routinization to the same extent that procedural organizational capital is. In fact, the most malleable knowledge products require the most personal interaction with customers (Gadrey and Gallouj, 1998). I suggest that they also require commensurately high levels of human capital.
Galbraith (1974) described the two forms of knowledge that can deal with uncertainty but argued that the highest levels of uncertainty required the use of human judgment. Again, where firms are able to, they would prefer to have written, recorded procedures for dealing with uncertainty. They have much greater control over such recorded knowledge (Zander and Kogut, 1995) because they own it (Youndt and Snell, 2004). Plus, it is more divisible than human resident knowledge, which lacks of divisibility of its resources (Penrose, 1959). Unfortunately, where uncertainty is very high, the development of such knowledge won’t be possible, leaving firms with human capital as their only alternative.

Thus, while firms may prefer not to rely on human capital, there are levels of uncertainty that demand its use. Routinizing allows for the use of codified procedural knowledge, but forgoing routinization and allowing work processes to vary widely requires the use of highly skilled, experienced workers (Crossan, Land and White, 1999). This is also why individual workers within a firm that can deal with the highest levels of uncertainty carry extra prestige (Thompson, 1967). These individuals are fixers, so to speak, that are called upon to resolve the most difficult issues that the firm faces.

When a firm converts human capital into organizational capital it takes a useful resource and makes it more divisible and non-rivalrous. The purpose of recording and codifying procedures is so that the knowledge contained within that procedure can then be distributed broadly and utilized by employees without the tacit skill it represents (Barney and Wright, 1998). Where firms have gone to the effort to explicate this procedural knowledge they’ll want it adhered to. This will restrict the activities of
workers, and give them less discretion in their work. Thus, where work processes are being codified and taught, firms should need fewer highly skilled employees.

**H3: Procedural organizational capital will be negatively associated with human capital.**

Procedural organizational capital, as an embodiment of the knowledge in the work process, should bring greater efficiency and productivity to knowledge-intensive firms (Crossan, Land and White, 1999). Conversely, where firms compete on the basis of efficiency, higher levels of human capital may harm performance, because the most skilled, knowledgeable employees are also the most expensive and labor forms the key variable expense for a knowledge-intensive firm (Greenwood, Hinings, and Suddaby, 1990; Sheehan, 2005). In order for a firm using procedural organizational capital to perform well, procedural organizational capital levels should be set so as not to conflict with the appropriate human capital levels. Just as it would make no sense to take the time and effort to codify procedures if workers were simply going to do their work without using such codified knowledge, it would make no sense to have highly codified, regulated processes with clearly defined steps while employing workers with the highest levels of skill and knowledge. In such a firm these workers would be bored and underutilized - codified procedures lead to less cognitive involvement on the part of the workers (Wilcox-King and Zeithaml, 2003).

Developing human capital is a long, expensive proposition that is only worthwhile if such services are required well into the future (Malos and Campion, 1995). In essence, these two types of intellectual capital can offset each other, or they can complement each other in firms that effectively allocate the two different forms of knowledge contingent
on the particular situation. Either way, we simply wouldn’t expect them to both be used at exactly the same time and place in the same manner to solve the same issue. Therefore, I hypothesize an interaction between human capital and procedural organizational capital leading to performance gains.

**H4: Procedural organizational capital will interact with human capital to improve firm performance.**

Declarative and procedural organizational capital perform different roles in the firm (Ofek and Sarvary, 2001). Procedural organizational capital is meant to improve productivity by showing workers how to do their work, but declarative organizational capital is designed to make workers more knowledgeable about the work that they are doing. Additionally, there are two ways firms can cope with uncertainty: by structuring and regimenting the production process, or by giving workers the discretion and the ability to determine the proper course of action themselves (Shostack, 1987). Declarative organizational capital helps in the latter case by better preparing and equipping workers to do their jobs.

Thus, where I suggest that procedural organizational capital, because it is an embodiment of the work process, can offset human capital, declarative organizational capital should act in a different way with human capital. It isn’t meant to substitute for human capital, but rather to augment it by helping the workers be more effective. For example, written research in a financial firm helps the client advisors make more informed decisions when they invest or suggest investments for their clients. The research leverages their knowledge and skill. Where declarative knowledge can be of value to customers it should help workers be more effective at producing the products
that the firm has chosen to offer. Declarative knowledge should therefore interact with human capital. Books in a law (or any other) library are of no use for creating a competitive advantage in and of themselves. They only have value in the hands of skilled attorneys, where they can leverage the existing knowledge and experience of the firm’s attorneys.

Further, the added knowledge and experience that the individual workers in a firm gain through their work can be used to develop new declarative knowledge (Nonaka, 1994). All knowledge begins as individuals’ experiential learning (Spender, 1996), but as knowledge is recorded and spread it allows others to learn more themselves as they have their own experiences. This is broadly how Nonaka conceptualized his ‘knowledge spiral’ (1994). This suggests that declarative organizational capital should work to leverage human capital. Knowledgeable workers can use declarative knowledge by applying it to customer problems that require both forms of knowledge. A larger law library would help talented lawyers be more effective, and strong economic research would help an investment advisor offer better advice to her clients. I suggest that high levels of both human and declarative organizational capital would produce high performance. Thus I expect that the highest levels of performance will be with high levels of both human and declarative organizational capital – higher performance than with a high level of one and a low level of the other.

**H5: Declarative organizational capital will interact with human capital to improve firm performance.**

Social capital is the third component of intellectual capital (Reed, Lubatkin, and Srinivasan, 2006). It consists of the value a firm has due to the relationships that its
workers have (Adler and Kwon, 2002; Youndt and Snell, 2004). Social capital was recognized as being a contributor to the development of knowledge beginning with the work of Coleman (1988, 1990). Coleman found that the relationships that a person has and the social system he or she inhabits have a significant impact on their educational achievements. Scholars differ in their views of the extent to which knowledge is a purely individual phenomenon (Felin and Hesterly, 2007), but there is broad agreement that interpersonal interaction is an important contributor to the development of knowledge within firms (Nonaka, 1994; Spender, 1996; Nahapiet and Ghoshal, 1998). Nonaka (1994) argues that the interchange of knowledge between individuals leads to the growth of knowledge, either as individual learning or organizational learning. Given the importance of having knowledge grow and progress (Winter, 2003), social capital will clearly be an important part of a firm’s intellectual capital.

These theories give us an understanding of the role of social capital – it facilitates the development and diffusion of knowledge in organizations. However, we also would like to understand if there are contingencies or other factors involved in its use within knowledge-intensive firms. Research has shown that social capital is important for knowledge-intensive firms: for example, individual KIF employees, even ‘star’ employees, do not do as well after leaving their firm with its social network (Groysborg and Lee, 2008).

Nonaka’s work seeks to offer explanations for how social capital facilitates knowledge transfer. He refers to the transfer of individualized knowledge from one person to another as “socialization”, a process that allows individuals to “share each other’s thinking processes” (1994:19). However, social capital is not the only resource
that can facilitate the diffusion of knowledge. An important benefit of codified knowledge is its transferability (Zander and Kogut, 1995). Codified procedural knowledge is more easily transferred than internalized, personal knowledge. Even procedural organizational capital that isn’t written or accessible in written form, such as “ways of working” (e.g., Youndt and Snell, 2004), can be transferred relatively quickly, by virtue of being clear enough to be commonly understood. Crossan, Lane, and White (1999), for example, talk about firms “institutionalizing” routines and ways of working. They note the difficulty in enacting this process. However, once achieved, the institutionalization of routines, etc., speeds the process of integrating workers into the firm’s processes. In this way procedural organizational capital diffuses organizational knowledge in a more efficient fashion than a long, intensive socialization process.

Social capital and procedural organizational capital thus constitute two different mechanisms for the sharing of organizational knowledge. However, there is a tradeoff involved. Codified procedures are an efficient means of spreading knowledge, but their use reduces flexibility and adaptation (Crossan, Land and White, 1999). In addition to this tradeoff, the two methods are somewhat incompatible. Social capital is a human-centric asset, involving all the variance inherent in human activity (e.g., Tsoukas and Chia, 2002). Procedural organizational capital comes from having reduced variance. It stems from the firm’s ability to have some level of routinization and standardization in their process. Highly social methods of transferring knowledge are likely to frustrate and/or be frustrated by the transfer of codified knowledge. Procedural organizational capital should allow the firm to operate with fewer internal interactions. In fact, it may be more effective with fewer interactions.
These two intellectual capital assets, then, can substitute for each other as mechanisms for the spread of knowledge, but their development is facilitated by different organizational conditions. More specifically, since procedural organizational capital is more easily spread and leveraged, it is a less expensive knowledge resource for firms to utilize. One would expect that firms would use procedural organizational capital when they can and rely on more human-centric processes, including the use of social capital, where they must. This leads to the following hypothesis with regard to social capital:

**H6: Procedural organizational capital will be negatively associated with social capital.**

In the previous segment I have argued that procedural organizational capital and social capital are different methods for the spread of knowledge. Where they are hypothesized to be substitutes for one another, we need to further explore and understand social capital’s role in spreading knowledge.

As discussed, human capital is individualized, personal knowledge (Youndt and Snell, 2004). It resides in an individual worker. One of the key challenges for organizations that want to grow their stock of knowledge resources is how to spread such individualized knowledge (Grant, 1996a). As knowledge spreads more broadly within the firm’s boundaries, it becomes more valuable to the firm, as the firm can use this knowledge to provide more value to clients and earn more revenue. Firms want to disseminate their own knowledge as extensively as possible within their firm (Kogut and Zander, 1992). Given the personalized nature of human capital, the process by which this is done will not be as simple as it would be for procedural organizational capital, which
can simply be duplicated and spread throughout the organization. The method for spreading human capital will be more complex.

In order to share someone’s thinking process for the purposes of transferring personalized knowledge (Nonaka, 1994), a substantive relationship must be developed. The depth of the issues that KIFs address require high levels of relevant, experiential knowledge (McGrath, 2005), so the transfer of this knowledge would not be quickly or easily done. Rather, such a process would be highly involved and time consuming. Accordingly, the development of new personnel in knowledge-intensive firms is accomplished “through an elaborate process” of socialization (Greenwood and Empson, 2003:923). This social process is in addition to the formal education that workers bring with them to their work (Greenwood and Empson, 2003; Hitt, et al, 2006).

Transferring detailed, substantive, experiential knowledge from a senior worker to a new employee will only be effective when internal relationships are an important part of a firm’s makeup. While a firm can hire experienced senior personnel, knowledge-intensive firms also recognize the value in developing new professionals. For example, writing about law firms, Malos and Campion note: “The guidance, feedback, and knowledge about partnership that come with higher levels of mentoring provide a vehicle for developing firm-specific human capital such as knowledge of firm-specific practice specialties, relationships with partners and clients, and firm shared reputation” (2000:752).

The process of socialization and inter-personal knowledge transfer that these scholars are writing about will be dependent on social capital – the relationships that the
firm’s workers possess. Without such relationships (i.e., such social capital), the transfer of personalized, experiential knowledge will be extremely difficult.

The use of social capital to develop new workers is an investment in the future human capital value of the firm (Malos and Campion, 1995). Thus, I hypothesize that social capital will interact with human capital, leveraging it so that performance is improved with the use of both, and not human capital alone.

**H7: Social capital will interact with human capital to improve performance.**

In summary, the model hypothesizes ways that customer interaction uncertainty impacts the development and use of intellectual capital resources. It also suggests how those resources operate, in conjunction with the strategy and with each other, to improve the performance of the firm. The next chapter of the proposal delineates how the model will be tested empirically.
CHAPTER 4
DATA AND ANALYSIS

4.1 Sample

In research that examines specific resources, sampling a single industry can improve the ability to focus attention on the resources of interest (Hitt et al, 2001). Doing so filters out a variety of extraneous factors that can impact firm performance. It also keeps the study from the need to control for industry influences using variables other than those that the study is concerned with. Additionally, in this paper, using a single industry has the effect of controlling for a number of types of uncertainty other than customer interaction uncertainty. For example, using a single industry controls for the environmental uncertainties facing that industry, such as regulatory issues, changing technologies, etc. For this project using a single industry focuses the study on both the strategic variable (customer interaction uncertainty) and the resources of interest in the research questions (intellectual capital).

Given the focus on customer interaction uncertainty, the sample needed to be from an industry with a strong customer orientation. Additionally, it needed to be an industry that utilizes all the various forms of organizational capital. Thus, the sample cannot be of single proprietor firms, for example, that would have no procedural organizational capital or social capital. The sample must also be an industry where norms allow for variance in the use of intellectual capital in order to do business. Obviously, the sample must be of a set of knowledge-intensive firms, given their unique
attributes (e.g., Mintzberg, 1980), and given the research questions there must be available data on performance.

Knowledge-intensive firms pose a particular challenge for sampling in strategic management research because many of them are private corporations or partnerships (Greenwood, Hinings, and Brown, 1990) and thus do not publicly report performance data. In fields such as law, accounting, consulting, architecture, engineering, and investment management, only the largest few firms are publicly owned. Much empirical KIF work has therefore been either qualitative in nature (i.e., case study) or has used industry-specific samples with data obtained from industry sources. Such samples have included advertising firms (Faulconbridge, 2006; von Nordenflycht, 2007), accounting firms (Greenwood, et al, 2005), engineering firms (Aharoni, 1993; Sharma and Johansen, 1987), law firms (Scherer, 1995; Hitt, et al, 2001), consultants (Empson, 2001b; Fin cham, 2003), healthcare (Argote, 1982), financial service firms (Reed, Lubatkin, and Srinivasan, 2006; Groysberg and Lee, 2008), financial market trading businesses (Zaheer, 1995), and even business schools (Ferris, 2002).

