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# Harnessing Tacit and Explicit Knowledge: An Empirical Investigation of Knowledge-Centric Drivers of Service Management Performance

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# Harnessing Tacit and Explicit Knowledge: An Empirical Investigation of Knowledge-Centric Drivers of Service Management Performance

## **Abstract:**

Increasing our understanding of how service firms can enhance their operations with knowledge-based assets, this study investigates empirically if, how and when the implementation of information technology (IT) initiatives, human resource management (HRM) procedures and knowledge management (KM) systems can enhance service quality and ultimately improve firm results within the services sector. Linking several seemingly unrelated bodies of literature, theory is drawn from a cross-discipline range of management literature to support the research hypotheses. Two separate datasets, both multi-year research efforts designed to gain insights into state of the art managerial practices within the services sector, are employed in this work. Rigorously gathered data is tested empirically with robust multivariate statistical methods. Insights and discoveries with regard to the contribution new technological adoptions are drawn, helping to clarify the means by which investments in human capital coincide with firms' outcomes. Strong evidence is found indicating that firms better able to manage their knowledge, via dynamic knowledge management systems designed to acquire and transfer both tacit and explicit knowledge, do in fact achieve improved levels of firm performance. This differentiates the study from much of the earlier work that concentrates on either tacit or explicit knowledge, but rarely both. Furthermore, this research indicates that the transfer of explicit and tacit knowledge is positively related to certain links of the service profit chain, more clearly explaining how managerial choices can lead to enhanced service quality and improved firm performance. In summary, the fruit of this research evidences that firms better able to manage their knowledge-based assets via dynamic KM systems, deploy IT initiatives and human-enabling HRM practices, and foster improved service quality, ultimately achieve increased business performance and profitability. These findings have important implications for the academe and service firms interested in improving performance through the more efficient use of existing knowledge-based assets, shedding light on methods that lead to managerial and financial success in a poorly understood segment of the services sector, the hedge fund industry.

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## 1. Introduction

There exist many approaches by which managers may attempt to improve organizational performance, and management scholars are continually searching for new ways to implement them and measure their effectiveness. This research addresses two broad methods to enhance organisational results. At first glance the two methods may appear fundamentally distinct, but upon closer examination are (or at least can be) tightly integrated. In one case, "Hard-Tech" implementations may be rolled out across all or part of an organization, enabling staff to better leverage their efforts through the use of cutting edge tools. "Soft-Touch" policies and procedures, on the other hand, may be implemented to attempt to finesse firm results through the use of progressive human resource management practices.

The purpose of this research is not to argue that one of the above approaches is more likely to succeed than the other, or that either choice will be more effective. Nor will it put forth that the decision among the alternatives is mutually exclusive. Instead this study seeks to unite the two implementations, exploring how "Hard-Tech" adoptions and "Soft-Touch" procedures work together to form an apt organizational improvement solution. It will be argued that knowledge management is one approach that integrates both "Hard" and "Soft" practices. On the outset of this study, it is this author's belief that investments in Hard-Tech implementations are more successful when made in conjunction with corresponding investment in Soft-Touch procedures and vice versa.

Central to this endeavour is that the knowledge perspective has important implications for organizations of all kinds (Kogut and Zander 1992; Grant, 1996; Grant 1996b), and service organizations in particular. In a state of heightened consumer awareness, not only are product life cycles becoming shorter, but the demand for new and more elaborate service offerings is also wanted at an increasing rate. The ability to continuously develop new services is essential to the survival of service organizations, thus requiring the adoption of innovative routines, systems and procedures in order to move faster than

competitors. Learning and unlearning capabilities (Hedberg, 1979; Senge, 1992) are of utmost importance to any service firm in this economic landscape. Complicating matters yet further, the knowledge necessary to develop a competitive customer offering is declining in durability. To develop and deliver new service offerings, knowledge must now be combined and recombined across geographical, organizational, technological, and in some cases, across institutional borders (Ridderstrale and Engstrom, 2000). While this development presents a manageable task, the time available to accomplish it is scarce, thus further complicating the task of systematizing these actions.

In this introductory chapter I will present a brief overview of my research agenda, underscoring why this study is worth pursuing. In doing so, I will first provide a macro overview of the research questions. Then I will outline the common thread that ties these questions together under a singular common theme and goal. Next, I will more specifically detail the undertaken study, providing a brief synopsis of the gaps in the literature. Subsequently I will outline the two separate empirical studies that have been carried out to answer my range of research questions under a common framework. Finally, I will highlight the contribution this work makes to academics and practitioners.

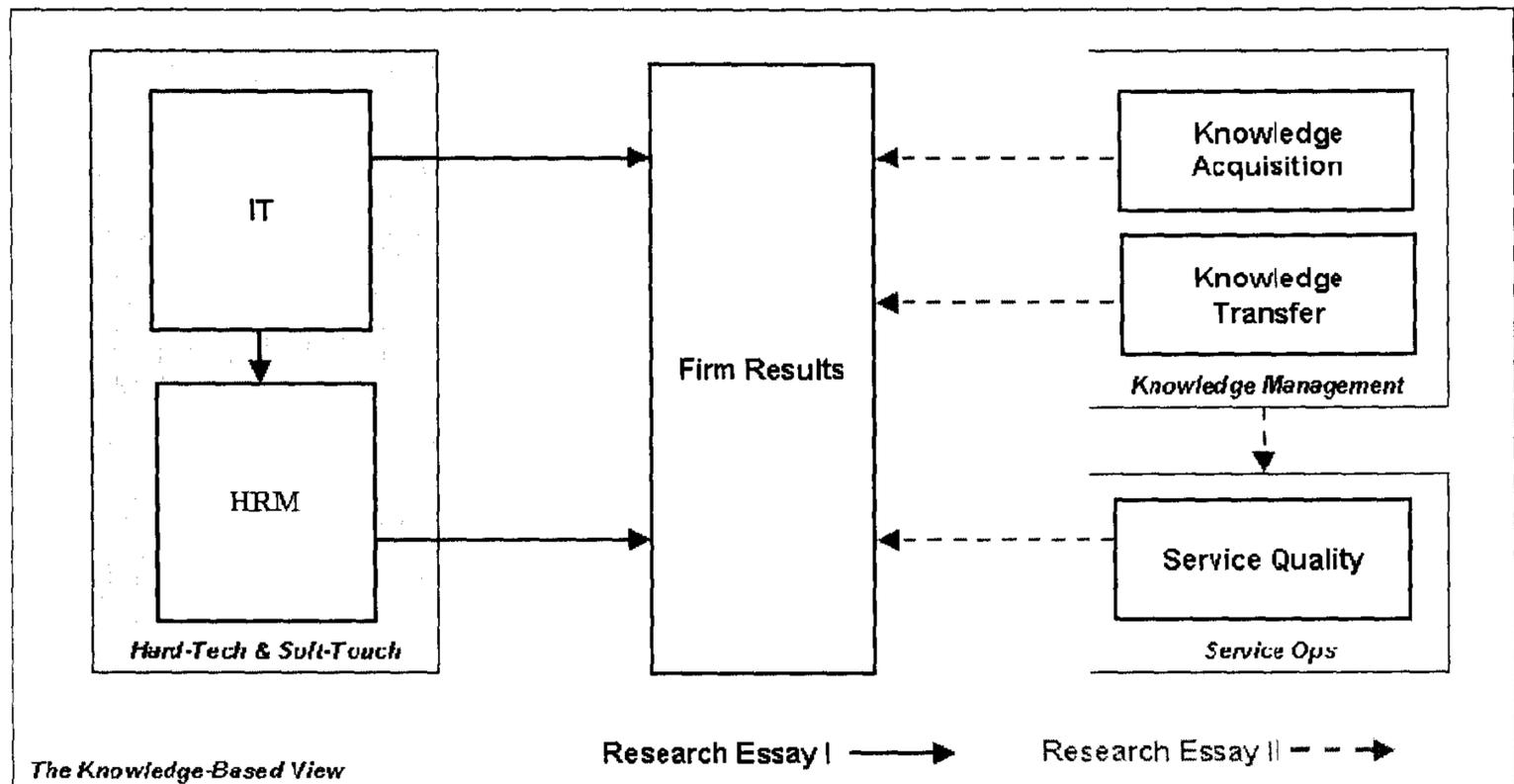
### **1.1. Research Overview**

From the lens of the knowledge based view of the firm (KBV), this research focuses on “Hard-Tech” and “Soft-Touch” concepts, integrating service management, quality management (QM), technology management, strategic human resource management (HRM) and knowledge management (KM). Our understanding of how service firms can enhance their operations with specific practices proposed by the research streams becomes clearer from the Knowledge perspective. Specifically, this research investigates if, how and when IT implementations, HRM procedures, dynamic knowledge management systems and enhanced service quality impact firm results within the services sector. Theory is drawn from a cross-discipline range of

management literature to support the research hypotheses, which are tested empirically with robust multivariate statistical methods