I selected an industry-specific sample in financial services. Other scholars interested in knowledge and intellectual capital have sampled financial services as well (e.g., Zaheer, 1995; Knorr-Cetina and Breugger, 2002; Reed, Lubatkin and Srinivasan, 2006). The financial services industry is a broad industry with a variety of work processes, though, so care must be taken to sample specific organizational units that will be appropriate. For example, there are numerous functions in banks’ processing areas that are highly routinized and do not require customer contact. Such areas would not offer the opportunity to study the questions of interest to this paper.
With these needs in mind, I sampled two specific business units that operate within a number of financial institutions: their foreign exchange and derivatives businesses. These businesses are largely focused on their clients’ needs and thus have substantial customer interactions on an ongoing basis. Resolving customer issues is their objective, though of course they also process basic transactions. Customer issues may be simple, involving only a modest market transaction or resolving a narrow question. They can also be quite complex. These businesses advise clients on the management of cross-border M&A transactions, the hedging of multi-dimensional market risks, and on the makeup of international investment portfolios. In some cases these firms have contact with clients multiple times in a day, and they may also work on specific projects over a period of months or years. They have sales teams that are the primary contacts for clients, but also have research, trading, and operations staff that support the client business. (These business units have been separated from the proprietary trading units in banks as banking regulators have worked to reduce any conflicts of interest with the client service businesses. This serves to increase the strategic focus of these business units on their customers’ needs.)

These business units therefore need to have a strategy with regard to customers that drives them. Some firms, for example, see their primary role as market intermediaries, while others see their focal role as being client advisors (this distinction is akin to Thompson’s [1967] “mediating” and “intensive” processes). There are also strategic differences in terms of the range of products that are offered (e.g., Larsson and Bowen, 1989). Thus, this sample should have sufficient variance in terms of the strategic variable, customer interaction uncertainty.
These organizations also are very clearly based on the deployment of knowledge resources. The products that they offer are complex and specialized, requiring substantial knowledge to understand, sell, and process. Personnel need knowledge of financial markets and an assortment of financial products and derivatives. Additionally, firms often seek to have their personnel be knowledgeable about their clients’ issues (such as tax and accounting treatments for hedges) and their assorted market exposures. These firms at times employ substantial research and tools for data analysis for clients. This creates a need for declarative organizational capital that varies based on what firms want their workers to be expert in.

Procedural organizational capital is used as well. Given the range and complexity of customer needs, there are a variety of ways to enact the services that these firms offer. The nature of the transactions is such that errors can be extremely costly to the firm and/or clients, requiring substantial care in the work itself. This creates the potential for a variety of ways to enact work processes.

In terms of human capital, some of these organizations use recruiting and development processes whereby new employees undergo a training period lasting a number of months, while others use simpler approaches. Some firms hire new graduates and spend extended periods of time with them in a junior/senior mentoring structure, while some only hire individuals with experience. The education level of the staff on the core desks ranges from undergraduate degrees to MBAs. Specialists in the firms will at times have Ph.D. degrees as well. Educational pedigree is highly important to some firms, but not to others. These workers are well paid, but their compensation varies
widely. Thus while human capital is clearly important, it should also vary among the sample.

The unit of analysis for the data is the business unit for a given product (either foreign exchange or derivatives) in a given financial institution. The technical core (Thompson, 1967) of these business units is comprised of a number of different ‘desks’ that typically consist of a team of individuals that are responsible for effecting client transactions and developing client business. Larger firms may have a large number of such teams, while smaller business units might have only a handful. The business units also have additional support staff and managerial personnel. Staff in each business unit consists of approximately 100-500 personnel. The financial institutions that compete in these businesses are almost all international banks and therefore the business units may have personnel in different countries. The typical structure for a given firm would be to have these teams fall under a global product manager (e.g., “Global Head of Foreign Exchange”) with separate business units based either on geography or client type. Each of these business units would have its own management serving underneath global product managers. This element of the sampling was worked out with assistance from a consulting firm I worked with that also supplied many of the contact details for the respondents.¹ This firm suggested that I sample multiple geographies (i.e., separate operations in North America, Europe/U.K., and Asia) in the largest firms, which is what I did.

¹ Comments on the nature of the work, the teams, and the foreign exchange and derivative business come from the author’s own experience and from conversation with industry participants. Other empirical management research has used the same type of sample: see Zaheer, 1995; and Knorr Cetina and Bruegger, 2002, for example.
The two product areas (foreign exchange and derivatives) have different management teams that report to a high level executive that is in charge of all capital markets operations. They operate largely as stand-alone businesses with their own strategies, budgets, and financial goals. Performance (profitability) is publicly reported for these businesses, and it was also made available (as market share) from the consulting firm.

To assist with the data gathering I worked with a consulting firm that has been working with these organizations (the financial institutions’ foreign exchange and derivatives businesses) as clients for over 30 years. The consultant supplied the names of some survey respondents (which are not publicly known) and they also granted access to their customer survey data. This data was used to provide data for performance (market share), but they also provided data that could be used in some of the independent variables as well. The consulting firm’s data, I believe, presents an attractive opportunity, as strategic management studies very rarely use customer data, and their customer database is extremely large – they conduct thousands of direct, in-person surveys of customers of these institutions on an annual basis.

The consultant supplied the names of survey respondents that manage 194 business units in 30 different firms. They noted that this was a subset of their actual data, but they had gone through an analysis internally to ensure that no clients’ contact details were given that they felt would have been sensitive. This reduced the number of contacts that they could supply the study substantially, and they noted that there were numerous other contacts that I could work to find on my own. They also assured me that the
contacts they had sent were senior managers capable of answering the survey questions appropriately.

In reviewing the consultant’s list against my own knowledge of the industry, as well as other sources of industry information, such as trade periodicals, I could see that there were a number of financial institutions that were not included on their list. I then undertook the work necessary to expand the contact list to get a complete sample that was as close to the entire industry as possible.

The process for adding names began with a review of industry news and trade periodicals to find both financial institutions names as well as contact names. My own background in this industry helped, as well as contacts in the industry that I still have. I also used internet searches and reviews of industry conferences and meetings. Based on this work I expanded the contact list to 332 contacts responsible for business units in a total of 62 financial institutions.

Survey respondents were initially contacted via e-mail. I sent an email informing them about the general nature of the study, assuring them that the results were confidential, and offering to share the results of the study with them. They were offered the ability to complete the survey in one of two ways: either on the University of Massachusetts’ survey website (via Qualtrics) or using an attached form.

I followed up with respondents in several ways. Each respondent that did not reply received, in the case of individuals that I did not already know, one follow up email. (This was agreed with the consulting firm in order to avoid antagonizing their clients.) With respondents that I knew in some sense from my experience in the industry I sent additional email follow-ups and phone follow-ups. Additionally, I attended four
separate industry events in which I brought paper surveys with return envelopes. At these events I was able to establish contact with senior managers of a number of financial institutions and gave out numerous surveys. Lastly, I mailed surveys out to a group of respondents in the U.S. None of these were returned, so I did not pursue physical mailings further.

It was made clear to me when I spoke with respondents that confidentiality was a very major concern. Many respondents replied to the initial query and said that they would need to get approval to complete the survey from their legal and compliance departments. In some cases, this approval took many weeks, and in many cases approval was not granted. A number of respondents that I had known for many years refused to complete the survey in spite of my assurances of confidentiality. Confidentiality and avoiding sharing any information whatsoever is extremely important to many of these firms and obtaining surveys proved to be quite difficult, even where respondents liked the idea of the study and wanted to participate.

The result of the sampling was that I obtained 94 usable responses, representing 94 different business units – 28% of the sample. This is consistent with other samples of senior managers (e.g., Skaggs and Huffman, 2003; Reed, Lubatkin, and Srinivasan, 2006; Groysberg and Lee, 2008). The responses from these 94 business units came from 38 different financial institutions. Clearly, this resulted in multiple survey responses from a given firm (though each survey was for a unique business unit.) For example, some firms had survey responses from a unit in North America, one in Europe, and one in Asia, or from business units serving corporate clients or institutional investor clients, depending on how the firm was organized. This results in useful and unique information, though, as
the same firm will typically use different strategies and deploy different resources for different geographies and customer segments.

A review of the sample showed that there is a substantial variety in the business units within a given financial institution. Firms that had multiple business units represented in the survey had business units that either differed by geography or customer segment. For example, a firm headquartered in Australia provided survey data for business units in their home office as well as in New York. I spoke directly with the global manager of the business in this firm, who noted that their approach to the business in the North American market was very different than in their home market. I received survey data from other firms that differed between their business units supporting corporate clients vs. institutional investors or private clients, too. In other conversations with senior level managers in the sample both before and after the survey similar sentiments were noted – firms have different strategies and resources at work in the different business units. In many cases, a financial institution will serve a wide range of client types in a number of geographical areas but they will focus most of their efforts on a given segment or geography. A firm might focus primarily on corporate customers, for example, while providing a very different level of service to private clients.

This variance across business units within a given financial institution could be seen not only in the surveys (as well as the managers’ comments from direct conversations) but also in the performance data provided by the consulting firm. This firm collects their data in this same manner: divided by both geographic and customer segment (i.e., corporate vs. investor, etc.) The differing performance results seen in the consulting firm data evidence the variance between business units within a given
financial institution. Of course, the fact that this consulting firm has gone to the effort of gathering and compiling this data by business unit for over thirty years provides further evidence of the value of examining the data by business unit. The data in this study allow for the examination of both business units and the overall financial institution.

The geographic breakdown of respondents was as follows: U.S.: 54%, Europe: 31%, Canada: 9%; and Asia: 6%. All surveys were in English. Additionally, all surveys were conducted with individuals and business units that either have predominantly English-speaking customers or that interact (i.e., trade) heavily with the core interbank foreign exchange market. All business within this market is conducted in English, primarily in New York, London, and Singapore. This served to both remove language barriers but also to ensure that the survey items would be clearly understood by all respondents.

4.2 Variable Operationalization and Measurement

4.2.1 Customer interaction uncertainty

Uncertainty is broadly and generally defined as the absence of knowledge about future states (Galbraith, 1974). It can be categorized as one of three types: environmental (Lawrence and Lorsch, 1967), task (Galbraith, 1973), or input (Siehl, Bowen, and Pearson, 1992). This project is concerned with the extent of customer interaction uncertainty that a knowledge-intensive firm allows into its service process. This is a strategic choice that service firms make (Argote, 1982; Jones, 1987; Skaggs and Huffman, 2003), and it is uncertainty that is due to a lack of knowledge of how the production process will proceed. Thus, it is a form of input uncertainty.
Customer interaction uncertainty is an issue that must be considered and addressed by all firms with substantial customer dealings (Jones, 1987; Tansik, 1990; Gittell, 2002). KIFs exist to solve customers’ challenging problems (Alvesson, 2004), so when and where KIFs interact with clients the interactions will not be simple or straightforward – the potential customer interaction uncertainty for KIFs could be very high. Therefore, customer interaction uncertainty is a key strategic issue for KIFs.

To be more specific, customer interaction uncertainty is defined as the diversity of demand and the extent to which the customer participates in the production process (Larsson and Bowen, 1989). As Larsson and Bowen describe diversity of demand they suggest that it corresponds to the range of services offered, as in Argote’s (1982) study of hospital emergency units. Argote argued that the nature of uncertainty tended to be underspecified by scholars, and thus chose an extremely specific and clear measurement of input uncertainty: the number of illnesses that a given hospital would treat. Larsson and Bowen note that demand diversity can also come from differences in how customers want the same service. This would be measured in terms of uniqueness of the service that’s demanded, akin to a customization vs. standardization distinction.

Accommodating a wider range of demand would be expected to require the firm to offer a wider range of products or services.

Customer disposition to participate describes how active the customer is in “supplying labor or information inputs to the service production process” (Larsson and Bowen, 1989:218). As the customer participates more directly in the production process, the uncertainty grows, simply due to the nature of human activity (Tsoukas and Chia,
(It is safe to say that Argote had no need to measure customer participation for emergency rooms, as it would be high in all cases.)

Several scholars have empirically measured customer interaction uncertainty. Jones (1987) stipulated three aspects of customer interaction uncertainty that could be measured. He used transaction cost economics (Williamson, 1975) as a guide for his work and applied these aspects to transactions themselves. Jones argued that customer interaction uncertainty is a function of the specificity, infrequency, and duration of transactions. This is based on an information processing argument (e.g., Galbraith, 1974) wherein greater information processing needs are associated with greater levels of uncertainty. Jones’ items therefore measured the extent of information being transmitted during the transaction. Jones’ reasoning was that a more specific transaction requires additional information about how it should be conducted, a less frequent interaction doesn’t have the benefit of past experience (and accumulated information), and longer interactions allow for greater levels of information to be passed. These items are analogous to Larsson and Bowen’s customer participation measure in that each is concerned with the level of uncertainty that the firm faces based on the extent of the information needed. Jones’ specificity construct is also related to the diversity of demand. This is the same idea as the uniqueness or level of customization of the service that Larsson and Bowen describe.

To summarize this literature, there are a handful of aspects to customer interaction uncertainty:

1. Range or breadth of the product/services offering; (Argote, 1982; Larsson and Bowen, 1989)
2. Qualitative differences in demand (uniqueness, customization, specificity);  
(Jones, 1987; Larsson and Bowen, 1989)  
3. Infrequency of interaction (Jones, 1987)  
4. Duration of interaction (Jones, 1987)  

Larsson and Bowen argued that the first and second elements together constitute “diversity of demand”, which they viewed as different than the propensity to participate in the service. These diversity of demand types of items formed the bulk of what was measured and ultimately used as customer interaction uncertainty in this study’s dataset.

Each of these elements discussed, therefore, is measuring either the need for or the evidence of exchanging lots of information. This is the important factor to consider in measuring customer interaction uncertainty, because uncertainty is defined as insufficient information for the task at hand (Galbraith, 1947). Thus, where specificity or diversity of demand creates a need for a large amount of information being exchanged, increased duration of the interaction would be evidence of such information being exchanged and not a separate construct that needed to be added into the others.

Similarly, offering a greater range of services (e.g., Argote, 1982) would create the need for more information being exchanged. Thus, the emphasis on the range of customer issues (i.e., the diversity of demand) that constituted the bulk of the items that were used in the data analysis of this project is appropriate as a measure of customer interaction uncertainty.

A firm would not have to offer a broad range of services in order to have the need to exchange a lot of information with customers, though. A specialist firm that works ‘deeply’ into customer issues as opposed to ‘broadly’ across a range of issues would still
potentially need to have lots of information transferred. Such a ‘deep’ specialist could be facing lots of customer interaction uncertainty. In order to deal with this issue, in addition to exploring the dimensions of customer interaction uncertainty independently, the survey looked at the use of specialists vs. the use of generalists (e.g., Kang and Snell, 2009) in the human capital measure. However, these items were generally not used, as they did not load appropriately in the CFA.

Skaggs and Huffman (2003) wrote of customer interaction uncertainty and its impact on service production complexity. They broke customer interaction uncertainty into three components: service adaptability, service focus, and the extent of co-production. Their adaptability construct was quite similar to the second factor noted above and their service focus measure is the inverse of the first factor noted above.

Another important dimension of customer-induced uncertainty is that it can be deterministic and it can be determined (Larsson and Bowen, 1989; Skaggs and Huffman, 2003). There are processes that come with large amounts of missing information and processes that don’t, regardless of the strategic orientation towards customer interaction uncertainty. However, within a given business or industry, a firm sets its own strategic domain for customer interaction uncertainty. It is a choice they must make. By focusing on a single industry, this research project is able to control for deterministic customer interaction uncertainty and attempt to measure differences in customer interaction uncertainty as a strategic choice. The items used in the survey and ultimately in the analysis reflect this strategic choice.

The study asked respondents about the scope of services that they offer, in order to cover (1), above. In order to cover both (1) and (2) the survey asked firms about the
extent to which customers bring their most unusual and difficult issues to the firm. Respondents were asked about the duration of interactions and the extent of information exchanged in interactions. These items cover the extent of information processing in the transactions, as Jones (1987) measured in aspects (3) and (4), above. The specific items are listed in the Appendix and the items that were ultimately used in the hypothesis testing are discussed below, in the section describing the confirmatory factor analysis results.

4.2.2 Human Capital

Human capital is defined as the knowledge and skill that reside in the firm’s employees (Youndt and Snell, 2004). It comes from the ideas and work of Schultz (1961) and Becker (1964), and has been widely discussed as the critical knowledge resource for PSFs (Empson, 2001a). For KIFs, firms human capital development comes from two areas, the formal education of workers and the informal mentoring and training that takes place in the presence of senior employees (Hitt, et al, 2006). Past studies have largely operationalized human capital in one of two ways. In the first, scholars have looked at the “leverage” of human capital, measuring human capital as a ratio of senior partners to junior employees, for example (Hitt, et al, 2001). In this manner, researchers would consider partners or senior employees as high levels of human capital. This approach has been used, for example, with regard to law practices (e.g., Sherer, 1995; Kor and Leblebici, 2005).

The second general method for measuring human capital used in prior research is not related to numbers of employees and leverage, but looks at relative skill and
knowledge levels of the firm’s employees as a whole (e.g., Bontis, 1998; Youndt and Snell, 2004). This is a more direct measure of human capital than the leverage measures previously noted, and therefore this measure comprises most of the items in the human capital scale for this study. The operationalization of human capital in this project involved both elements (formal education and internal mentoring) used by Hitt, et al (2006), but also asked for a broad assessment of the firm’s employees. It utilized items from Youndt and Snell (2004), as well as Reed, Lubatkin, and Srinivasan (2006), in addition to the items that assess leverage (counter-indicator) and formal education. (Note that, instead of a measure of junior/senior level employees, which is publicly available as secondary data for law firms, this study asked the respondent for a comparative assessment.) The survey also asked about the firm’s use of generalists vs. specialists (e.g., Kang and Snell, 2009). These items are listed in the Appendix and the items used in the hypothesis testing (i.e., after the CFA) are listed in the Results section.

4.2.3 Procedural Organizational Capital

As noted, procedural knowledge within firms is the recorded knowledge of how to do something (Gupta and Govindarajan, 2000; Wilcox, King, and Zeithaml, 2003). It may be the embodiment of a work process or it may be simpler and less formal, describing, for example, ‘how we do things around here’ (e.g., Subramaniam and Youndt, 2005). It can also consist of recorded routines (Nelson and Winter, 1982). Procedural organizational capital is created and used by firms in order to make work processes easier to manage and execute. It “leads to improved abilities and lower requirements for cognitive involvement” (Wilcox, King and Zeithaml, 2003:2004).
In their study of Swedish SMEs, Wiklund and Shepherd (2003) measured procedural organizational capital by asking firms about their relative strength in a series of business processes such as marketing, customer service, innovation, management, etc. Similarly, Gupta and Govindarajan (2000) asked respondents about the extent of procedural knowledge relative to a range of specific functions. One advantage of a single-industry study such as this one is that the domain of knowledge-driven competencies I am interested in is limited, making the list of questions to ask much more modest. Thus, I followed Wiklund and Shepherd in using items designed to measure the extent to which the organization uses codified process/procedural knowledge.

Kyriakopoulos and de Ruyter (2004) used more general questions to assess procedural knowledge, asking about “well-defined procedures” and “a standard approach,” along with skill levels (2004:1494). Similarly, Youndt and Snell (2004) asked about structures, systems, processes, and ways of doing business. Combining these specific and general approaches and relying on the scales of these prior studies, I asked a set of questions that was intended to cover procedural knowledge specific to workers as well as the notion of general procedures and ways of working.

Additionally, some scholars argue that organizational capital includes the organization’s culture (e.g., Lado and Wilson, 1994; Marr and Schiuma, 2004). Others do not include it. I included three separate items measuring the strength of the organization’s culture, giving the study the opportunity to either use the idea of culture as a part of organizational capital or to control for it. These items draw in part on Denison and Mishra’s (1995) work on defining the different aspects of organizational culture, and are listed in the Appendix. The culture items were not used in the analysis of the
hypotheses, as they did not load in the CFA. The items that were used in the hypothesis testing are noted in the Results section.

4.2.4. Declarative Organizational Capital

For declarative organizational capital I followed a similar approach to the one used for procedural organizational capital, given that the two constructs are linked in many studies (e.g., Kogut and Zander, 1992; Moorman and Miner, 1998; Gupta and Govindarajan, 2000; Wilcox King and Zeithaml, 2003). I used items for this construct that attempt to capture both domain-specific declarative knowledge (e.g., Glynn, 1996) and the general concepts of declarative knowledge.

Kogut and Zander help illustrate the difference between declarative and procedural knowledge when they note that amnesia is more likely to cause declarative knowledge to deteriorate than procedural knowledge (1996). Szymanski (1988) posited a model of selling effectiveness suggesting that declarative knowledge helps assess customer needs and the appropriate sales approach, while procedural knowledge informs the actual work of selling itself. Declarative knowledge is more akin to facts and figures – it can include data in databases and the systems to analyze and manage such data (Youndt and Snell, 2004), as well as “significant and meaningful concepts, categories, and definitions” (Zack, 1999:49).

I used items for this construct that are derived from the various forms of declarative knowledge listed by and used in this prior scholarship. Domain-specific declarative capital (Glynn, 1996) is simple, given the narrow sample, and was covered by focusing on research and analytical tools available for the workers’ use. The broader,
more general questions supplement these industry-specific items. The items are listed in the Appendix and the items used in the hypothesis testing are noted in the Results section.

Lastly, it should be noted that while numerous scholars have made the distinction between procedural and declarative knowledge and many have successfully measured them, they are both explicit, or codified knowledge. The ability of the model to delineate between these two is important, obviously, and was assisted by several aspects of the study. First, the study was thorough in combining industry-specific and general items based on previous scholarship. The industry-specific nature of this study also helped. The sample both limits the domain of knowledge and allows for detailed, relevant items to be included in the survey items. A part of this work also involved a careful review of these items with industry experts, in order to determine the face validity, and a thorough CFA was run. As is discussed below, the CFA offered strong support for declarative and procedural organizational capital being two distinct constructs.

4.2.5 Social Capital

Social capital is defined as the extent of the relationships that exist internally (within and amongst workers) and externally (with suppliers, customers, and external stakeholders). The construct comes from the work of Bourdieu (1985) and Coleman (1988) who sought to describe and measure the value of various relationships. Some researchers have operationalized social capital as one variable that encompasses all internal and external relationships (e.g., Youndt, Subramaniam and Snell, 2004) by having specific items that refer to both types, and by listing customers, suppliers, and alliance partners. Other researchers have split the construct into two segments, internal
and external, or have singled out customer relationships as customer capital (e.g., Stewart, 1997; Bontis, 1998; Reed, Lubatkin, and Srinivasan, 2006). Items in previously used scales capture the depth of relationships by using terms such as “collaborate,” “interact,” “share”, etc.

For this project the research question primarily involves the use of internal knowledge, but knowledge can be developed based on connections with outside actors as well. Therefore, I used the both the internally and externally focused items from Youndt and Snell (2004) and Reed, Lubatkin, and Srinivasan (2006). To address the specific application in KIFs I added items that asked respondents about relationships between junior and senior personnel, consistent with other KIF literature on human capital (e.g., Greenwood and Empson, 2003; Hitt, et al, 2006). The items for this construct are listed in the Appendix, and the items that, after the CFA, were used in the hypothesis testing, are delineated in the Results section.

4.2.6 Organizational Performance

To measure performance of the business units I use multiple measures, as scholars have called for (Chakravarthy, 1986). First, I used publicly available data for the financial institutions’ trading income. Banks report currency trading income and other forms of trading income, from which a close approximation of derivatives trading income can be derived. The non-banks typically report this income as well. These data are available from annual reports and banking regulators. In the U.S., for example, these data are collected by the Federal Reserve in conjunction with the FDIC. This measure is
a “top-line” measure, consisting of the revenue from trading activities prior to expenses being allocated.

Second, the market share data from the consulting firm was used as a measure of performance. This measures the market share of a given business unit relative to its sector, where the sector is based on the geography and type of end client. For example, a firm might have 7% market share among corporate foreign exchange clients in Europe. There are two reasons for using market share. First, market share is an important statistic for these businesses - it is often an element on which top managers are rated. Market share rankings are circulated by the consulting firm to the top managers of financial institutions; additionally, industry press sources (such as Euromoney Magazine) publish market share rankings in closely watched annual surveys.

The second reason to use market share is that in this industry it is considered to lead to, and be a proxy for, profits. In many businesses market share and profitability would represent very different outcomes for very different strategic objectives. A firm might aim for high market share by cutting prices, for example, foregoing profits. However, in this industry, firms expect that customer business volumes contribute directly to profits, and therefore market share should lead to profits. Sales personnel in a number of firms, for example, are given sales credits whereby transaction volumes with clients are used to calculate “economic value” and other internal measures. In effect, then, market share directly creates measurable value for these desks. It also represents a top-line measure of performance, consistent with other studies of knowledge-intensive firms (e.g., Hitt, et al, 2001). Thus, the use of a market share measure should not be inconsistent with the performance hypotheses in the project.
The third measure of performance was self-reported. Recipients were asked to report their profits per employee. This is a commonly used metric in these businesses that is used to measure the success of individuals, teams, and entire business units. This metric is technically a revenue or “top-line” measure. However, there is also an element of “bottom-line” results in it too, as the primary variable cost in this business is personnel, and this profit per employee metric is monitored closely by business unit managers. When profit per employee falls to an unacceptable level, for example, firms typically cut costs by laying off workers. This would be a key metric in the goals and rewards of the managers who were surveyed in the project that offers them the ability to attempt to impact both revenues and expenses, and as such also constitutes a “bottom-line” performance measure.

Using this measure of performance, of course, subjects the results to concerns of common-method bias. However, this particular measure is very specifically and broadly known in these businesses. Unlike the independent variables, it is not a qualitative measure, but a very specific quantitative measure, which should help to ameliorate these concerns.

In using these three sets of data, the project has performance data that is publicly reported, sourced from customers, and internally reported, which gives a strong, effective representation of organizational performance.