This research links several seemingly unrelated bodies of literature. Consistent with quality management literature, efforts to analyze organizational data with IT and to effectively manage human capital with strategic HRM procedures are associated with business excellence. Supporting this claim, human resource management and data analysis are fundamental criteria of the Baldrige award, and the Baldrige award is synonymous with quality management (Ahire et al, 1995). In this work it is not argued that these practices embody quality management (as they are but small components of a much larger management philosophy), but rather that these specific management practices help organizations better manage their knowledge. Insights with regard to how technological adoption actually contributes to firm performance are pulled from the growing body of technology management literature. Similarly, the strategic human resource management (SHRM) literature (see for example Russell et al., 1985; Kleiner et al., 1987; Arthur, 1992 and 1994; Pfeffer, 1994 and 1998; Hueslid, 1995; MacDuffie 1995; Delaney and Huselid, 1996; Youndt et al., 1996; Ichinowski et al., 2001) helps clarify the means by which investments in human capital coincide with firms' outcomes. Scrutiny of the operations management (see for example Flynn et al., 1995; Hendricks and Singhal, 1996, 1997, 2001; Soussa and Voss, 2002; Linderman et al., 2004) and strategic management (see for example (Davenport and Prusak, 1998; Grant, 1996; Kogut and Zander, 1996; Spender, 1996), literature provides a foundation for the study of knowledge management in this effort, explicitly underscoring a gap in the body linking firm performance to a robust knowledge framework. The surface of this area has only been scratched and empirical examinations are scant. Finally, through the analysis of operations management literature, with acute emphasis on the Service Profit Chain (SPC), see for example Schlesinger and Heskett (1991b); Heskett et al., 1994; Loveman, 1998, this study builds a framework that can empirically demonstrate how service quality not only affects firm performance directly, but also mediates

the firm's positive relationship with knowledge management. In summary, the aim of this research is to investigate whether firms better able to manage their knowledge via dynamic knowledge management systems, implement IT initiatives, employ human-enabling HRM practices, and foster service quality, do in fact achieve increased business performance and profitability.



(Figure: Conceptual Research Framework)

The proposed research has been broken down into two empirical efforts; the data to assess these variables has been carefully collected; and the hypothesised relationships have been tested with robust methods. Accordingly, this document provides a conceptual model of the proposed research as a whole, diagramming the work overall, and will also outline the two underlying research essays. The first essay investigates specifically the link between IT and firm performance. This work tests for direct, mediated and moderated relationships. On the outset, the author holds that these relationships will be positive and significant. After investigating whether the purported relationship holds, the subsequent examination of HRM's role in the process will follow. The second effort probes deeply into the components of knowledge, exploring how "the

strategically most important assets of the firm” (Spender, 1996) can lead to enhanced business performance in the services sector. The value of managing firm knowledge is commonly held, however this framework is designed to examine specifically how service firms can improve their performance through the acquisition and transfer of both tacit (know-why) and explicit (know-how) knowledge. This differentiates it from much of the earlier work that concentrates on either tacit or explicit knowledge, but rarely both. Finally, it has been proposed that integrating quality management practices with organizational knowledge concepts can provide insights into how knowledge management leads to improved performance (Linderman et al., 2004). This author believes that such systems will link directly into the service profit chain, more clearly explaining how internal service quality ultimately drives firm performance, but this theory must be further developed and tested.

## **1.2. Common Thread**

Central to this study is knowledge, or more specifically, the investigation of knowledge-centric management practices designed to increase firm performance in the services industry. Bearing this in mind, I argue the ultimate objective of knowledge management, strategic human resource management and technology management are fundamentally the same, that is, to facilitate organization improvement through the effective use of knowledge assets. Although operations researchers have contemplated knowledge, their work has diverse and generally an incomplete use of knowledge (Linderman et al., 2004). Pivotal to this research effort is a robust knowledge framework inspired by Nonaka’s (1994) foundational work on knowledge creation. Nonaka offers a comprehensive portrayal of knowledge that considers individual and organizational knowledge, incorporating both tacit and explicit components.

The integration of the theory of knowledge creation with operations management illuminates some noteworthy insight and propositions.

According to Nonaka (Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998), knowledge creation occurs through four primary processes - socialization, externalization, combination, and internalization. These knowledge conversion processes are supported by a variety of sound management practices. Progressive human resource management practices such as team building, for example, promote socialization. Similarly, the implementation of information technology to aid in data analysis fosters combination. This implies that organizations can create more knowledge by implementing specific management practices that support components of the knowledge creation processes (Linderman et al., 2004). Dooley (2000) suggested that the future of the quality management field will mandate a more complete understanding of the role of tacit knowledge. This underscores the need to apply more robust knowledge management frameworks in order to understand the process whereby firms create, acquire and transfer knowledge.

### **1.3. Gaps in the Literature**

#### **1.3.1. Does IT Matter?**

Although firms of all kinds around the globe have implemented a wide range of information technologies, it has been hotly debated whether these costly and time intensive investments actually correspond to increased gains in productivity and performance. This phenomenon has been referred to as the "Productivity Paradox". Studies reporting negative or non-existing relationships (Loveman, 1994; Roach, 1987; Franke, 1987) have at least historically outnumbered the research that argues the presence of positive relationships. Moreover, there have been numerous research efforts disclosing low IT capital productivity across several industries (Berndt and Morrison, 1995; Morrison, 1996; Parsons, Gottlieb and Denny, 1990).

It is noteworthy however that several researchers have argued that increased investment in technology is in fact associated with enhanced performance (Brynjolfsson and Hitt, 2003, 1996 and 1995; Lichtenberg,

1995). This study, in part, attempts to add new insights to the debate through an empirical analysis of mechanisms within firms which may enable and foster increased performance through the use of information technology.

### **1.3.2. Can Strategic HRM Drive Performance?**

A theoretical understanding is the natural starting point, but because the literature is unclear to what extent IT is related to firm level operation or financial performance, a rigorous empirical investigation is needed in order to gain insights into the nature of the relationship. This empirical analysis will investigate whether enhanced performance stems from investment in IT, human enabling HRM systems or in combinations of them both. There exists debate among HRM authors whether firm performance can be driven by a universal set of 'best practises' or if specific set of procedures that best 'fit' certain strategies are required. Investigating empirically HRM's impact on performance from a 'Universalist's' perspective will provide meaningful insights to the discussion. Clearly, these findings will have strong managerial implications. Although the results will not unambiguously demonstrate causality, they will present strong indications of the fundamental roles that IT and human resource management play. Failing to adequately invest in information technology and progressive human resource management practices may have dire consequences on firm performance while strategic investment in the apposite combination may enable sustainable competitive advantage.

### **1.3.3. Does Knowledge Management Drive Performance?**

There exists limited academic research connecting organizational knowledge and firm performance in the operations management literature. For example, Ahire et al. (1995) and Sousa and Voss (2002) provide comprehensive literature reviews of the quality management literature, but neither identified any papers specifically relating quality management to knowledge (Linderman et al. 2004). The same authors

propose a basis for understanding the relationship between service quality and knowledge, and from a knowledge perspective develop insights into how certain knowledge management practices lead to improved performance. This work provides an important theoretical contribution but does not provide quantitative evidence that these relationships hold under scientific scrutiny. "Future research should focus on testing and refining the proposed theory" (Linderman et al. 2004). Concentrating on knowledge management, service quality and firm performance, the purpose of this research in part is to answer the call, empirically examining fundamental links of theory integrating service operations management practices with the knowledge perspective.

#### **1.3.4. What is the Role of Knowledge Creation in the Service Profit Chain?**

The theoretical link between knowledge management and service operations is not clearly understood. The knowledge-based view of a firm provides an appropriate theoretical lens to establish this link because there is a strong connection between improvement and knowledge creation. However, other theoretical perspectives could also explain the relationship between quality management and performance. For example, Choi and Eboch (1998) suggest institutional theory can be a useful theory to explain the link between certain quality management practices and performance. They find a strong direct link between quality management practices and customer satisfaction, but a weak link when operational performance mediates the relationship

A comprehensive knowledge perspective helps enlighten what effective organizational-wide deployment of management practices aim to accomplish. Specifically, it provides insights into the relationship between knowledge, service quality and firm performance. For example, organizations maintaining a set of management practices that support knowledge creation foster 'socialization' between customers

and employees providing a basis for learning (Bitner and Booms, 1990; Lengnick-Hall, 1996). These firms should be better able to understand the spoken and unspoken needs of their customers (Dean and Bowen, 1994) cultivating higher levels of service quality. This research indicates that management practices should be bundled around knowledge creation processes, but this concept requires further development and investigation.

## **1.4. The Research Essays: Overview**

### **1.4.1. Research Essay I**

Rigorously exploring the productivity paradox, the much debated failure to link increased organizational investment in technology with enhanced productivity, this paper investigates empirically the impact of implementing information technology (IT) and human enabling human resource management (HRM) on operational and financial performance. Specifically, by applying a series of straightforward techniques to test for mediation and moderation, in addition to testing for a direct association, the purpose of this paper is to investigate and expose the illusive relationship between the adoption of information technology and firm level operational and financial performance. The findings have important implications for service firms interested in improving their performance through employing IT and human resource management systems. While much of the earlier research addressing the relationship between technology and productivity has been set in a manufacturing setting, to further differentiate this study, I investigate exclusively whether investments in IT for service firms correspond to increased performance.