4.2.7 Control Variables

Consistent with most strategic management studies I control for firm size, as it can influence performance and a variety of other factors (Baum, 2003). The specific
variables used will be the number of employees in the business unit and the logarithm of the firm’s overall assets, (e.g., Zahra, Ireland, and Hitt, 2000; Shrader, 2001; Baum, 2003).
CHAPTER 5
METHODOLOGY

5.1 Face Validity

In order to determine face validity, I first sent an initial copy of the survey to 6 individuals, one of whom answered the questions relative to two organizations. These individuals were predominantly former (i.e., retired) managers of the types of organizations that were sampled in the survey. The survey was sent with general descriptors for each variable and the items grouped under each of those variables. The survey and the general ideas of the study were discussed with each respondent after they had filled it out.

After these individuals had looked at the survey I sent it to be reviewed by the consulting firm that was helping with the sample. A senior consultant there with many years of experience reviewed the items, also after a discussion with me about what the project was trying to measure and understand.

This work elicited several useful comments and it drove a few small changes to items in the proposed survey. First and foremost, the respondents generally felt that the research question was interesting and that the items would be useful measures. The overall constructs, too, were readily understood by respondents. They felt that most of the items were clear and understandable.

One interesting point that was raised in this pre-survey was that I had an item in the procedural organizational capital scale that was akin to looking at organizational culture. (It was the item that discussed “ways of working”). One respondent noted that
he wasn’t quite sure what that was asking. Culture can be a part of organizational capital (Marr and Schiuma, 2004), but it’s not really a part of processes and procedures, which is how I have defined procedural organizational capital. I left the item in, and then added other items that directly try to measure the strength of the culture in the organization. They can be assessed for fit with the procedural organizational capital construct or act as a control. Either way, the items added some depth and clarity to the organizational capital idea.

5.2 Confirmatory Factor Analysis – Measurement Model

Confirmatory Factor Analysis is the process by which the validity of the constructs was examined. In order to test the validity of the constructs for this study I employed Structural Equation Modeling (SEM) using the software package AMOS. SEM is an appropriate and broadly used approach because it allows for the testing of individual relationships between variables as well as the effectiveness of the overall measurement model (Kline, 2005; Hair, et al, 2010). SEM offers advantages over traditional validity tests that largely use alpha measures of reliability (Shook, et al, 2004), though I also calculated traditional alpha reliability measures in addition to the others.

There are several pieces of a CFA process when using SEM (which gives it its effectiveness). First, the overall fit of the measurement model is assessed. This primarily assesses convergent validity. SEM tests fit by testing the relationships in the researcher’s model and comparing them to the actual data using covariance matrices. The CFA in this project used several different fit statistics, as different fit statistics test different aspects of a model but no single indicator addresses the overall quality of fit (Kline, 2005). The
appropriateness of various fit statistics is established by rules of thumb (Shook, et al, 2004), so I used generally accepted values to examine the measurement model. To assess the fit of the measurement model I measured and report a normed Chi-square fit statistic, a Comparative Fit Indicator (CFI), and the Root Mean Square Error of Approximation (RMSEA). These three measures each examine different aspect of the fit.

In performing the CFA, a number of items needed to be removed in order to attain appropriate fit and validity. These were removed one at a time, based largely on suggested improvements that came from the AMOS program itself. A wide variety of different sets of measures were tried, and the combination that I ultimately used offered the best fit that I could find, while retaining as many items as possible.

The survey items are listed in the Appendix. The items that I ended up using were as follows: customer interaction uncertainty: 1, 2, 3, and 6; procedural organizational capital: 1, 5, and 6; declarative organizational capital: 2, 3, and 5; human capital: 1, 2, 4, and 8; and social capital: 3, 4, 5, and 7.

Chi-square fit statistics in SEM indicate a “badness of fit.” With large sample sizes this test almost always shows a statistically significant “bad” fit (Hair, et al, 2010). Thus, standard practice is to correct them for the degrees of freedom in the measurement model by dividing the Chi-square statistic by the degrees of freedom. This gives the measurement model a “normed Chi-square.” This value should be below three (Bentler and Bonnet, 1980), and ideally below two, in order to indicate a good fit for the model (Klein, 2005). The data for this project that was used for testing the hypotheses had a normed Chi-square value of 1.84. This indicates a good fit for the measurement model.
The CFI test compares the measurement model against a baseline model, such that a CFI value that is greater than 0.9 indicates a good fit (Hair, et al, 2010). The data for this project had a CFI value of 0.909, which also indicated a good fit.

The RMSEA indicator corrects for model complexity and takes into account sample size. The rule of thumb is to have an RMSEA < 0.10 as an indication of a reasonable fit (Hair, et al, 2010). AMOS produces a confidence level for the RMSEA value, as it can only be approximated. For this project’s data and measurement model the estimated RMSEA was 0.094, with a 90% confidence interval of 0.076 to 0.11. While one would prefer to see the entire range of the confidence interval below 0.10, these values indicate a reasonable fit.

In summary, these various fit measures (with the exception of the upper bound of the RMSEA confidence interval) indicate an acceptable or good fit. Since no one can accurately determine the fit of the measurement model, and the various benchmarks are rules of thumb (Klein, 2005), this fit analysis indicates that the measurement model can be used for the analysis of hypotheses.

If the fit statistics indicate that the items are measuring the constructs that they are supposed to be measuring, the next part of the CFA testing process involves looking at the individual paths between the construct and the associated items to check for statistical significance. SEM does this with t-tests for the individual paths. Each and every item must load onto its correct factor with a statistically significant t-test. For these data and this model, this was the case: every item loaded significantly onto the factor it was designed to measure (p<0.05).
The last test for convergent validity that was performed was to check to see if each item’s standardized regression coefficient (regressed against their assumed factor) was greater than 0.5. For this data and measurement model all such coefficients were above 0.5 and all but two were greater than 0.7. Combined, these tests indicate strong convergent validity for the constructs in the model (Hair, et al, 2010).

Discriminant validity is tested in order to determine how effectively the items are loading onto variables that are unique and distinct. It is important to ensure that the model doesn’t actually measure one variable while thinking that it actually measures more than one. To test for this, one utilizes the SEM data on variance. The Average Variance Extracted (AVE) is calculated for each of the constructs. The rule of thumb is for each AVE to be above 0.5, meaning that half of the variance of the construct should be explained by the measurement model (Hair, et al, 2010). The AVE is essentially an \( R^2 \) value for each construct that tells how much of the variance in the construct is explained by the items in the measurement model. Further, the AVE for each construct should be higher than the squared inter-construct correlation estimates (SIC) for each correlation relating to that construct. This test examines whether more variance is being explained by the model than is seen in the constructs’ correlations (Hair, et al, 2010). If discriminant validity is poor (i.e., multiple variables are measuring the same underlying construct), these tests will show AVE values that are low and/or lower than their associated SIC values.

These discriminant validity tests were performed on the data and measurement model for this project. In terms of the AVE, for this measurement model all AVE values were above 0.5 and all but one were greater than their associated SIC values. (In one
case there was an AVE = 0.757 with an associated SIC = 0.734). These two tests therefore indicate good discriminant validity for the sample and model.

Lastly, reliabilities for the five constructs in the model were calculated. The alpha values for each of these were all above the rule of thumb value of 0.8 (Youndt and Snell, 2004), indicating strong reliability of the constructs being measured.

In summary, the measurement model testing indicates that the items in the dataset do in fact measure the constructs that they are designed to measure.

5.3 Hypothesis Testing

In order to test the hypotheses this project used regression analysis, either as standard linear regression (utilizing SPSS) or as Hierarchical Linear Modeling (HLM, using the “HLM” software package). The dependent variable, performance, was measured both at the business unit level and at the financial institution level. The independent variables were all at the business unit level. There were controls at both the business unit-level and at the financial institution level. Standard ordinary least squares regression was used where all variables were at the business unit-level (the majority of the hypothesis tests.)

Where the financial institution level performance measure was used, the analysis required the use of Hierarchical Linear Modeling (HLM) for hypothesis testing. HLM utilizes regression analysis, but is able to analyze the data at multiple levels of analysis (Raudenbush and Bryk, 2002). For this study, that means that it is possible to analyze the data in a way that allows for looking through the business unit up to the financial institution. Since the sample includes multiple business units from some of the financial
institutions, this is important in order to effectively analyze data with the \( n \) at the financial institution level. In the multi-level testing, therefore, the independent variables were at Level 1, and the performance (trading income) and financial institution level control variables were at Level 2. I used group-mean centering of the independent variables, as the research questions HLM was used for needed to examine the impact of the independent variables on performance within the financial institutions (Raudenbush and Bryk, 2002). As noted, these firms have different strategies and deploy different resources across business units. The HLM analysis is able to look at this in aggregate for each of the 38 financial institutions, by examining the relationships across the variables within the 94 business units and properly applying them to each of the financial institutions.

To test the hypotheses where all data were at the business unit level, I used SPSS (PASW version 17). In order to help to avoid multicollinearity, both in general and in testing for interactions, the five constructs that measured the independent variables were centered, along with their interaction terms. Descriptive statistics are listed for the variables in Table 1.

In spite of this centering, the descriptive statistics show high correlations between the independent variables, indicating problems with multicollinearity. These high correlations are consistent with other empirical data testing for intellectual capital in a single (financial) industry sample (Reed, Lubatkin, and Srinivasan, 2005), but multicollinearity is nonetheless problematic. Its direct statistical impact is upon the standard errors of the regression estimates, which it tends to increase.
There are two primary concerns for data analysis when multicollinearity is present. The first is an increased likelihood of Type II errors (Aiken and West, 1991). This would lead to falsely concluding that no relationship existed between independent and dependent variables. In the case of this study, there were several such relationships that did not appear to be significant, and multicollinearity may have contributed. This is discussed further, below, in the Results section. The second problem stemming from multicollinearity is that the regression coefficients themselves can be inaccurate (Aiken and West, 1991). This is not a major concern in this project, as we are not trying to accurately predict the dependent variable, but simply to test for significant relationships.

For the hypotheses that related the independent variables, but not performance, the size of the business unit was controlled for. Hypothesis 1 suggested that customer interaction uncertainty (CIU) would be negatively associated with procedural organizational capital (POC). Though the coefficient was in the direction hypothesized, this hypothesis was not supported \((b = -0.211, p=0.14)\). Results for the statistical tests among the intellectual capital variables and the strategy variables (Hypotheses 1, 2, 3, and 6) are listed in Table 2.

Interestingly, procedural organizational capital was negatively associated with declarative organizational capital (DOC). While I did not suggest a hypothesis for this relationship it does tell us something useful. In addition to the divergent validity tests noted earlier, this clearly supports the notion advanced in this dissertation that organizational capital is not a unitary construct, but consists of at least two pieces: declarative and procedural.
Hypothesis 2 suggests that CIU will be positively associated with DOC. This hypothesis was supported (b=0.228, p < 0.05). Additionally, CIU was found to be positively associated with Human Capital (b=.567, p < 0.01), suggesting that firms that have made a strategic decision to allow a high level of customer interaction uncertainty are also developing high levels of HC and DOC.

Hypothesis 3 suggests that POC will be negatively associated with human capital (HC). This hypothesis was not supported.

Hypothesis 6 suggests that POC will be negatively associated with social capital (SC). This hypothesis was not supported (p > 0.05). Though not hypothesized, human capital was found to be positively associated with Social Capital (SC) (b=.417, p<.01).

The models for each of these tests (i.e., with the different dependent variables noted) were statistically significant (p < 0.05) as well. Results of these tests are listed in Table 2.

In summary, the empirical relationships among the independent variables were clearly not all as hypothesized. However, there are clear links between the strategic variable in the study, CIU, and some of the resource (intellectual capital) variables, namely HC and DOC. Further, as discussed previously, the finding that DOC and POC are negatively related is a noteworthy result, given that the literature has previously viewed those as one variable.

The model hypothesized three different interactions relative to performance. Hypothesis 4 suggested that procedural organizational capital and human capital interact, Hypothesis 5 suggested that declarative organizational capital and HC interact, and Hypothesis 7 suggested that social capital and HC interact, all to impact performance.
Empirically the study had three measures of performance. The first measure was profit per employee (e.g., Hitt, et al, 2001). This measure of performance was reported by the survey respondents. The second performance measure was market share, which was measured by the consulting firm’s data. These data are market share within the specific client sector, such as foreign exchange services being provided to corporations, financial institutions, etc. (Each survey respondent was asked to classify his/her business unit on this basis in order to match-up the survey to this performance measure.) Each of these first two performance measures was at the business unit level.

The third performance measure was a financial institution level measure: income in the product area (e.g., foreign exchange). This was an archival measure. The sources for these performance data were bank regulatory databases (the Federal Reserve, for U.S. banks) and annual reports. Additionally, the financial institution asset data, used as a control for the performance hypothesis tests, were gleaned from regulatory databases and annual reports. Thus, each of these hypothesis tests (H4, H5, and H7) was performed three times, one for each of the different performance measures.

To test the hypotheses using the business unit-level performance data, SPSS was used, employing a two-step regression analysis. First, the control variables and main effects were regressed onto the performance measure. Next, the interaction term was added. The significance of the interaction terms was tested, but also the significance of each step was tested to determine whether or not each set of variables that was added had a significant impact on the $R^2$ of the overall model (Aiken and West, 1991).

For Hypothesis 4 - the interaction of POC and HC - the test using profit per employee (RPH) data was marginally significant ($b=-0.099$, $p<0.10$). The two steps of
the model both brought significant improvements in the model’s $R^2$. The data from the statistical test is listed in Table 3 and the interaction is graphed and is shown in Figure 2a. The graph shows that the performance generating ability of procedural organizational capital depends on the level of human capital. Where human capital levels are high, increasing POC detracts from performance, but where human capital is low, adding POC improves performance. This is consistent with the idea that human capital and procedural organizational capital function more or less as substitutes that can get in the way of each other. For the test using market share as performance, the interaction term was not significant.

The third test, using HLM as the analytical tool, showed the interaction to have a statistically significant impact on performance, measured as product-level income ($b=-0.192$, $p < 0.01$). The results of the HLM output are shown in Table 4 and the graph of the interaction is shown in Figure 2b. Figure 2b illustrates that when the performance variable is trading income, the interaction shows that procedural organizational capital improves performance dramatically in the low human capital organizations, while it has only a marginal positive effect in high human capital firms. The two figures illustrate somewhat different relationships: Figure 2a shows an ordinal interaction (i.e., one slope is positive and one is negative), but Figure 2b does not. In Figure 2b both slopes (i.e., for high and low levels of human capital) are positive. The high human capital line in Figure 2b has a significantly lower slope, though – it is almost flat, indicating little performance gains from POC accruing to high human capital organizations. While this is somewhat different from the result seen using profit per employee as a performance measure, it is nonetheless broadly consistent with the notion of POC and HC working to improve
performance independently, as alternative methods for coping with customer interaction uncertainty.

Scholars have noted that interpreting interactions in HLM is not a simple or straightforward process (Zhang, Zyphur, and Preacher, 2011). Thus, one must take care in interpreting any of the results of the three interaction tests that use HLM to assess the financial institution-level performance measure. Additionally, there are some aspects of the HLM results that are somewhat counter to existing theory on intellectual capital and firm performance. For example, all three interaction tests in HLM show some implied evidence (non-statistical) of a negative relationship between human capital and performance. There is no significant main effect of human capital on performance in these tests, but the sign of the coefficient is negative. I address this issue more fully in the Discussion section, as well as an aspect of the sample that I think may contribute to this, based on my review of the data. The interaction graphs for the HLM tests are presented, but this cautionary note must be added for each of the three interaction hypothesis tests using HLM. In summary, then, these tests provide support for Hypothesis 4, which argued that POC and HC would interact to impact organizational performance.

Hypothesis 5 suggested that human capital and declarative organizational capital would interact to improve performance. This hypothesis was not supported for the performance measures at the business unit level (profit per employee or market share). However, with performance measured as trading income (i.e., by financial institution), the HLM results did show a statistically significant interaction (b=−.40, p<.01). The results of the HLM analysis are shown in Table 4 and the graph of the interaction is
shown in Figure 3. The graph shows that declarative organizational capital improves performance when paired with low levels of human capital, but not when it is paired with high levels. This is not as I had hypothesized – I had suggested that declarative organizational capital would leverage human capital, such that organizations with high levels of human capital and high levels of DOC would outperform those with low levels of either. Though this interpretation is subject to the caveats with regard to HLM interpretation noted above, I cannot say that Hypothesis 5 is fully supported, even though there is a statistically significant interaction when measuring performance as financial institution-level trading income.

Lastly, Hypothesis 7, which suggested the HC and SC interact to improve performance, was not supported using the performance measure of profit per employee. There was marginal support for this hypothesis using the market share performance measure (p<0.10). The results of the regression tests are shown in Table 5.

The test of the HC and SC interaction for financial institution-level trading income (using HLM) also showed a statistically significant relationship (p<.01). The results of the statistical tests are shown in Table 4 and the interaction relationship itself for this performance measure is illustrated in Figure 4. In this case, the graph shows that social capital harms performance when human capital is low, but has a modestly positive sloping line (indicating a modest positive contribution to performance) when human capital is at a high level. Taken at face value, this indicates support for Hypothesis 7. However, there are two aspects to this graph that give us pause. First, as noted, HLM interpretations of interactions must be made cautiously, but second, the graph shows lower performance at higher levels of human capital. This is not a relationship that was
suggested or hypothesized, and it is not consistent with other empirical work in intellectual capital (e.g., Youndt and Snell, 2004). Due to the interpretation of the graphs, I will only assert that there is mild support for Hypothesis 7.
CHAPTER 6
DISCUSSION

This project has explored the management of knowledge in KIFs in order to better understand how these firms develop and deploy their knowledge resources in order to improve performance. The first research question was interested in delving deeper into these firms than existing scholarship, which has largely focused only on how such firms utilize human capital – I wanted to understand how these firms use organizational capital, in the form or both procedure and declarative knowledge, as well as social capital. The second key research question was to understand how a critical strategic variable for service firms, customer interaction uncertainty, impacts the deployment and usage of knowledge resources in KIFs, as well as how these impact the ultimate goal: improved performance. In so doing the aim has been to substantially expand our understanding of how strategy and resources function to drive performance in these important firms.

The empirical data offered limited support for the hypotheses in the paper, but what support there was, combined with other statistically significant relationships, paint an interesting picture of how KIFs manage strategy and intellectual capital resources. I believe that it can add substantially to the extant literatures on knowledge management, intellectual capital and the strategic management of knowledge-intensive firms.

6.1 Relationship Between Strategy and Intellectual Capital

I have presented a model that seeks to look at strategy, in the form of customer interaction uncertainty strategy, resources, and performance in KIFs. The resources, of
course, are intellectual capital resources: human capital, social capital, and what I have argued are the two (not one) forms of organizational capital, procedural and declarative. Classic strategy literature has argued that firms must have the correct fit between their strategy and their resources in order to perform well (Zott and Amit, 2008), and much empirical work has examined and found support for such relationships (e.g., Youndt, Snell, and Dean, 1996; Hitt, et al, 2001; Skaggs and Huffman, 2003).

I have argued that high levels of customer interaction uncertainty will be associated with lower levels of procedural organizational capital, but the relationship was not found to be statistically significant. There are several reasons why this could be the case. One is power. The regression test showed a negatively signed regression coefficient with a p value of .146. Nonetheless, this is not a satisfying explanation simply because so many of the other relationships between the intellectual capital variables (and customer interaction uncertainty) were significant. There are also high correlations between the other intellectual capital variables and customer interaction uncertainty, but not so with procedural organizational capital. Of course, this points to the multicollinearity that was found in the results, which could also explain the lack of a significant result. Multicollinearity inflates the standard errors of the regression coefficients, even to the point where their confidence intervals can include zero. Thus, findings are susceptible to Type II error, wherein a hypothesis such as this is not supported. This particular relationship, with its p value that is somewhat low, is therefore likely to have suffered from multicollinearity.

I also suspect that part of the reason why a significant relationship was not found between POC and CIU is the nature of the sample. This may have come from three
areas. First, in the face validity testing I received comments from industry participants that pointed out the importance of compliance processes to this industry. In order to deal with this, I specifically noted that the questions were aside from compliance related issues or mandates. Nonetheless, there is clear social bias in favor of having strong processes and procedures, especially now, at a time when the financial services industry has come under fire for the recent financial crisis. Few respondents may have been willing to admit that their organization’s processes and procedures were less stringent than they might like to think. POC had the highest mean of all the independent variables measured on a seven-point scale, which, though not a statistical test, could be indicative of this problem.

The second aspect of the sample that may have been problematic for measuring POC is the fact that it is something that is taken for granted in these firms. Human capital is more easily noted for survey respondents, especially since the survey asked about relative pay, which is clearly understood and readily examined. Similarly, research and analytical tools (i.e., declarative organizational capital) are examined and valued externally, so organizations have clear and consistent feedback on those types of intellectual capital resources. This is less so for POC and Social Capital, and it may have meant that evaluation of POC was simply more difficult for survey respondents.

The third aspect of the sample that may have been troublesome for the POC variable is that there may simply not be large amounts of variance within these firms. POC had the lowest standard deviation of all of the independent variables. As with the means noted above, this is not a statistically tested relationship, but it may be illustrative.
These issues could have acted in concert or individually to limit the study’s ability to effectively test the hypothesized relationship. They extend to the other tests that involved procedural organizational capital, of course, some of which were also not statistically supported.

Aside from the hypothesized relationship between customer interaction uncertainty and procedural organizational capital, the statistical testing showed empirical evidence of other relationships between CIU (strategy) and intellectual capital resources that are worth noting and discussing.

Regressing the intellectual capital variables onto CIU (while controlling for business unit size) produces statistically significant relationships between human capital (b=0.567, p< .01) and declarative organizational capital (b=.228, p< .05). The CIU relationship to social capital, like POC, was not statistically significant. (As with POC, this lack of significance in the model may stem from the multicollinearity.) However, social capital and CIU do a have statistically significant bilateral correlation. This argues that there is a set of intellectual capital variables that could be described as “high customer interaction uncertainty” intellectual capital variables. At least in the case of this sample of firms, where a business elects to allow high levels of interaction uncertainty with their customers, they are likely to also have high levels of human, social, and declarative organizational capital.

This makes for a useful and interesting finding, especially with regard to human capital, which has commanded so much of the attention in the knowledge-intensive firm literature. While other scholars have found that human capital is not universally valuable (e.g., Hitt, et al, 2001), there has been little attempt to explain why, where, or how
knowledge-intensive firms would choose to invest in low or high levels of human capital (nor any other intellectual capital variable, for that matter). Skaggs and Youndt (2004) showed that service firms in general use human capital in order successfully employ a strategy of allowing for high levels of customer uncertainty, but scholars have yet to explore this relationship with regard to KIFs, where human capital is so critically important. This project’s findings shed light on that issue, which was a key research question: knowledge-intensive firms will use high levels of human capital when the level of customer interaction uncertainty they allow into their service process dictates that they need to do so. This finding is also consistent with the application of Galbraith’s (1974) view of knowledge and uncertainty – that processes can accommodate and cope with some levels of uncertainty but the highest levels of uncertainty require human-based knowledge. In the parlance of everyday life (or the world of practitioners), for the tough problems, one must call in an expert. This is clearly what firms in the sample are doing.

Further, firms are bringing in social capital and declarative organizational capital to work with their human capital resources in order to accommodate these high levels of uncertainty. (As noted, this is also seen in the marginally significant interaction between social and human capital with regard to performance). I have suggested that social capital and declarative organizational capital complement human capital, and it appears that KIFs are using them in such a way when customer interaction uncertainty dictates that they will be needed.

In summary, one can see a clear application of Galbraith’s (1974) principle at work, wherein high uncertainty is being met with investments in human capital and
associated intellectual capital assets. One can also see a bundle of high customer interaction uncertainty resources that appear to be in use.

### 6.2 Relationships Among Intellectual Capital Variables

As has been discussed, the data from the study illustrated several significant relationships between the intellectual capital variables. However, the study hypothesized three. The first was a negative association between human capital and procedural organizational capital, which was not supported in the statistical testing of the sample.

The lack of a hypothesized relationship could stem from the issues with regard to measuring procedural organizational capital as discussed previously in Section 6.1: multicollinearity, low power, social bias, a poor sense for POC among respondents, or a simple lack of variance. However, I would like to postulate and discuss a different alternative, which is that human capital and procedural organizational capital do not function as substitutes for coping with uncertainty, but rather function as complements to each other. In part, I suggest this because it is hinted at (but no more) by the positive regression coefficient when regressing human capital onto POC (the p value = 0.222). I also suggest it because it is worth discussing as a serious alternative to the way I have presented knowledge management as a choice between the use of human-resident knowledge and process knowledge in order to resolve uncertainty. It’s quite possible that this dichotomous distinction, as a tradeoff or binary choice, was made too strongly.

The best way to consider this conceptually is that firms are capable of making the best of both worlds. Perhaps firms are able to use procedural organizational capital to automate, so to speak, the types of tasks that can be proceduralized without harming
customer service, while at the same time managing other segments of their service provision using human workers. This would constitute a substantial management skill: knowing where to find and exploit efficiencies by applying processes and procedures and where to invest in human capital resources. Put another way, this would mean using complex processes where doing so is appropriate and using divergent processes where necessary (e.g., Shostack, 1987). In fact, Shostack argued that business processes could contain both types of processes. High performing firms may be those that perform this balancing act skillfully and effectively, while low performing firms may struggle to do this. I will discuss this more below.

Setting aside for the moment performance and returning to the idea that HC and POC are complements, in financial institutions with trading businesses this is quite conceivable. Firms make a substantial distinction between front and back office activities. While in the survey I made a clear notation that this was a survey of front office activities, this clear organizational distinction between front and back office is nonetheless illustrative of these firms’ ability to differentiate and segment client-related activities between processes and workers. It is clearly something that they have had to work on, and it may be that they are doing this even within the scope of the front-office business units that were surveyed.

Therefore, it’s possible that the lack of a negative relationship between human capital and procedural organizational capital is because they are not a tradeoff or an either/or proposition, but rather because they work together to complement each other, at least in this context. This doesn’t mean that they cannot act as substitutes, of course. For a given activity it would make no sense to have a highly skilled worker performing a
highly routinized job or task – it would be inefficient and ultimately counter-productive. Even so, within a specific business unit there may be a place for both types of intellectual capital; human capital and highly skilled workers can enact a portion of the work while another portion of the work necessary could be done within the confines and requirements of processes and procedures.