Research Essay I tests empirically the following relationships:

- The direct relationship between IT and firm performance
- The direct relationship between HRM and firm performance

- The indirect relationship between IT and firm performance, moderated by HRM
- The indirect relationship between IT and firm performance, mediated by HRM

#### **1.4.2. Research Essay II**

Integrating the knowledge-based view and service operations research, this paper investigates empirically the impact of knowledge on service quality and firm performance. Effective acquisition and transfer of knowledge will be shown to hinge upon incorporating both tacit and explicit knowledge. This research framework is built upon a theoretical framework that argues that the interaction of knowledge management practices link together to create new organizational knowledge. This research posits that such systems will link directly into elements of the service profit chain, more clearly explaining how managerial choices can lead to enhanced service quality, and ultimately, to improved firm performance. The path and validity of these relationships are tested using hierarchical regression analysis.

Research Essay II tests empirically the following relationships:

- The relationship between the acquisition of explicit knowledge and firm performance
- The relationship between the acquisition of tacit knowledge and firm performance
- The relationship between the transfer of explicit knowledge and firm performance
- The relationship between the transfer of tacit knowledge and firm performance

- The relationship between the acquisition of explicit knowledge and service quality
- The relationship between the acquisition of tacit knowledge and service quality
- The relationship between service quality and firm performance

### **1.5. Academic and Managerial Contribution**

This research makes an important contribution to a broad range of management literature. The knowledge perspective provides a unique context for studying service management, allowing the illustration of how specific practices can be used to manage existing knowledge assets in attempt to enhance firm performance. This study will help us understand not only what organizational knowledge is, but also how new knowledge can be created through specific management practices. Linderman et al. (2004) put forth a challenge to the academy to focus on testing and refining their proposed theory integrating knowledge and specific quality management practices, this effort will help fill this void.

Findings from this research will have important implications for service firms interested in improving their performance through employing IT and human resource management systems. Quite simply, both IT and human-enabling human resource management may be related to firm performance. This result would be consistent with earlier resource based view research where authors have argued and found support for the notion that increased productivity and firm performance is dependent upon the contribution of employees of the firm (Youndt et al., 1996). It is reasonable to infer that employees enabled via a human enabling HRM system are better able to contribute to the goals of the firm than employees deprived of such power (Arthur 1992, 1994). ). When attempting to assess the relationship between IT and performance it is worthwhile to imagine that "IT is the catalyst but organizational design is the bulk of the iceberg". In

fact, research has indicated that organizational assets, specifically human capital, business processes and culture, are more important to the relationship than the new technology itself (Brynjolfsson 2003) and investments in such complements warrant up to 10 times the size of the investment as the new technology (Brynjolfsson and Yang, 1999; Brynjolfsson, Hitt and Yang, 2002). Thus it will not be surprising if findings indicate that HRM is more important in explaining the link between IT and both operational and financial performance than IT itself. Additionally, econometric findings have indicated that firms that adopt decentralized organizational structures do appear to have a higher contribution of IT to productivity (Bresnahan, Brynjolfsson and Hitt, 2002). This suggests that enabled employees equipped with new technologies can make an even greater contribution (Youndt et al., 1996) to the firm and productivity in general. However, these relationships must be tested.

## **2. Cross-Discipline Literature**

In this chapter I will briefly review the core bodies of literature most relevant to my research. Starting with the knowledge perspective, I will trace its roots to the resource-based view of the firm, making clear the appropriate use of this perspective as the foundation for my study. Next, I will briefly discuss the generally mature body of quality management research, underscoring the context by which the managerial variables of this study, IT, HRM and KM (knowledge acquisition and knowledge transfer), can be construed as quality management practices. This study does not propose that IT, HRM and KM comprise quality management (QM is a much broader research philosophy), but rather they are important management practices that overlap into the field. Subsequently, I will review the literature, and specifically the literary gap, integrating the knowledge perspective and quality management practices. I will then review the technology management literature, initially highlighting the diverse range of research streams, but primarily unravelling the theoretical and empirical efforts to link (Hard-Tech) technology implementations to increased productivity and enhanced firm performance. The strategic human resource management literature will be assessed next, outlining the arguments for (and against) the 'fit', 'universalist' and 'configuration' streams. Central to this research is the necessity of human capital to direct organizational initiatives and ultimately drive firm performance. Integrating the knowledge perspective, quality management practices, technology strategy and strategic human resource management, the knowledge management literature will then be reviewed. Lastly, an overview of the service profit chain research stream will shed light on the means by which the managerial variables above can impact internal service quality and overall business performance. Noteworthy, the core of the literature review is presented within chapters five (Research Essay I) and six (Research Essay II).

### **2.1. The Knowledge Perspective**

The knowledge-based view of the firm is a more recent outgrowth from the resource-based view, concentrating on knowledge, “the most strategically important of the firm’s resources” (Grant 1996b). Causing a fair amount of debate, publications by Conner (1991) and Kogut and Zander (1992, 1996) have built upon the resource based view, leading the field to focus more narrowly on knowledge. It has been suggested by Grant that the knowledge perspective is not yet a theory, but rather an apt perspective to view the underpinnings and interactions of core internal resources of the firm. As aforementioned, the knowledge-based view of the firm is a significant outgrowth from the resource based view, concentrating on knowledge, “the most strategically important of the firm’s resources” (Grant 1996b). A vital element of the knowledge-based view is the relaxation of the assumption of opportunism (Kogut and Zander 1992; Conner and Prahalad 1996). Enabling the relaxation of a key assumption would seem to make the knowledge-based view more elegant and parsimonious and, therefore, more attractive than the transaction cost theory. According to the knowledge-based views of the firm (Spender, 1996), organizational effectiveness is an outcome of knowledge creation, explication, communication and application (King, 2003).

Central to the foundation of the knowledge based view is the identification of critical aspects of knowledge that have important implications for management. A review of the literature uncovers a few fundamental characteristics that enable an organization to make use of knowledge within the firm and to generate value. Three criteria of knowledge that receive wide recognition as being of central importance to management are transferability (Barney, 1986; Kogut and Zander 1992; Grant, 1996), capacity for aggregation (Hayek, 1945; Meckling, 1992; Grant, 1996) and appropriability (Arrow, 1984; Teece, 1987; Levin et al., 1987; Rosen, 1991; Grant 1996b).

Having established the foundation of the knowledge based view, it is important to assess the broad ability of knowledge to impact firm performance. According to this view, the general prescription for

enhanced performance is to augment the functionality and security of unique aspects of knowledge. It is argued that one way to achieve this is through the transformation of them into 'inimitable capabilities', and to create new knowledge (Kogut and Zander, 1992; Grant, 1996; Teece, Pisano and Shuen, 1997). Theorists add that to ensure survival over the long term, organizations must uphold a healthy balance between exploiting existing resources while simultaneously developing new ones (March, 1991; Levinthal and March, 1993; Hedlund and Rolander, 1990; Hedlund and Ridderstråle, 1996).

It would appear that the resources firms hold most dear have changed significantly over the years. Traditionally, critical firm resources were considered to be land and hard labour. Afterwards, the development of new technologies and access to capital became the foremost differentiators. Presently, many scholars concur the knowledge is the most important resource for organizations striving to create new prosperity. The evolution is particularly relevant to the rapidly expanding services industry. This change has occurred for a host of reasons, but the growing body of research, and the majority of researchers, most often site the following four drivers;

- **Increased complexity of organizations increases knowledge diversity** (Schumpeter, 1942; Kogut and Zander, 1992; Grant, 1996; Toffler, 1980; Baba and Imai, 1991; Granstrand and Schölander, 1989; Nonaka and Takeuchi, 1995; Clark and Fujimoto, 1991)
- **Innovation decreases knowledge durability** (Tapscott, 1996; Davies and Meyer, 1998; Hedberg, 1979; Senge, 1992)
- **Globalization increases knowledge dispersion** (Knoke, 1996; Reich, 1991; Ridderstråle, 1996)
- **Education increases knowledge depth** (Pavitt, 1991; Micklewait and Wooldridge, 1996; Stewart, 1997; Dearlove and Crainer, 1999; Davies and Botkin, 1994)

## **2.2. Quality Management (QM)**

Quality Management as an “all-pervasive management philosophy” came into being about twenty years ago (Sousa and Voss, 2002). Founded by QM gurus such as Philip Crosby, W. Edwards Deming, Kaoru Ishikawa and Joseph Juran, it was received with great hype and heralded a “revolutionary approach to effective management” (Ahire et al., 1995). Quality Management has spread throughout divisions and industries, and today most business have embedded QM practices and procedures into their day to day operations (Sousa and Voss, 2002). Despite the fact that it was received with fanfare, QM has meant (or does mean) many different things to different people. For example, questions such as “Is there such a thing as QM?” (Watson and Korukonda, 1995) have arisen.

Management scholars have answered the call (see for example Hackman and Wageman, 1995), demonstrating empirically that QM does in fact exist. Moreover, a host of supporting literature has proposed theoretically and confirmed empirically that quality management drives firm performance (Flynn et al., 1995; Hendricks and Singhal, 1996, 1997, 2001; Easton and Jarrell, 1998; Douglas and Judge, 2001; Kaynak, 2003). A comprehensive review of the quality management literature undertaken by Sousa and Voss (2002) underscores that quality management practices have both a direct and indirect impact on firm results. Hendricks and Singhal (1996, 1997, 2001) agree that effective deployment of quality management leads to firm performance, although it is not perfectly clear from the literature what precisely entails effective deployment (Linderman et al. 2004). The authors propose that an examination of how quality management can lead to knowledge creation would be illuminating in better understanding the means by which QM is effectively deployed and related to firm performance.