This idea can be extended further to include the strategic variable in the study by conceptualizing a continuum of customer interaction uncertainty that must be contended with. In its most simple form, there could be three stages. First, there may be an amount of customer interaction uncertainty that can be accommodated with the use of processes and procedures. As noted, my research also involved conversations with participants that noted the importance of increasing use of technology. Many firms now exist that simply trade only in an automated fashion, and some of these are quite profitable, even with limited human capital resources. This type of financial institution can suit some clients, but leaves a class of clients that are not able to be satisfied with “e-trading.” Similarly, there are limits to what process and procedurally-driven services can do to accommodate customer interaction uncertainty.

The second piece of this conceptual continuum would be where uncertainty is higher and therefore requires human capital as well. Here firms could usefully and successfully employ both procedural organizational capital and human capital in order to accommodate customer interaction uncertainty. Lastly, there may be a level of customer interaction uncertainty whereby only human capital can be employed, or human capital with only modest use of procedures and processes. If this is the case, it may be that the
bulk of the firms surveyed in this sample lie in the center of this continuum, and thus productively use both forms of intellectual capital.

Returning to discussion of the hypotheses, the study also hypothesized that procedural organizational capital would be negatively associated with social capital. This relationship was also not found to be statistically significant. Naturally, the prior discussion with regard to human capital and POC can also relate closely to social capital, as social capital complements human capital. Therefore, it is logical to assume that it may have a relationship to POC as discussed for human capital, wherein it is being used within a business unit even though procedures and processes are being used as well.

Another reason that this relationship may not have been supported by the empirical analysis is that over time firms become more familiar with their clients, thus increasing the level of social capital, while reducing customer interaction uncertainty. As the firm is less uncertain about their clients’ interactions, they may be able to routinize their work, i.e., increase their procedural organizational capital. Put another way, firms with lots of repeat customers and little new business might be likely to show a positive relationship between POC and social capital, while firms that constantly added new clients and rarely performed similar work for a given existing client would exhibit a negative relationship between the two. Perhaps client turnover moderates this relationship.

Lastly, I hypothesized that procedural organizational capital would be negatively related to declarative organizational capital, for essentially similar reasons to those for hypotheses two and six (human capital and social capital). This relationship, though, was
supported by the empirical results. These firms, therefore, are using less written research, analytical tools, and data when they use higher levels of processes and procedures.

This poses something of a conundrum if one tries to triangulate the relationships between the intellectual capital variables and customer interaction uncertainty. One would like to understand why we see a negative relationship between POC and DOC, but not the other hypothesized relationships, while there are strong positive associations between HC, DOC, SC, and CIU. It is possibly a statistical artifact or it could be due to the nature of declarative organizational capital. While human and social capital are clearly both all about people, we’ve suggested that declarative organizational capital supports the work of human capital but it is clearly not a human/social resource – it’s a form of organizational capital that is hard-coded knowledge. Thus, it is akin to procedural organizational capital but works towards a different purpose – in service of human capital. Seen in this way it is not as surprising that DOC would end up with a different statistical relationship than any of the other intellectual capital variables. Another aspect of DOC specific to this study will be discussed below in the discussion of Hypothesis 6: the interaction of HC and DOC in support of performance.

6.3 Hypotheses Related to Performance

I have hypothesized that three pairs of intellectual capital variables will each interact to impact performance. The first relationship is an interaction between human capital and procedural organizational capital. The statistical tests found some support for this relationship. The results as discussed previously suggest that the performance impact of procedural organizational capital is contingent on the level of human capital. Where
human capital is low, procedural organizational capital improves performance, but where human capital levels are high, POC detracts from performance. While interaction interpretations are not straightforward and should be done cautiously, this would appear to lend support to the idea that procedural organizational capital and human capital are substitutes, as opposed to complements. I argued in the theory and hypothesis development section of this paper that these could function as substitutes or complements and noted that procedural organizational capital and human capital may be complements in the previous section of the Discussion (due to indications from the relationships between the intellectual capital variables themselves). The interaction results are more consistent with the idea that they substitute for each other: either form of knowledge can be used to counter uncertainty.

The results of this hypothesis do argue that firms shouldn’t simply invest in and deploy as much intellectual capital as possible, whatever the form. Too much procedural organizational capital and human capital in the same place can decrease performance. This could happen due to conflict and confusion as to how work should be completed, in addition to frustration on behalf of either those tasked with policing the procedures or those tasked with bringing their personal knowledge and experience to bear on customers’ issues. It would also be simply inefficient to use high levels of human capital in tasks that are highly procedural or highly routinized. This is an important finding for the study: more is not always better, even when it comes to knowledge resources.

Additionally, having very low levels of both human capital and POC might detract from performance. However, it needs to be considered whether this is a broad issue or an issue specific to this sample. There are indications that it is specific to this
sample: CIU is correlated to some of the performance measures. In this business, then, firms that are allowing greater levels of customer interaction uncertainty into their processes are reaping rewards when they can effectively deal with such uncertainty.

These types of considerations are hallmarks of the need for fit among strategy and resources. Empirically, this study has found support for an interaction of procedural organizational capital and human capital, which, at its most basic, tells scholars and practitioners that these resources must be balanced thoughtfully and carefully.

The second interaction hypothesis (Hypothesis 5) suggested that declarative organizational capital and human capital would interact to impact performance. This hypothesis was not supported as written, even though the empirical data supports the idea that they interact to impact trading income in these firms. The graph of the interaction (Figure 3) indicates that DOC only positively impacts the performance of firms using low levels of human capital, but not those firms with high levels of HC. It may be that firms with high levels of human capital use DOC in support of their work but not in such a way that it improves performance, whereas low human capital firms can really use the help that DOC can provide.

As noted, declarative organizational capital is something of a different resource, not being human-centric but also not being procedural in nature. This may account for its use and effectiveness not being as clear as it might be. Another reason for the results seen with this interaction could be that research and analytical tools are a hygiene factor in this industry: they are a necessary but not sufficient condition for performance. If most every firm has some research, etc., available to their clients (and they do), research (declarative organizational capital) may not function as an important business driver.
Anecdotally this is supported by comments I received in the face validity portion of the research from participants and the consultants. Individuals commented that research and analytical tools are simply not crucial components of these firms’ business.

Interestingly, several firms in the sample that focused more heavily on electronic trading appear to eschew the use of declarative organizational capital almost completely, seeing their role as being around transactional and technology services as opposed to market advice, which has traditionally been the realm of declarative organizational capital in this business.

In summary, the role of declarative organizational capital in generating performance gains isn’t clearly seen in these data. While it seems to “go along” with human capital, social capital, and customer interaction uncertainty, its impact on performance isn’t exactly as hypothesized.

The third and final hypothesis relating to performance suggested that human capital and social capital interact. This is based on the idea that human capital grows with sharing information and interaction amongst senior and junior colleagues, for example. It is also based on the idea that certain customer issues will be so challenging as to require very intelligent, experienced workers to collaborate and share their knowledge in order to find an appropriate solution for their clients. As knowledge-intensive service firms grow their human capital they would be expected to use social capital as a tool to do so, and one would expect such firms to use social capital to augment their human capital, in order to foster productive collaborative efforts.

This hypothesis received only mild empirical support, however, using two of the performance measures, market share and product revenue. First, the tests found a
marginally (p<0.10) significant relationship with regard to market share. Figure 4 illustrates the interaction stemming from the financial institution level data analysis, which was statistically significant. It is consistent with the theorized relationship: firms with low levels of human capital see their performance deteriorate with higher levels of social capital. Put simply, a firm that chooses not to invest heavily in their people doesn’t benefit when they spend a lot of time interacting.

Theory suggests that social capital can aid human capital in two broad ways. First, social capital can facilitate developing newer employees, training them, and providing them with close observation and hands-on learning. Many knowledge-intensive service firms use such techniques. Law firms, investment banks, and other firms pair junior staff with senior staff in long-term development programs. Figure 4 would suggest that the firms in this sample are doing the same thing. In such cases, the use of social capital is in place to help firms develop their human capital. Used in this manner social capital is something of a growth engine.

The second way in which social capital can aid performance is by engendering a process of idea sharing and internal knowledge transfer, even among senior staff. Here one would expect to see social capital aid performance even when human capital is high.

Thus, while there is evidence to support the use of social capital as a growth engine in these firms, the implication may just be that social and human capital work together. Human and social capital are strongly correlated in this sample, as they have been in other similar empirical studies (e.g., Reed, Lubatkin, and Srinivasan, 2006). The two variables clearly go together in these firms, but it may be that their joint use in high performing firms is the norm even though the two do not necessarily amplify each other.
Additionally, it may be that firms using a high customer interaction uncertainty strategy typically have both, such that their interaction to improve performance is modest, in spite of both being necessary.

Also, in testing the main effects on the market share measure of performance, only the customer interaction uncertainty has a significant relationship to performance ($b=1.85, p<0.01$), so it may be that the strategic variable is accounting for much of the performance in this case.

Exploring the nature of the performance variables further, I did not hypothesize any relationships between the strategic variable, customer interaction uncertainty, and performance. However, it is certainly worth examining what the data showed. The aforementioned relationship between market share and CIU points to the idea that the strategic approach to both customers and outcome measures may be at work in this dataset. As an issue to consider, then, it is interesting to examine this result, i.e., the outcome of the regression of CIU onto market share, in contrast to the results of the regression onto the profit measures. I didn’t hypothesize any differences, but some differences exist. With the profit per employee measure, customer interaction uncertainty has a marginally significant relationship to performance ($b=0.225, p<0.10$), whereas the relationship to market share, as noted above, is strongly significant. While market share for this industry is considered by participants to be broadly indicative of profits as well, it may be that a strategy of accepting and catering to higher levels of customer interaction uncertainty is more effective in capturing market share, while using such a strategy to generate profits requires more nuanced management, given the need to balance more
resources such as human and social capital. The data do not necessarily bear this out in a striking and statistically significant fashion, but there are signs of this.

Additionally, the use of electronic trading has likely impacted this relationship, as there are clients who only use electronic trading venues to access the market that are giving very high levels of market share to their suppliers (financial institutions), and the provision of electronic execution services by a financial institution may not require the same high levels of human and social capital. A qualitative review of the data indicates that this may play a role in the relationships seen in the HLM analysis, where human capital’s relationship to performance is ambiguous, and in some ways appears to be negative. I suspect that some of the firms that focus heavily on electronic trading are currently reaping quite substantial profits with limited investments in human capital. Electronic trading is, according to some respondents I spoke with, evolving rapidly and firms with an early start in this area are quite profitable. Further, their human capital is concentrated in a few key individuals that understand the technologies and how they impact the markets. Thus, it is possible that this phenomenon – the recent emergence of electronic trading – may lie behind some of the results seen in this study. In summary, the relationship between customer interaction uncertainty, intellectual capital, and different measures of performance may depend on the specific performance goals that a firm has selected for emphasis with regard to clients.

6.4 Summary

The study examined the relationship between customer interaction uncertainty, procedural organizational capital, declarative organizational capital, human capital, social
capital, and organizational performance, building on theories of the use of knowledge to
counter uncertainty. I found significance (or marginal significance) in several of the
hypotheses, but not in others. Nonetheless, the study makes contributions to three
different streams of literature.

By linking a strategic variable - customer interaction uncertainty - to the
deployment of resources and performance, the study has made several contributions.
First, it brings the knowledge management and knowledge-intensive firm literatures more
clearly into the strategy realm. Any discussion of strategy has been sorely lacking in
these literature streams. This is especially problematic for the KIF literature, given the
outsized role these firms now play in our economy. Yet, customer interaction uncertainty
is positively associated with declarative organizational capital and also with human
capital. This, combined with the relationship that was seen between human and social
capital, points out a clear relationship between critical intellectual capital resources and
the strategy with regard to customers that a KISF employs.

This is an especially useful finding given that the resources needed for successful
management of knowledge-intensive businesses do not necessarily fit the mold of
traditional strategies such as cost leader and differentiator. These strategic ideas stem
from research interests in largely industrial sectors (e.g., Porter, 1985), and the Strategic
Management literature has not been sufficiently updated to reflect more contemporary
firms and their resources. A discussion of economies of scale, for example, which would
be expected to be useful to cost leaders, could be more effectively replaced by a
discussion of how reduced customer interaction uncertainty and the deployment of
procedural organizational capital could enact a cost leader strategic orientation. I would
hope that this study, simply by raising the idea that the nature and purpose of these firms is to accommodate customer interaction uncertainty, and by showing CIU’s relationship to these resources, could open up the field to more productive arenas for study. There have been no “big ideas” in the knowledge management literature for ten or more years in spite of its relevance to practice, so it would seem to be a field in need of some new constructs that can help to explain key phenomena.

The second key contribution of the study is in its examination of the relationships within the intellectual capital variables themselves. First and foremost, I have suggested that organizational capital is best considered as two constructs, and not one: procedural and declarative organizational capital. Their makeup is consistent: they are both recorded, codified knowledge, and this has driven the theory behind the development of the constructs. Both are knowledge that is ‘owned’ by the firm. However, they perform very different roles within KIFs, and the data here indicate that they are negatively associated with each other. If nothing else, due to this negative empirical relationship, scholars need to be aware of this, as it may be confounding or confusing empirical work that focuses on organizational capital as a single variable.