Establishing how quality management practices and knowledge creation leads to firm performance requires a specific understanding of what is actually meant by quality management. A definition of quality management should be parsimonious (Wacker, 1998). Sousa and Voss (2002) found

that throughout the quality management literature common definitions of QM included the concepts such as “a philosophy or an approach to management...a set of mutually enforcing principles...supported by a set of practices and techniques”. Also embracing these concepts, Ahire et al. (1995) defined quality management as “an integrative management philosophy aimed at continuously improving the quality of products and processes to achieve customer satisfaction”. Although accurately portraying many of the aspects of quality management, their definition lacks the requisite conceptual breadth for this research effort. A special issue of the Academy of Management Review dedicated to Quality Management presents two viable definitions that embrace these concepts. Sitkin et al. (1994) described Quality Management as “customer satisfaction, continuous improvement, and Systems View of Organization”; whereas Dean and Bowen (1994) encapsulated Quality Management as “customer focus, continuous improvement, and team work”. Although both definitions are quite similar and offer well reasoned designations, a fusion of the two incorporating both the ‘systems view of the organization’ from the former and the notion of ‘teamwork’ from the latter helps establish a theoretical link between knowledge and quality.

### **2.3. Integration of Knowledge and Operations Management**

The knowledge-based view (KBV) of the firm offers a unique theoretical perspective in understanding how quality management is related to performance. According to KBV theorists, knowledge is the strategically most important resource of firms and a potential source of competitive advantage (Davenport and Prusak, 1998; Grant, 1996; Kogut and Zander, 1992, 1996; Spender, 1996). From this point of view, if quality management practices are seen as yet another means of knowledge creation, then the relationship between quality management and firm performance can be better explained. Explicitly, quality management becomes a basis of knowledge creation that ultimately results in a competitive advantage.

Academics have only just begun to formally integrate quality management to knowledge perspective concepts (Linderman et al., 2004). One of the first attempts by Fine (1986) employed analytic models to exemplify the relationship between quality and learning. The crux of his findings was that the optimal quality level increases over time due to learning – ‘learning by doing’. Similar analytical studies followed linking learning to quality control (Tapiero, 1987; Dada and Marcellus, 1994; Hatch and Mowery, 1998; Li and Rajagopalan, 1998; Zangwill and Kantor, 1998). More recently, researchers have developed theory and conceptual models that relate quality management to knowledge. Sitkin et al. (1994) for example theorized that TQM consists of both Total Quality Control and Total Quality Learning. They hypothesized that under conditions of great ambiguity and complexity, a ‘Total Quality Learning’ approach is more effective than a ‘Total Quality Control’ approach. Consistent with this work, Linderman et al. (2004) make significant progress explaining the theoretical link between knowledge and quality. The authors present a conceptual model (see Figure 2) relating quality management practices to well supported components of knowledge creation and ultimately to organizational performance. Developing strong theory linking quality management practices to the knowledge perspective, they conclude their study with a call for empirical testing.

The early pioneering work of Taylor (1911) concentrating on choosing an apt worker for a specific task and then training all other workers throughout the organization to carry out that job using the same techniques is a one natural starting point for the review of knowledge acquisition and transfer. Essentially, Taylor sought to capture the individual knowledge of a specific worker and transfer it throughout the organization (transforming it into organizational knowledge). Attempting to make identified ‘best practices’ the standard operating procedure for the organization, Taylor linked fundamental concepts of quality management with the heart of the knowledge perspective.

Almost thirty years later, Shewhart (1939) delineated three steps of the quality control process. This process of quality control incorporated specifying what is wanted, the production of what is wanted to satisfy the specification, and ultimately inspecting the production of what was wanted to ensure that they satisfy the specification. These three steps, According to Shewhart, correspond to putting forward a provisional hypothesis, administering an experiment, and ultimately testing the hypothesis. Conceptually linking quality management to the knowledge perspective, Shewart claimed that “the three steps constitute a dynamic scientific process of acquiring knowledge”.

Ishikawa (1985) endorsed the implementation of ‘quality circles’ to improve organisational performance. The formulation of quality circles is based on five elementary principles, including: voluntarism, self-development, mutual development, participation by all of the members, and continuity. Crucial to the success of quality circles, according to Ishikawa, is an emphasis on teams working closely together on voluntary bases over a long period of time. Although not necessarily stated in such terms, the employment of the quality circles endorsed by Ishikawa, promotes the sharing of tacit knowledge. This implicit and unspoken knowledge, now a hallmark of knowledge management, is extremely difficult to codify and often lost when individuals leave an organisation. The use of quality circles is an apposite method knowledge management that captures the elusive tacit knowledge and transfers it throughout an organization.

Finally, Deming (1994) proposed The System of Profound Knowledge™ that consisted of four basic components: appreciation for system, knowledge about variation, theory of knowledge, and psychology. In terms of understanding and improving an organization Deming believed that these four elements were all interconnected and interact with one another (Deming, 1994). Deming’s system of profound knowledge is not a theory of knowledge, but a set of principles to guide action. Deming (1986) also advocated the PDCA (Plan, Do, Check, Act) cycle, which he described as a “learning cycle”. Later he changed the “Check” step in the PDCA to

“Study” to emphasize learning and reflection aspects of the “learning cycle”.

## **2.4. Technology Management**

The study of technology management provides insights on significant managerial problems, benefiting both academics and practitioners. Some of the important managerial questions answered (at least in part) include – how to assess the potential usefulness of new and existing technologies, how to properly design and implement new technologies, how to manage the investment in new technologies within the organization, how to exploit technology for effective intra-organizational coordination, how to evaluate the value of technology driven or influenced change. And perhaps the most important issue to be addressed, at least the most relevant from this point of view of this research effort, is how to measure the degree to which IT generates business value and productivity improvements.

From a macro perspective, the technology strategy literature can be divided into three major themes – economic, behavioural and process (Shane and Ullrich, 2004). The economic theme is primarily focused on deriving economic explanations for technology strategy and technology’s relationship with overall performance measured on a multitude of units of analysis, ranging from process and sub-process to national or even global outcomes. The behavioural theme of technology strategy generally seeks to identify the source of firm performance, but have considered a variety of topics including: creating new knowledge, the strategy-environment fit, intra-organizational relationships, and the effects of top management team characteristics explanations for technology strategy. Finally the strategic process theme concentrates on understanding, implementing and managing inter-organizational and intra-organizational systems.

Although firms across almost all industries have adopted a wide range of information technology, in many cases it is difficult to calculate the return on such investments. In fact, an increasingly deep body of literature has proposed that there is insignificant evidence to uphold that investments in

IT are linked to increased gains in productivity and performance. There is at least healthy debate between authors such as Brynjolfsson and Hitt (2003, 1996 and 1995) and Lichtenberg (1995) who have written about positive relationships, and authors such as Loveman (1994), Roach (1987) and Franke (1987) who maintain the relationship is negative or non-existent. The lack of reliable quantitative measures for the output and value created by IT has made management's job of justifying investments incredibly difficult.

The relationship between IT and productivity has been extensively debated. Perhaps Snow's (1966) claim that information technology would be "the biggest technological revolution men have known" was one of the earliest and most boisterous, while the Economist's (1990) refute that "computers do not boost productivity, at least not most of the time", the most damning. Nevertheless, the emergence of a "productivity paradox" stimulated a significant number of researchers to argue on both sides of the debate.

As a majority, recent studies uphold that new technological adoption is related to improved firm productivity (Brynjolfsson and Hitt, 2003, 2000, 1999, 1996b, 1995; Lichtenberg, 1995) and even heightened financial performance (Boyer et al., 1997). However questions with regard to the mechanisms of the relationships and the direction of causality, have yet to be answered (Brynjolfsson and Hitt, 2000).

## **2.5. Strategic Human Resource Management**

In this section I review the strategic human resource management literature, uncovering the work binding human capital with performance. Specifically, this work will address the "universal" (or 'best practices'), contingency (or 'fit') and configurations approach to human resource management. This research does not propose that there is one best way approach to manage human capital or is the managerial choice mutually exclusive.

Previous research has proposed the importance of HRM practices in shaping both employee and organisational outcomes (Delaney and Huselid, 1996). Organisations can implement a wide range of human resource management practices to augment employee skills. Led by Peters and Waterman's (1982) portrayal of "excellent" organizations, a general awareness of the benefits of progressive HRM practices and systems have emerged (Delaney and Huselid, 1996). Moreover, Meyer and Collier (2001) have proposed that a wide range of human resource management practices, including the improvement of employee training and the measurement of staff well being, should result in increased organizational results.