This distinction is especially useful given the importance of procedures, processes, and routines in resolving uncertainty. Empirically I found some support for the central dichotomy of resolving uncertainty with either human capital or procedural organizational capital. This is a critical area of study, given the nature of how knowledge is used to counter uncertainty (Galbraith, 1974) and given the importance of routines in organizational work (Nelson and Winter, 1982). Illustrating the distinction between
procedural and declarative organizational capital thus should help us to substantially improve our understanding of how firms use the knowledge that they own and control.

A third contribution of the study lies in the nature of the relationships between the different intellectual capital variables and in the relationship they have to customer interaction uncertainty. The data show that human, social, and declarative organizational capital are being used together by firms in order to accommodate high levels of customer interaction uncertainty. This indicates that these particular intellectual capital resources are not exchangeable; that knowledge intensive firms are not picking and choosing one or two with no particular regard for which ones. Instead, firms are using the three forms of intellectual capital together as a group. As noted, this has been substantially facilitated by the study’s division of organizational capital into the two components, procedural and declarative. Conflating them into one construct would have obscured the relationship substantially and would have not painted an accurate picture of this basket of three intellectual capital resources.

This is an important finding that adds depth to the knowledge management literature. Scholars have suggested how different forms of knowledge work together to build knowledge (e.g., Nonaka, 1994), but this shows how firms are combining these forms of knowledge towards productive ends. Firms are bundling intellectual capital assets, one would assume, because they need to in order to accomplish their objectives successfully.

Further, this study suggests and illustrates that the objective that these firms have that drives them to bundle three forms of knowledge is to allow high levels of customer interaction uncertainty into their firm. Combining human, social, and declarative
organizational capital is a purposeful decision on the part of firms – it allows them to fulfill their strategic objectives with regard to customers. Again, given the dearth of study of strategy itself within knowledge intensive service firms, this is an important contribution.

Lastly, the study has shown that intellectual capital resources can be productively combined to improve organizational performance. Performance is improved with an appropriate balance between human capital and the use of processes and procedural knowledge. Firms cannot maximize performance by simply investing in and deploying the maximum amount of intellectual capital that they can get. Instead, managers of such organizations need to consider the entire set of intellectual capital resources and how they work in concert or in opposition. While human capital may work well with social capital, for example, human capital and procedural organizational capital do not go well together when it comes to generating performance.

In summary, the study has shown that more is not necessarily better when it comes to organizational knowledge. Firms must look to their strategy, in terms of their approach to customer interaction uncertainty, and integrate that with the entire range of available intellectual capital resources (including two forms of organizational capital) in order to prosper.

6.5 Implications for Practice

This study has important implications for managers of knowledge-intensive firms. First and foremost, they must recognize that their strategic approach to customer interaction uncertainty needs to drive their use of knowledge resources. Managers would
only want to incur the costs of such resources in order to enact services for customers. If they have a clear and coherent approach to customer interaction uncertainty, they need to ensure that they have the correct knowledge resources in order to perform the services required to deal with that uncertainty. Further, having the wrong resources (such as human capital when procedural organizational capital will suffice) will be either inefficient (and too expensive) or frustrating to workers. These problems could cause organizational performance to suffer.

Managers need to be aware, too, of the need to combine social and human capital. (Declarative organizational capital may not be as critical, but it is generally included with the other two as well.) Practitioners must recognize that simply adding more highly skilled, knowledgeable workers may not be an effective way to counter customer interaction uncertainty if such workers are not able to interact, allowing them to share ideas, solutions, and experiences with each other. The data in the study indicate that a series of relationships exist amongst the intellectual capital variables. For practicing managers, this may describe situations whereby human and social capital are combined because firms want their most knowledgeable, skilled employees to interact with each other to share and generate ideas.

Additionally, the growth of knowledge-intensive service firms that are built around using human capital may be contingent on sufficient social capital. The training and development of employees that is inherent in the interactions of even highly skilled workers are likely to be a critical factor in firms’ abilities to grow, if in fact they are attempting to allow high levels of customer interaction uncertainty into their service processes. This will come from sufficient levels of social capital.
This study can also inform practitioners as they seek to understand how to balance human capital with procedural organizational capital. By pointing out that these two forms of intellectual capital interact to impact performance, the study has illustrated an important nuance that managers should be aware of. While practitioners have likely understood that highly skilled workers can be frustrated by routines and the need to strictly adhere to processes, the findings of the study serve to bring added depth to this issue. Social capital may also enter into the equation in this regard. Just as firms are likely to want their most knowledgeable workers to interact, they may want less skilled workers to simply follow procedural guidelines without much interaction (i.e., with low levels of social capital). Further, the emphasis on the strategic approach to customers can offer managers guidance on where and when to use workers and where and when to rely on processes and procedures to enact services.

Lastly, practitioners may find that with regard to the deployment of human capital and procedural organizational capital they need to focus on the unit of analysis as they seek to balance these out. It may be that the appropriate unit of analysis for balancing these two is the task, as opposed to the organization, firm, or business unit. Managers may need to select tasks where procedural organizational capital can be deployed while still satisfying customers, while selecting other tasks where the only effective path to resolving customer issues is via human capital.

6.6 Implications for Research

As noted at the beginning of this chapter, the study makes a number of contributions to the academic literature. This research has shown the importance of
understanding contingencies in the development and use of knowledge assets. Too often
the field has operated under the assumption that knowledge is an unambiguously
beneficial resource for firms. This work adds to other important empirical scholarship on
the contingent value of knowledge (i.e., Hitt, et al, 2001) by showing that organizations
can in fact have too much of a good thing. The use of knowledge is contingent on
strategy and performance is contingent upon the appropriate use of the different forms of
intellectual capital concurrently with the commensurate strategy.

While the very existence of contingencies should impact scholarship on
knowledge management, the study has offered a clear sense of what those contingencies
might look like – they stem, at least in part, from the firm’s approach to customer
interaction uncertainty. This has added depth and complexity to our understanding of
how firms manage intellectual capital, and it should provide opportunities for additional
scholarship along the same lines. I would hope that it can contribute to the field in the
same ways that the discovery and exploration of other contingencies have had for other
topics of interest to scholars. The exploration of contingencies is the sign of a field
maturing, after constructs have been explored, measured, and tested as direct effects.

On a practical basis, the study raises several issues for organizational scholars.
First and foremost it has introduced an important contingent variable with regard to the
development and use of intellectual capital assets: customer interaction uncertainty. This
strategic variable has been shown to have a significant impact on the choice of
intellectual capital resources by knowledge-intensive firms. As scholars examine the use
of knowledge in general, and the management of these firms in particular, they should
recognize that customer interaction uncertainty is an important factor in resource
decisions. Further, the use of customer interaction uncertainty offers management scholars the opportunity to reach across the borders of the field and into marketing scholarship, where customer-driven issues (especially within service firms) are central to the field.

Another substantial issue for organizational scholars to consider and incorporate into their work stems from the distinction the paper makes (and finds support for, empirically) between the two types of organizational capital. As noted, empirical work that has combined these two forms of knowledge may have been clouded by their different purposes and uses by firms. Scholars that collect and analyze organizational capital data would be well served to include items that measure both procedural and declarative organizational capital, as the specific questions asked may more readily pertain to one or the other.

This project may also assist scholars focused on the use of routines. An understanding of how the use of procedural organizational capital relates to the use of other forms of organizational knowledge could productively inform research on routines driven by Nelson and Winter’s (1982) work. For example, research into how firms determine which tasks and/or functions to routinize as opposed to which tasks to leave in the hands of knowledge workers would provide valuable insight. Such work would provide insight into an important contingency. This project has shown that knowledge-intensive firms are using routinized and personalized knowledge based on a strategic view of customers, but a more detailed analysis of these choices would be useful.

The delineation of organizational capital into two separate and distinct forms may also aid the empirical study of knowledge in general. Knowledge is a highly abstract and
ambiguous construct, of course, and much of the extant scholarship has been theoretical. By more effectively developing measures (i.e., by separating the two forms of organizational capital and measuring it) the study will likely assist the empirical study of organizational knowledge and its application.

I have suggested that practitioners may need to examine the task when deciding how to use procedural organizational capital vs. human capital, and this is an implication for scholars to consider as well. It may be that measuring these two at the organizational level obscures this distinction and makes the effective deployment of these two knowledge resources difficult to measure and study.

In summary, the use of clearer constructs, strategic contingency, and understanding how the different forms of intellectual capital work together in support of organizational performance, offers new and important food for thought for a range of management scholars.

6.7 Limitations

The project has several important limitations. First and foremost, this is a single industry study. While this serves to both control for extraneous influences on the variables and to focus the results on the areas of interest to the study, it also limits how widely the results can be applied to other sectors. I have only examined data from one area within the financial services industry. While I have sought to gather data from as wide a swath of that area as possible, it is nonetheless a single industry that has unique attributes that limit the study’s generalizability.
The fact that the study studied knowledge-intensive service firms also represents a limitation. Service firms are substantially different from manufacturing firms; that said, there are a number of manufacturers that compete as knowledge-intensive firms focused on research and development, specialized technologies, etc.

The business studied herein is useful in that there are clearly substantial uses of both human capital and procedural organizational capital, but the industry’s emphasis on compliance in particular is an issue that is worth considering as a limitation. Other knowledge-intensive businesses, such as consulting, may not have the same concerns in terms of compliance with regulations and such. However, there are other professional service businesses that would have a heavy emphasis on compliance, such as accounting and healthcare. This may in fact be a useful contextual variable to explore.

The project was also limited by the difficulty in gathering data, which limited the sample size. With additional data it’s quite possible that I would have seen clearer significance in some of the statistical tests, or a reduction in the potential impact of multicollinearity. Firms in general are increasingly concerned with the confidentiality of any data about them, given the ease with which data can be stolen and/or misappropriated. This is especially the case in financial service firms, which are under very heavy scrutiny. This limited the willingness of respondents to fill out the survey. Thus, while the $n$ of the sample is adequate according to rules of thumb for SEM analysis (Klein, 2005), it nonetheless is a limitation of the study.

The study was also limited by the somewhat narrow scope of this business segment. Unlike consulting, for example, which can offer firms a very wide range of customers and areas to work in, the foreign exchange and derivatives business has a
highly prescribed scope, limiting it to only clients with an interest in transacting in those markets. Therefore, while the strategic variable is still important, a different industry could offer the opportunity to explore a wider range of strategic alternatives.

6.8 Directions for Future Research

This study points out the need for substantial additional research to build on the findings of the project. First, these questions need to be explored in other knowledge-intensive industries in order to test their generalizability. Performance data is a particularly difficult challenge for these firms, as many are private or closely held. However, even a broad survey of the independent variables across a range of industries would be an extremely useful test of the relationships.

As noted, further research that explores the importance of regulatory and compliance mandates on the use of procedural organizational capital would be valuable as well. Such research conducted across a range of industries would be the most useful, as opposed to simply measuring two industries with a wide disparity on this front.

Aside from generalizability, there are a number of other useful directions for future research. The analysis of data raised the issue of whether or not procedural organizational capital and human capital act as substitutes or complements to each other. This study was not able to look at the nature of this relationship, but research with more granular data on where firms are using both types of intellectual capital would be quite useful. Such research could be quantitative or qualitative in nature. Additional research in this area might also uncover useful contingencies that determine when or where the relationship would be one of substitution or one of complementarity.
As with any cross-sectional study, there are questions that are raised that could be addressed with longitudinal research. This study points out the importance of customer interaction uncertainty in KIFs, given the nature of their work as organizations that solve problems for customers. However, we were unable to assess the changing nature of the customer interaction uncertainty across time. As firms become familiar with a given customer’s needs, we would expect that uncertainty would be reduced. This, of course, could have commensurate impact on the knowledge resources that are applied. Firms do not always have repeat customers, but many do and this could be useful research that builds off the findings of this study.

This project has raised interesting questions about the use of declarative organizational capital that suggest further avenues for exploration. It seems to work with human and social capital in firms allowing high customer interaction uncertainty, and yet it is a form of codified, recorded knowledge. Additional research on how firms develop this knowledge and how it interacts with human and social capital would be beneficial. Scholars might also usefully explore whether or not building codified process knowledge aids the ability to build codified declarative knowledge, or vice-versa. Codifying and recording knowledge could well constitute a valuable capability that differs depending on the nature of the codified knowledge.

The differences that were seen in the empirical analysis between intellectual capital combinations leading to different performance metrics (profit or income vs. market share) also indicate an area for useful future research. It may be that market share is most effectively increased by broadening the range of customer interaction uncertainty that the firm allows, if in fact it is accompanied by the appropriate knowledge resources.
Profit goals, though, may require different combinations of strategies and resources. Thus, the nature of the performance objective could be a useful contingency for scholars to explore.

I have suggested earlier in the discussion that there may be gradations of customer interaction uncertainty, wherein organizations in the middle are usefully using both human capital and procedural organizational capital. Exploring this empirically would be a fruitful area of research as well. For example, it would be useful to know the extent to which KIFs allowing for very high levels of CIU are still utilizing procedural organizational capital, and if they are doing, so it would be productive to know where. Perhaps even an approach akin to Porter’s (1985) value chain would shed light on this. KIFs may be using procedural organizational capital for certain support activities, for example, no matter the level of CIU they allow into their firm, or there may be firms allowing so much CIU that they have humans enacting services at all points in the process.