Researchers have developed some empirical evidence supporting the claim that specific HR practices can directly affect organizational performance, as studies have shown that comprehensive selection and training correlate with productivity and performance (Russell et al., 1985; and Kleiner et al., 1987). More recently, however, "Bundles" of HR practices have been shown to exert more impact on firm performance than singular practices acting alone (Hueslid, 1995; and MacDuffie, 1995). Additionally, a recurring theme suggests that organizations need to foster a high degree of internal "fit" among their HR practices, for such practices "must fit with and support each other" (Baird and Meshoulam, 1988). There are three primary streams of research linking HR management to performance, Universal, Fit and Configuration, and each will be reviewed in turn.

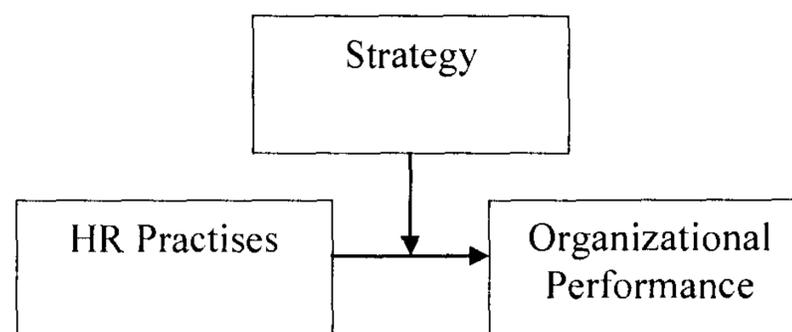
Delery and Doty (1996) advance the Strategic Human Resource Management (SHRM) literature by clearly articulating the important difference among the universalistic, contingency, and configurational perspectives that are used in the literature and then empirically testing hypotheses that are consistent with the logic of each of the three perspectives. According to the authors, Strategic HR practices are those practices related to overall organization performance. Their research found support for the following list of seven across a diverse literature:

Internal career opportunities; Formal training systems; Appraisal measures; Profit sharing; Employment security; Voice mechanisms; Job definition



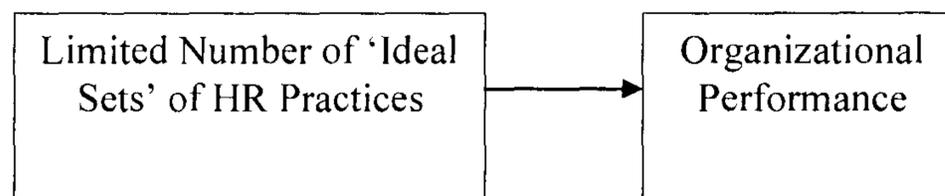
(Figure: Universalist Approach)

- **Universalistic approach** posits that some HR practices are always better than others and all organizations should adopt these practices.



(Figure: Contingency Approach)

- **Contingency approach** posits that in order to be effective, an organizations HR policies must be consistent with the strategy.



(Figure: Configurational Approach)

- **Configurational approach** posits that a discrete (or at least limited) number of 'ideal sets' can result in maximal performance. An ideal type is a pattern of HR policies and practices with an optimal level of horizontal fit or internal consistency.

## 2.6. Knowledge Management

Over many years, a number of authors have proposed a variety of approaches for classifying the tools (methods, practices and technologies) that typically comprise knowledge management systems (Spender, 1996b; Davenport, 1998; Malone et al., 1999). As with any discipline that lacks a recognized unifying paradigm, various views will emerge, each based on what can be readily observed or what can be applied from practices associated with other disciplines. Likewise, as individuals encounter particular phenomena, they tend to describe and interpret them in different ways (Kuhn, 1969).

Knowledge management includes the gamut of procedures and techniques used to maximize the impact of an organization's tacit and codified know-how (Teece, 2000). Although defined in many different contexts ways, knowledge management generally refers to how organizations create, retain, and share knowledge (Argote, 1999; Huber 1991). The study of knowledge sharing, which is the means by which an organization obtains access to its own and other organizations' knowledge, has emerged as a key research area from a broad and deep field of study on technology transfer and innovation, and more recently from the field of strategic management. Increasingly, knowledge-sharing research has moved to an organizational learning perspective.

In developing an understanding as to how firms manage what they know, it is important to underscore the distinction between explicit and tacit knowledge. Whereas explicit knowledge, such as unequivocal facts, figures, symbols and axiomatic propositions, is readily transmittable once put in formal, systematic language (Kogut and Zander, 1992), tacit knowledge is far subtler. Simply put, at the individual level "we know more than we can tell" (Polanyi, 1962) and at the organizational level "organizations know more than what their contracts say" (Kogut and Zander, 1992). Tacit knowledge is the non-verbalized and unarticulated (Polanyi 1962) knowledge that embodies "the way things are done around here" (Spender 1996b).

Overemphasizing explicit knowledge and the formation of hierarchical management, static systems and widespread standardization diminishes firms' potential to create and share new knowledge (Hedlund and Nonaka 1993), thus inhibiting their ability to learn. Polanyi's notion of tacit knowledge and his famous maxim that "...we know more than we can tell" (Polanyi, 1967: 4), reminds us that established firms not only possess product and process knowledge that can be documented and recorded (and rendered useless), but that they also know the intangible and interdependent complementary knowledge that helped them get where they were going.

From the knowledge perspective one could reason that knowledge, when harnessed and managed properly, serves as foundation for providing a sustainable advantage (Davenport, 1998). Thus, tying the movement into the resource-based and suggesting that the knowledge advantage can be sustained because it can lead to the generation of increasing returns and continuing advantages (Barney, 1991; Wright and McMahan, 1992; and Wright et al., 1994). Unlike material assets, which depreciate and decrease in value as they are used, knowledge assets increase with use, Davenport (1998).

## **2.7. Service Profit Chain**

The service profit chain proposed by Schlesinger and Heskett (1991b) integrates distinct bodies of research including human resource management, services marketing and services operations, suggesting a series of relationships linking employee outcomes to customer and business outcomes (Heskett et al., 1994; Loveman, 1998). The framework has roots in Reicheld and Sasser's (1990) investigation of customer satisfaction and loyalty and the ultimate impact these drivers have on firm profitability. Noteworthy, the importance of employee satisfaction was also central to the SPC's development. Specifically, the service profit chain proposes that human resource management practices designed to both

support and enable employees result in capable and satisfied employees (Heskett et al., 1994). This is consistent with the resource-based view in which the resources and capabilities of an organisation serve as a foundation for sustained competitive advantage (Barney, 1991, 1995; Wright and McMahan, 1992; and Wright et al., 1994).



(Figure: Service Profit Chain)

### **3. What is Science?**

Before going forward, it is important to address the process through which an individual comes up with a creative idea (such as a theory?). Can this more creative, possibly less logical process, be specified, and can it be (or has it been to date) incorporated into the scientific process? This chapter will review some of the seminal papers written by social scientists addressing the nature of science, the dynamic process of theory development and the role of empirical investigation. In doing so, the foundation for the guidelines and merits for undertaking this research project (or any other) will be laid.

In science, an agreed upon set of rules exists that determine what constitutes acceptable evidence to support or reject a theory. Each methodology further has its own set of more specific rules for determining evidence within that method. Babbie provides 7 characteristics of science: logic, determinism, parsimony, generality, empirical verifiability, intersubjectivity, and openness to modification. Where to draw the line between parsimony and explanatory detail is a debate in organizational research. In other words, this implies a debate between parsimony and 'truth seeking' because parsimony implies that we do not need to understand the 'true' reason as long as we can predict outcomes. For example, Pfeffer argues that we don't need to include process variables in explaining the impact of diversity on team performance, because amount of diversity alone is sufficiently predictive.

#### **3.1. Science versus Common Sense**

According to Nagel (1961) a continuum exists between "common sense" and "pure science". Nagel identifies a variety of dimensions along which common sense and science are said to differ. Two of the most noteworthy differentiators are: (1) the interest of science in matters not only closely related to human interests and values, and (2) the more rigorous standards of empirical evidence required by science than by common sense to substantiate its claims. In respect of the former, Nagel (1961) asserts that science is concerned with "developing systematic

explanations for extensive ranges of diverse phenomena”. In respect of the latter, he asserts (1961) that science follows a deliberate policy of exposing “its cognitive claims to the repeated challenge of critically probative observational data, procured under carefully controlled conditions.” In other words, to be science results must be replicable by other scientists.

### **3.2. Aim of science**

Braithwaite (1959) appears to somewhat skirt the constructivist-positivist debate in the first half of the chapter, only to assume a highly positivist approach in the remainder of the chapter. He justifies this position by asserting that the philosophy of science (or, in his terms, the “science of perception” which revolves around the role of human experience in science) can be separated from the study of scientific laws. He accordingly claims that both publicly observable data (as in the “natural sciences”) and privately experienced data (as in psychology and as may be utilised in economics and sociology) can be utilised in science. Core propositions made by Braithwaite (1959) included the following:

- The function of a science is “to establish general laws covering the behaviour of the empirical events or objects with which the science in question is concerned, and thereby to enable us to connect together our knowledge of the separately known events, and to make reliable predications of events as yet unknown”
- The essential feature of a science is the hypothetico-deductive method by which specific cases can be deduced from general hypotheses.
- The fundamental unit of analysis in science is a scientific law: “a proposition asserting a universal connexion between properties”.
- Scientific laws are arranged in a “scientific system” such that “from some of the hypotheses as premises all the other hypotheses logically follow”

- A deductive system is tested by empirically testing its lowest-level propositions in application to cases. Empirical evidence never proves a hypothesis: “in suitable cases one may say that it establishes the hypothesis, meaning by this that the evidence makes it reasonable to accept the hypothesis; but it never *proves* the hypothesis in the sense that the hypothesis is a logical consequence of the evidence”. A hypothesis can be proved to be false (or refuted), however, by a single known contrary instance. This asymmetry entails logical deduction in the case of refuting hypotheses, and induction in the case of establishing hypotheses.
- The logical strength of hypotheses increases the higher their level. A hypothesis in a deductive system is supported both by instances that provide direct support and by instances that support higher-level hypotheses from which the specific measurable hypotheses logically follow. It thus is very difficult to directly refute hypotheses at the “grand theory” level, such as the economic premise of self-interest. A substantial body of non-supporting evidence at mid-range theory level is required before a grand theory can validly be refuted.