Another interesting question to explore would be whether or not this is based on the type of customer interaction uncertainty involved, i.e., a range of alternatives vs. the level of customer participation. It may be that firms that limit the range of alternatives but allow for high levels of customer participation are able to use procedural organizational capital to a greater extent than those firms that allow both a wide range of alternatives and high levels of customer participation.

The use of technology in the form of electronic trading could also raise interesting issues for additional scholarship. This issue arose in conversations I had during the face validity portion of the project, as well as from my general scrutiny of the industry.
Electronic trading is quite a pertinent topic for practitioners in a number of industries – technology and its impact on knowledge-intensive firms is an area of scholarship that would be of pressing interest to practitioners.

The way in which the different intellectual capital constructs are combined within firms could also provide interesting avenues for future research in organizational learning. Nonaka (1994) suggested a knowledge spiral model to suggest how organizations learn. This project has brought some clarity to how knowledge-centric firms manage knowledge resources, but I have not examined the processes by which different forms of knowledge are combined to foster learning. This work would involve a longitudinal component, but this would be extremely valuable work. Organizations may, for example, begin with only human capital and have two avenues by which to pursue learning: via procedural organizational capital or via the use of social capital.

Lastly, I have talked of how the paper has contributed by bringing a strategic contingency into the study of knowledge-intensive firms. Further research on the fit of the strategy and resources leading to performance would be quite productive as well. Using structural models or mediated regression models could help to understand if the knowledge resource relationships identified in this paper mediate the relationship between customer interaction uncertainty strategy and firm performance.

6.9 Conclusion

This project has productively explored interesting and useful research questions: how do knowledge-intensive firms’ strategic approach to customers and their use of intellectual capital assets above and beyond human capital vary and operate in order to
impact their performance. Not all of the questions of the study have been addressed as effectively as I would have hoped, but the empirical results have generally supported the use and application of theory that the project represents. They have also raised other interesting questions that can be explored in the future. The study can make a substantive contribution to the management literature and it can certainly serve to open up other doors of useful, productive scholarly research as we seek to better understand and manage these critical firms.
Table 1

Descriptive Statistics and Correlations

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<td>9.64</td>
<td>5.97</td>
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<td></td>
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<tr>
<td>Market Share</td>
<td>2</td>
<td>5.76</td>
<td>5.53</td>
<td>0.158</td>
<td></td>
</tr>
<tr>
<td>Product Income</td>
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<td>685</td>
<td>681</td>
<td>-0.131</td>
<td>0.09</td>
</tr>
<tr>
<td>Revenue per Head</td>
<td>4</td>
<td>5.04</td>
<td>1.39</td>
<td>-0.12</td>
<td>0.111</td>
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<tr>
<td>Customer Interaction Uncertainty</td>
<td>5</td>
<td>4.95</td>
<td>1.55</td>
<td>-0.036</td>
<td>.298**</td>
</tr>
<tr>
<td>Declarative Organizational Capital</td>
<td>6</td>
<td>4.32</td>
<td>1.67</td>
<td>-0.158</td>
<td>0.102</td>
</tr>
<tr>
<td>Human Capital</td>
<td>7</td>
<td>4.62</td>
<td>1.58</td>
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<td>.240**</td>
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<tr>
<td>Procedural Organizational Capital</td>
<td>8</td>
<td>5.08</td>
<td>1.34</td>
<td>0.123</td>
<td>0.018</td>
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<tr>
<td>Social Capital</td>
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<td>-0.085</td>
<td>0.138</td>
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</table>

Correlations

<table>
<thead>
<tr>
<th>Correlations</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td>Business Unit Employees (Size)</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Product Income</td>
<td>3</td>
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<td></td>
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</tr>
<tr>
<td>Revenue per Head</td>
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<td>.695**</td>
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<td>.771**</td>
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<td>-0.162</td>
<td>-0.216*</td>
<td>-0.034</td>
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<tr>
<td>Social Capital</td>
<td>9</td>
<td>.444**</td>
<td>.603**</td>
<td>.598**</td>
<td>.775**</td>
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Table 2

Statistical Tests of Main Effects

<table>
<thead>
<tr>
<th>Hypotheses 1, 3, and 6</th>
<th>Dependent Variable: Procedural Organizational Capital</th>
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</thead>
<tbody>
<tr>
<td>Controls</td>
<td>Business Unit Employees (Size) 0.023</td>
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<tr>
<td>Independent Variables</td>
<td>Customer Interaction Uncertainty -0.211</td>
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<tr>
<td></td>
<td>Declarative Organizational Capital -0.281 *</td>
</tr>
<tr>
<td></td>
<td>Human Capital 0.219</td>
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<tr>
<td></td>
<td>Social Capital 0.191</td>
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<tr>
<td>Model</td>
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<td>F 2.62 *</td>
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<table>
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<th>Dependent Variable: Declarative Organizational Capital</th>
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<tr>
<td>Independent Variables</td>
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</tr>
<tr>
<td></td>
<td>Human Capital 0.492 **</td>
</tr>
<tr>
<td></td>
<td>Procedural Organizational Capital -0.190 *</td>
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<tr>
<td></td>
<td>Social Capital 0.090</td>
</tr>
<tr>
<td>Model</td>
<td>R Sqr. 0.598</td>
</tr>
<tr>
<td></td>
<td>F 28.7 **</td>
</tr>
</tbody>
</table>

Regression coefficients listed are standardized coefficients.
† Test is significant at the 0.10 level. * Test is significant at the 0.05 level.
** Test is significant at the 0.01 level.
### Table 3

Linear Regression Test of Performance Hypothesis

<table>
<thead>
<tr>
<th>Hypothesis 4</th>
<th>Dependent Variable: Performance (Revenue per Head); Method: Linear Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
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<td>Controls</td>
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</tr>
<tr>
<td>Business Unit Employees (Size)</td>
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<td>Log of Assets (size)</td>
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<td>Main Effects</td>
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</tr>
<tr>
<td>Customer Interaction Uncertainty</td>
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<tr>
<td>Declarative Organizational Capital</td>
<td>-0.125</td>
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<tr>
<td>Human Capital</td>
<td>0.414 *</td>
</tr>
<tr>
<td>Procedural Organizational Capital</td>
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<tr>
<td>Social Capital</td>
<td>-0.013</td>
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<tr>
<td>Interaction</td>
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<tr>
<td>Procedural Org. Cap. X Human Cap.</td>
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</tr>
<tr>
<td>Models</td>
<td></td>
</tr>
<tr>
<td>Delta R Sqr.</td>
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<tr>
<td>R Sqr.</td>
<td>0.353</td>
</tr>
<tr>
<td>F</td>
<td>8.03 *</td>
</tr>
</tbody>
</table>

Regression coefficients listed are standardized coefficients.

† Test is significant at the 0.10 level. * Test is significant at the 0.05 level. ** Test is significant at the 0.01 level
Table 4

HLM Test of Performance (Product Revenue) Hypotheses

<table>
<thead>
<tr>
<th></th>
<th>Vs. Product Income</th>
<th>Vs. Ln Assets (Size)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent Variable: Performance (Product Revenue); Method: HLM</strong></td>
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</tr>
<tr>
<td><strong>Controls</strong></td>
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<td></td>
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<tr>
<td>Business Unit Employees (Size)</td>
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<td>1.1</td>
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<td><strong>Main Effects</strong></td>
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<td></td>
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<tr>
<td>Customer Interaction Uncertainty</td>
<td>-502.9 **</td>
<td>182.1 **</td>
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<tr>
<td>Declarative Organizational Capital</td>
<td>37.5</td>
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<tr>
<td>Human Capital</td>
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<td>Procedural Organizational Capital</td>
<td>1141.6 **</td>
<td>-425.0 **</td>
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<tr>
<td>Social Capital</td>
<td>-270.7 **</td>
<td>107.0 **</td>
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<tr>
<td><strong>Interaction</strong></td>
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<tr>
<td>Procedural Org. Cap. X Human Capital</td>
<td>-418.9 **</td>
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<tr>
<td>Social Capital X Human Capital</td>
<td>434.7 **</td>
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<tr>
<td>Declarative Org. Cap. X Human Capital</td>
<td>-1357.5 **</td>
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</table>

† Test is significant at the 0.10 level. * Test is significant at the 0.05 level. ** Test is significant at the 0.01 level.
Table 5
HLM Test of Performance (Market Share) Hypotheses

<table>
<thead>
<tr>
<th>Hypothesis 7</th>
<th>Dependent Variable: Performance (Market Share); Method: Linear Regression</th>
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<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><strong>Controls</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business Unit Employees (Size)</td>
<td>0.151 †</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Log of Assets (size)</td>
<td>0.569 **</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Main Effects</strong></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Customer Interaction Uncertainty</td>
<td>1.890 **</td>
<td>1.850 **</td>
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<tr>
<td></td>
<td>Declarative Organizational Capital</td>
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<td></td>
<td>Human Capital</td>
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<td>Social Capital</td>
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<td>-0.037</td>
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<tr>
<td></td>
<td><strong>Interaction</strong></td>
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<tr>
<td></td>
<td>Social Capital X Human Cap.</td>
<td>-0.378 †</td>
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<td><strong>Models</strong></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Delta R Sqr.</td>
<td>0.023 †</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R Sqr.</td>
<td>0.270</td>
<td>0.293</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>4.32 **</td>
<td>4.20 *</td>
</tr>
</tbody>
</table>

Regression coefficients listed are standardized coefficients.

† Test is significant at the 0.10 level. * Test is significant at the 0.05 level. ** Test is significant at the 0.01 level.
Figure 1

Hypothesized Model
Figure 2a

Interaction Plot, Human Capital X Procedural Organizational Capital and Firm Performance, Measured as Profit per employee
Figure 2b
Interaction Plot, Human Capital X Procedural Organizational Capital and Firm Performance, Measured as Trading Income
Figure 3

Interaction Plot, Human Capital X Declarative Organizational Capital and Firm Performance, Measured as Trading Income
Figure 4
Interaction Plot, Human Capital X Social Capital and Firm Performance, Measured as Trading Income
APPENDIX

SCALE ITEMS

Customer Interaction Uncertainty

1. We are known in the foreign exchange / derivatives industry as a place where customers go for solutions to their most difficult or unusual challenges.
2. Our clients see us as important and trusted advisors.
3. We seek to accommodate any and all customer needs.
4. When clients contact us, we almost never know what they will want before they tell us.
5. We seek to make our interactions with customers brief and to the point.
6. We offer the widest range of products in the industry.

Human Capital

1. Our employees are widely considered to be the best in our industry.
2. Our employees are highly skilled at developing new ideas and knowledge.
3. We are highly selective about which academic institutions our employees come from.
4. We work very hard to have the most knowledgeable and highly skilled staff in the industry.
5. We rely heavily on specialists to assist sales and trading personnel.
6. Challenging client problems are dealt with by our firm with the help of specialists in such areas as exotic products, risk management, etc.
7. Except in rare circumstances, we expect our employees to be able to accomplish their work independently, without the need for specialists or experts.
8. Relative to the industry average, compensation packages for our personnel are: (scale 1-7; ranging from “much lower” to “much higher”).

Procedural Organizational Capital

1. Over and above compliance issues, our work processes and procedures are clearly understood.
2. It is just as important to do the work correctly in our business unit as it is to get results.
3. The norms in our business unit strongly influence the actions of our employees.
4. Challenging issues such as unusual trades, product structures, and client requests are resolved by using clear guidelines and processes that our business unit has established.
5. New hires at all levels are given extensive instruction on how we do things in our organization: how to interact with clients, how the organization functions, etc.
6. Employees are expected to adhere to our general “ways of working” at all times – there is little variance in how our workers conduct their tasks, even in the front office.
7. We have a very strong internal culture that guides our work.
8. We encourage the use of individual discretion and judgment when our personnel are faced with unusual client requests.

**Declarative Organizational Capital**

1. We are a leader in producing and disseminating research and analysis on subjects such as market analysis, risk management, exposure management, etc.
2. Our research is a key factor in our ability to win client business.
3. We have the best research and/or analytical tools in our industry.
4. We invest more heavily in research and analytical tools than our competitors.
5. We have developed top quality research and analytical tools in the areas that we specialize in.
6. Our business unit invests in research and analytical tools in a very targeted manner.
7. We offer a very broad range of excellent research and/or analytical tools.
8. Our research and analysis can help clients with virtually any foreign exchange / derivatives issue.

**Social Capital**

1. Our business unit’s employees are highly skilled at collaborating with each other.
2. Mentoring is an extremely important process in our business unit.
3. A strongly emphasized part of our culture is for employees to share information and learn from one another.
4. Our employees constantly interact and exchange ideas with other areas of the bank.
5. We develop customer relationships such that we are able to gain useful knowledge and understanding of our business from them.

6. In order to keep up with developments in our industry we work to develop relationships outside the bank with customers, competitors, consultants, by attending conferences, etc.

7. Bank colleagues outside of our business unit are a major source of knowledge for our unit.

8. We actively seek to partner with customers, technology suppliers, alliance partners, etc., in order to develop business solutions.

9. We often collaborate on projects with colleagues from other business units.

What is the approximate revenue per professional, front-office employee of the unit you manage? (Scale: 1= less than $250M, 2= $250M to $500M, 3=$500M to $1MM, 4=$1MM to $2MM, 5=$2MM to $5MM, 6=$5MM to $8MM, 7= greater than $8MM).

How many employees does your business unit have?
BIBLIOGRAPHY