### 3.3. Theory Development

Psychologists involved in creativity research do study this as a cognitive process, and differ in their beliefs of to what extent it is fundamentally different from typical ‘logical’ processes. This work has had only superficial impact to date on organizational research. To what extent should one consider the normative implications in defining our research agenda or reporting our findings?

- From a positivist perspective, theory can never be proven, and therefore can never be normative (because we do not definitively know whether it is correct). Rules on process, not content, determine the scientific validity of a piece of research. Each individual must set his own ethical standards to guide the content of his research. Positivists also believe that anything that meets the standards of evidence in the

field should be published, even if it is counter-normative. As positivists, they believe it is possible and desirable to be separate from personal values, so as a scientist one stands away from the normative implications of research.

- From a constructivist perspective it is impossible to be separate from our personal values. Therefore, it is incumbent on the learned and scholarly community to police what individuals say under the guise of 'science' or 'scholarly opinion.' Hence, it is appropriate, even ethically necessary, to intervene to stop certain research from being published if we believe it will do harm to others.

### **3.4. Theory Construction v. Truth Seeking**

Davis (1971) examines a set of 'interesting' theories and suggests that the most interesting theories are counter-intuitive.

- In doing so, Davis both provides helpful advice for how to push forward and refine your own theory development and reminds us of the importance of how research results are communicated.
- In order for your ideas to appeal to others, you need to keep your audience in mind when presenting ideas. In the process of creating consensus about ideas, you risk that they seem too obvious, and therefore uninteresting; without sufficient consensus building, your ideas may seem too provocative and removed from the mainstream.

### **3.5. Empiricism versus phenomenology**

- Empiricism means governed by rules of observation, connected to sense data. It is often misinterpreted as 'quantitative' and 'lacking in theory', but it need not be either.
- Phenomenology means that description of phenomena rather than theory testing and does not have to be generally representative; we can disagree about 'what exists'.

- Sutton & Staw (1995) argue that organizational research is insufficient in theory development, and that authors substitute references, data, variables, diagrams and hypotheses for theory.
- They recommend lowering empirical standards for theoretical articles to address the imbalance of skills in the field.
- Weick responds to remind us that each of these substitutes has an important potential role in the process of theory development. DiMaggio suggests that there are different types and purposes of theories, some of which may be served by these substitutes.

## **4. Methodology**

This chapter presents the study's underlying methodology, from theory development, to data collection, and ultimately, hypothesis testing. First, the general principles of social science and research design will be reviewed. Then the data collection process will be outlined. It is noteworthy that two separate datasets will be employed for this project, the International Hedge Fund Research Centre (IHFRC) database and the International Service Study (ISS). The process for constructing sound multi-item scales will be sketched out followed by the requisite data checking procedures. Special attention will be paid to identifying common method bias, multicollinearity, outliers and ensuring independence of the error term. Finally, the critical assumptions behind the use of order of least squares (OLS) regression will be assessed, and its employment for hypothesis testing will be justified.

### **4.1. Data**

The data to test the hypotheses of Essay 1 will be gathered from the ISS dataset, an international, multi-year, research effort designed to gain insights into state of the art managerial practices within the services sector. The data to test the hypotheses of Essay two will come from the International Hedge Fund Research Centre (IHFRC) dataset, a bold new research effort designed to assess dynamic practices that lead to managerial and financial success in a poorly understood segment of the services sector, the hedge fund industry.

#### **4.1.1. IHFRC Dataset**

The data to test the proposed hypotheses will be obtained from the International Hedge Fund Research Centre (IHFRC) dataset. Commencing in 2004, the IHFR is a focused research initiative designed to determine pioneering management practices and to investigate a wide set of factors hypothesized to influence performance (Roth, Chase, and Voss 1997; Voss et al.1997). The IHFRC

questionnaire was strategically designed to determine cutting edge knowledge management practices, assessing the acquisition and transfer of tacit and explicit knowledge, and to investigate a variety of factors hypothesized to impact hedge fund performance. It draws from service operations and knowledge perspective literature.

From a universe of over 7000 hedge funds operating around the globe, including firms from North America, South America, Europe and Asia, a large sample of hedge funds were investigated in order to obtain the study's dataset. Measuring at the firm level, multiple respondents from each hedge fund were asked to participate in the study. The investigation focused on these financial services companies for two primary reasons: (1) Due to the logistical difficulties of managing a hedge fund, these firms have strong incentives to implement IT and have been early to adapt such applications; (2) given the knowledge intensive nature of this segment of the services industry, successfully managing new and existing knowledge is mission critical in order to compete.

In aggregate, over 45 focused questions were developed for the IHFR survey. The structure of the questionnaire and a list of the individual questions used to derive multi-tem indices are shown in section 5.3 ("Measures"). Each was assessed on a 5-point Likert scale, and each had a question descriptor. The scales also had descriptors of the states of practice or performance, ranging from 1 to 5, where 1 indicated low (poor) levels of best practices (performance) and 5 indicated state-of-the-art (outstanding) levels of practices (performance). Descriptors 2, 3, and 4 represented intermediate points. All questions were field tested, reviewed by subject experts, and where appropriate, revised before final use, based on tentative reliability and validity.

Sample firms were selected from a variety of sources, including trade journals and industry databases known to be comprehensive. The sample was stratified to envelop a wide range of organizational sizes; very small funds were excluded from the study. Although the resulting

sample is somewhat biased toward top performing hedge funds such sampling is suitable for exploratory research investigating unique or complex phenomena (Pinosonneault and Kraermer, 1993; Roth et al., 1997; Voss et al., 1997).

Data was collected by interview. At each Fund, multiple respondents were interviewed. The groups of interviewees were comprised of knowledgeable people throughout the organization, ranging from senior managers to junior analysts. Three researchers participated in every interview. The scores used in this analysis were determined by the team of research interviewers. Structured discussion of areas of disagreement among the individual responses, extensive probing for clarification and supplemental data collected to validate individual responses.

#### **4.1.2. ISS Dataset**

The data to test the hypotheses in this study were obtained from the European subset of the International Service Study (ISS). Started in 1996, the ISS is a collaborative research initiative designed to determine state-of-the-art service management practices and to investigate a wide set of factors hypothesized to influence performance (Roth, Chase, and Voss 1997; Voss et al.1997). The ISS research framework, drew on a range of sources, the most central of which was the "service profit chain" (Heskett et al., 1994), which postulates a chain of interaction from management of the workforce, through productivity, service quality, customer satisfaction, customer retention, to profitability. The questionnaire was designed specifically to determine cutting edge service management practices and to investigate a wide set of factors hypothesized to influence performance (Roth, Chase, and Voss, 1997; Voss, Blockmon, Chase, Rose and Roth, 1997).

To increase the validity of the overall model, it was tested against three established practitioner models: the Malcolm Baldrige National Quality

Award (NIST 1996), the European Quality Award (European Foundation for Quality Management 1996), and from the United Kingdom, the Citizens' Charter (1996). All three were widely used and accepted by commercial and non-commercial service organizations at the time of the study. The Baldrige model has been shown to have content, construct, and predictive validity; it is also broader than other models in these areas (Pannirselvam, Siferd, and Ruch, 1998).

Overall, 80 questions were developed for the ISS survey. The structure of the questionnaire and a list of the individual question topics are available in Roth, Chase, and Voss (1997). Each was assessed on a 5-point scale, and each had a question descriptor. The scales also had descriptors of the states of practice or performance, ranging from 1 to 5, where 1 indicated low (poor) levels of best practices (performance) and 5 indicated state-of-the-art (outstanding) levels of practices (performance). Descriptors 2, 3, and 4 represented intermediate points. All questions were field tested, reviewed by subject experts, and where appropriate, revised before final use, based on tentative reliability and validity.

Sample firms were selected from a variety of sources, including trade directories and government sources. The sample was stratified to envelop a wide range of organizational sizes; very small services were excluded from the study. Although the resulting sample is somewhat biased toward leading service organisations, such sampling is suitable for exploratory research investigating unique or complex phenomena (Pinosonneault and Kraermer, 1993).

Data was collected by interview. At each site a 'diagonal slice' team was formed of knowledgeable people from a range of departments, ranging from front line employees to senior management. Each answered the questionnaire individually, and then met to form a consensus. One or two researchers or facilitators met with the team. The scores used in this analysis were determined by the research interviewers based on structured discussion of areas of disagreement

among the individual responses, extensive probing for clarification and supplemental data collected to validate individual responses. The use of interviews rather than survey methods for data collection addressed the difficulties associated with the use of single respondents (Huber and Power, 1985), and greatly reduced the possibility of both response and common method bias (Flynn et al., 1990). To minimize the effect of response bias and to minimize any interviewer effects, the interviewers were exposed to a wide range of firms and their assessment scoring of organisations were cross-evaluated for calibration and consistency.

## **4.2. Measures**

Multi-item scales have been constructed to capture each construct. Each of the scales has been empirically validated with confirmatory factor analysis using maximum likelihood extraction. Each solution demonstrated satisfactory unidimensional qualities, producing only one factor with an eigenvalue greater than 1.0 and accounting for at least 60 percent of the total variance (Hair, Anderson, Tatham and Black, 1998). To further establish the reliability of the scales, Cronbach's alpha was used to measure the degree of internal consistency. Conventional wisdom holds that values greater than or equal to 0.70 for existing scales and 0.60 for new scales to be acceptable (Churchill, 1979; Flynn et al., 1990). All of the tests for internal validity were satisfactory; Cronbach's alpha for the scales measuring the study's independent variables (it, hrm and infra), all exceeded 0.80, and Cronbach's alpha for the dependent variable (operperf) exceeded 0.60. Finally, a thorough analysis of the literature helps to ensure content validity. The full operationalization of the scales is outlined in Appendices A (Research Essay I) and B (Research Essay II).

## **4.3. Data Checking**

### **4.3.1. Common Method Bias**

A common potential threat to survey research is common method bias. Because multiple respondents assessed each firm's IT, HRM,

infrastructure, innovation, growth and operational performance, common-method bias is of limited concern. However, for purposes of conservatism, Harmon's one-factor test (Podsakoff and Organ 1986) was used to check whether common method bias was present. Four factors with eigenvalues greater than one were extracted from all the measures in this study and in total accounted for 59% of the variance. The first factor accounted for 18% of the variance. Since a single factor did not emerge and one-factor did not account for most of the variance, this suggested that the results were not due to common-method bias (Tsikriktsis and Frohlich, 2003).

#### **4.3.2. Independence of Error Term:**

We assume in regression that each predicted value is independent, that is, the predicted value is not related to any other prediction and not sequenced by any variable. If the residuals are in fact independent, the pattern should appear random. In the inspection of the residual plots I did not identify any distinct patterns in the plots indicating non-independence of the error terms.

#### **4.3.3. Outliers**

Upon inspecting the scatterplots for extreme outliers unrepresentative of the population, I found no cases where the omission of datapoints was fully justified. Regardless, "Specialized regression methods (e.g., robust regression) have been developed to deal specifically with outliers impact on the regression results", (Hair et al 1998). Taking advantage of these new techniques, robust regression was employed in the analysis.

#### **4.3.4. Multicollinearity**

Multicollinearity occurs when any single independent variable is highly correlated with a set of other independent variables, thus affecting both the regression procedure and the researcher's ability to interpret the data. Multicollinearity results in larger portions of shared variance and

lower levels of unique variance, reducing the accuracy in estimating the regression coefficients and their statistical significance tests. To identify potential multicollinearity, I first examined the correlation matrix of independent variables. Not finding any correlations near 0.90 (the traditional benchmark), I felt confident that multicollinearity was not an issue in our model. However, to assess pairwise and multiple variable collinearity, I calculated the tolerance values, and its inverse, the variance inflation factors (VIF). A common cut-off threshold of tolerance is .10, which corresponds to a VIF above 10.

All of the variables appeared quite satisfactory. To counter the potential effects of multicollinearity, I mean-centred the variables in the moderation models to alleviate the problem.

#### **4.4. Multivariate Analysis**

##### **4.4.1. Hypothesis testing using OLS**

Multiple regression analysis is a popular multivariate analysis technique used by researchers across many disciplines. According to Hair, Anderson, Tatham and Black (1998) the purpose of multiple regression analysis is to use the known values of multiple dependent variables to predict a single dependent value of interest to the researcher. In its simplest terms the multiple regression equation is written as:

$$Y = b_0 + b_1X_1 + b_2X_2$$

Where:

$b_0$  = intercept

$b_1X_1$  = linear effect of  $X_1$

$b_2X_2$  = linear effect of  $X_2$

Multiple regression is a dependence technique (variable must be divisible into dependent or independent variables) that requires the variables under scrutiny to be metric. Wooldridge (2002) points out that multiple regression analysis is amenable to *ceteris paribus* analysis as it enables researchers to explicitly control for multiple factors that simultaneously effect the dependent variable. Applying a mathematical techniques known as the order of least squares (OLS), researchers can estimate the values of  $b_0$  and  $b_1$  such that the sum of the squared error term is minimized (Hair et al., 1998). In doing so, we are using the same criterion and can whether the predictive power from the independent variable is improved over the baseline prediction. Multiple regression analysis is a very straightforward and appealing technique, and because it allows many (potentially) correlated independent variables, we can “hope to infer causality in cases where simple regression analysis would be misleading” (Wooldridge, 2002:68). It is, however, important to bear in mind that its use is subject to a meaningful set of (limiting) assumptions.

The 5 Gauss-Markov assumptions collectively justify the use of OLS method over a range of competing estimators. Under assumptions 1 through 4, OLS is an unbiased estimator. And by incorporating assumption 5, it is argued that under all five assumptions (for cross-sectional regression) the OLS estimator is the best (most efficient) linear unbiased estimator. My observations and treatment of the five relevant assumptions are outlined briefly below.

- The first assumption is **Linearity in Parameters**: The presence of a consistent curvilinear pattern in the residual plots highlights the potential existence of a nonlinear relationship. Upon Examination of the residual plots, nonlinearity did not appear to be a problem.
- The second assumption is **Random Sampling**: Probably the most commonly occurring violation of the assumptions and for OLS to be unbiased we need this assumption to be true. Analysis of a normal probability plot confirms a normal distribution.

- The third assumption is **Zero Conditional Mean**: The error  $u$  has an expected value of zero, given any values of the independent variables. This assumption will fail if the relationship between the variables is mis-specified in the equation. Omitting an important factor that is correlated with any of the variables can cause misspecification. Such misspecification results in regression models that fail to properly account for the relationship between predictor and explanatory variables (Wooldridge, 2002). Results from the Ramsey (1969) regression specification error test (RESET) indicate that omitted variables do not appear to be a problem in the data.
- The fourth assumption is **No perfect Collinearity**: Singularity is the extreme case of collinearity that occurs when an independent variable is perfectly predicted (a correlation of  $+ / - 1.0$ ) by one or more other variables. Regression models cannot be estimated when singularity exists. Upon inspection of the correlation matrix, I have determined that singularity is not a potential problem in the data.
- The fifth assumption is **Homoscedasticity**: The presence of unequal variances in the error term (heteroscedasticity) is one of the most common assumption violations. Heteroscedasticity can be diagnosed by an examination of the residual plots or through simple statistical tests, such as Szroeter's test for homoskedasticity. Having performed both procedures, I have not identified heteroscedasticity in the data

## 5. Research Essay I

# IT and firm performance: a direct, moderated or mediated relationship?

### Abstract

Exploring the productivity paradox in the services industry, this paper investigates empirically the impact of implementing information technology (IT) on operational and financial performance. Specifically, this study examines how the illusive relationship between IT and firm performance can be made clear by testing for direct, mediated and moderated relationships. Because managers choose not only whether to invest in IT, but also what types of applications in which to invest and to what scope and scale to implement them, endogeneity is a viable concern in this type of analysis. Supplementing OLS models with the application of instrumental variables regression, this study addresses the threat of biased and inconsistent estimators caused by endogenous explanatory variables. Based on a sample of 188 service firms, this work demonstrates that IT has a direct effect on operational performance and an indirect effect, when mediated by human enabling human resource management, on both operational and financial performance. The findings have important implications for service firms interested in improving their performance through employing IT and human resource management systems.

Keywords: information technology, human resource management, productivity paradox, endogeneity, moderation, mediation and empirical research

## 1. Introduction

Despite the widespread adoption of information technology (IT), not only do firms struggle to determine the value of such investments, but also a significant body of literature has proposed that there was little evidence to support that investments in IT were associated with increased productivity or performance. While positive associations have been reported (Brynjolfsson and Hitt, 2003, 1996 and 1995; Lichtenberg, 1995) so too have non-existent and even negative relationships (Loveman, 1994; Roach, 1987; Franke, 1987). The lack of reliable quantitative measures for the output and value created by IT has made management's job of justifying investments incredibly difficult. Disappointment in IT has been chronicled in articles disclosing low IT capital productivity in a variety of industries (Berndt and Morrison, 1995; Morrison, 1996; Parsons, Gottlieb and Denny, 1990), and naturally this can be interpreted as a negative signal of its value.

The relationship between IT and productivity has been widely discussed but remains poorly understood. Given the enormous promise of such applications to usher in "the biggest technological revolution men have known" (Snow, 1966), intermittent disappointment and even disenchantment with information technology could not be ignored when statements such as "No, computers do not boost productivity, at least not most of the time", (Economist, 1990) were published in the literature. The emergence of the "productivity paradox," as it became known, stimulated a significant amount of research. Robert Solow (1987) summarized this apparent inconsistency in his well-known remark: "You can see the computer age everywhere except in the productivity statistics." Subsequent work, first at the industry level often finding no relationship, and later at the firm level uncovering a range of indirect relationships, has largely added to the confusion.

A number of industry level studies failed to find evidence supporting a clear association between IT and productivity. Research found that the impact of information technology on multifactor productivity was quite low between 1974

and 1987 (Parsons, Gottlieb and Denny 1990), and even associated with a sharp drop in capital productivity and stagnation in labour productivity (Franke, 1987). Moreover, in several papers examining Bureau of Economic Analysis data for manufacturing industries at the two-digit SIC level, Morrison and Berndt found that the gross marginal product of "high tech capital" was less than its cost and that in many industries these supposedly labor-saving investments were actually associated with an increase in labour demand (Berndt and Morrison, 1995; Morrison, 1996). However, optimism about the future potential of IT and speculation that it had positioned the industry for greater growth in the future was widely held. More recently, studies employing growth accounting techniques find that the annual contribution of IT to output growth in the second half of the 1990s were not only positive, but ranged from 1.0 to 1.1 percentage points per year (Oliner and Sichel, 2000; Jorgenson and Stiroh, 2000). Moreover, increased productivity in government activities both at the process level, such as postal package sorting and transport toll collection (Muhkopadhyay, Rajiv and Srinivasan, 1997) and at higher levels of aggregation (Lehr and Lichtenberg, 1998) have been linked to computerization.

As illustrated above, much of the early research on the relationship between technology and productivity using industry-level data found little evidence of a relationship between IT and productivity. Although similar conclusions have been repeated by a number of researchers, one must be careful not to over interpret these findings; in fact, many of the most widely cited aspects of the "paradox" do not stand up to a more thorough investigation (Brynjolfsson and Hitt, 1996b). Moreover, a growing body of work has indicated that new technologies do in fact impact productivity, but in many cases interpreting the relationship requires mediating or moderating mechanisms (Boyer et al. 1997; Bresnahan, Brynjolfsson and Hitt, 2002, 2000; Brynjolfsson and Hitt, 2003, 2000 and 1999; Ettlé, 1988; Meredith, 1987; Saraph and Sebastian 1992; and Zuboff, 1988).

Generally, recent studies advocate that new technological adoption is associated with enhanced firm productivity (Brynjolfsson and Hitt, 2003, 2000,

1999, 1996b, 1995; Lichtenberg, 1995) and even improved financial performance (Boyer et al., 1997). Having said that, questions in regard to the mechanisms of the relationships and the direction of causality, remain unanswered (Brynjolfsson and Hitt, 2000). Despite the fact that social science researchers have a long history of demonstrating mediated and moderated relationships, these functions, and even terms, have often been used interchangeably and incorrectly (Baron and Kenny, 1986). Whereas moderators specify when specific effects will hold, mediators explicate why and how such effects occur (Baron and Kenny, 1986). Generally speaking, a moderator is a quantitative or qualitative variable that impacts the strength and/or the direction of the relation between an independent and dependent variable (Baron and Kenny 1986). Within this framework, the existence of moderation indicates that the causal relationship between two variables changes as a function of the moderator (see Figure 1a). Mediation is fundamentally different from moderation. Broadly, a given variable serves as a mediator to the extent that it accounts for the relation between the independent and dependent variable. A standard example of a mediation hypothesis predicts that an active entity intervenes between stimulus and response (Baron and Kenny, 1986). This simple model assumes a three variable system providing two causal paths to the outcome (see Figure 1b). Many of the past failures to unearth or to interpret a clear link between technological implementations and increased productivity may be in part attributed to the poorly understood purpose and nature of the complex relationships.

Applying a series of straightforward techniques to test for mediation and moderation, in addition to testing for a direct association, the purpose of this paper is to investigate and expose the illusive relationship between the adoption of information technology and firm level operational and financial performance. While much of the earlier research addressing the relationship between technology and productivity has been set in a manufacturing setting, to further differentiate this study, I investigate exclusively whether investments in IT for service firms correspond to increased performance.

## 2. Theoretical Foundation and Hypotheses

As no universally accepted definition exists in the literature, it is difficult to know what precisely is meant by IT. Hamelink (1997) defines information technology as “those technologies that enable the handling of information and facilitate different forms of communication, including: capturing technologies, storage technologies, processing technologies, communication technologies and display technologies”. Brynjolfsson and Hitt (2000) describe IT as “computers and related digital communication technology that has the potential to reduce the costs of coordination, communications, and information processing”. In this paper I assume the latter definition of information technology in light of its conceptual breadth.

### 2.1. Direct Link

Business leaders and academics have long come to realize that the essential assets of today’s society are no longer land or unskilled labour, as they were in agricultural or pre-industrial society, or factories and financial capital, as they were throughout most of the industrial revolution (Edvinsson and Malone, 1997). Instead, in the age of the information, or knowledge society, the most successful firms are often those that best leverage information and knowledge assets. In a sample containing multiple industries, Black and Lynch (1996) found that plants where a greater percentage of personnel use computers achieve superior levels of productivity. Moreover, a growing number of companies utilize IT to capture firm knowledge in order to create and disseminate detailed process maps for the gamut of business activities (Malone et al., 1999; Sheer 1994; Winograd and Flores, 1986) to drive operational performance. Proponents argue that it is not a question whether such systems are useful, but rather how to improve upon them (Malone et al., 1999). Broadly, firms of all sizes and functions around the world use information technology in production, distribution, logistics, accounting, marketing and new service development to strip out barriers to communication (Teece, 1998) and ultimately drive performance. Aside from



indirect benefits to the firm, IT can have a direct effect on the organization that is disproportionate to its cost (Brynjolfsson, Hitt and Yang, 2002). Thus I propose the following hypotheses:

***H1: Information technology intensity is related to firm level operational performance (H1a) and financial performance (H1b).***

Human resources are often considered a company's most valuable resource, and human resource management is the means by which firms manage these precious assets. Research has shown that human resource practices can directly affect both firm productivity and performance (Youndt et al., 1996; Hueslid, 1995). Arthur (1992, 1994) has reported that certain human resource management systems are related to superior performance while others are connected to inferior performance. Influenced by Porter's (1980, 1985) argument that there are two viable generic strategies that firms can utilize to achieve and maintain a sustained competitive advantage over their rivals, Arthur examined the concept that there are two generic HRM strategies that firms tend to employ, *cost reduction* or *commitment maximization*. Research found that firms pursuing cost reducing HRM systems were characterized by intense supervision, narrowly defined tasks, minimal skill requirements and low, often hourly, wages. These *human-controlling* HRM systems were associated with lower performance. In contrast, firms employing a commitment maximization strategy focused on enhancing employee commitment through participation, comprehensive training, decentralized decision-making and salaried compensation. Such *human-enabling* HRM systems were connected with superior performance. This view has undergone a great deal of scrutiny and a significant body of research argues that best practices in human resource management lead to enhanced firm performance (Huselid, 1995; MacDuffie 1995; Delaney & Huselid, 1996; Ichniowski, Shaw and Prennushi, 1997; and Pfeffer, 1998). This leads to the following hypotheses:

***H2: Human resource management is related to firm-level operational performance (H2a) and financial performance (H2b).***

As with any tool or resource, I argue that IT can be used effectively or ineffectively and applied regularly or sporadically. Substantial variance in the relationship between IT and firm performance (Brynjolfsson, 2003) indicates that some firms use their resources (including IT) to their full potential while others fail to do so. I propose that the performance gains made possible with IT is contingent upon its effective use, hence the role of people, the users of IT, and human resource management are of fundamental importance. To better understand the relationship between IT and firm performance I examine not only the direct relationship between HRM and firm performance, but also human resource management's general ability to mediate and/or moderate the relationship between IT and the firm outcome.

## **2.2. Moderation**

A substantial body of literature supports the notion that "hard" technological implementations are buttressed by "softer" infrastructure in order to be successful (Boyer et al. 1997; Saraph and Sebastian 1992; Meredith, 1987; Ettlie, 1988; and Zuboff, 1988), indicating a moderated relationship. Likewise, other studies have shown that employee training, attitude and encouragement play a crucial role in the successful adoption of new technological tools (Frohele, Roth, Chase and Voss 2000; Agarwal and Prasad 1997; Leonard-Barton and Deschamps 1988). Operations management researchers have also found that investments in advanced manufacturing technologies (AMT), to improve business performance, not only often "fail to live up to their promise", but that "there are more failures than successes in AMT implementation" (Saraph and Sebastian 1992). Observers have "diagnosed the widespread problem as failure to balance investments" in AMT with the necessary investments in supporting infrastructure (Meredith, 1987; Ettlie, 1988; and Zuboff, 1988). Thus, firms that successfully implement IT not only invest in the new technology but also in the requisite supporting complements. The investment payoff occurs only when both investments are made and a fundamental interaction between the two items drive performance.

Testing this relationship empirically, Boyer et al. (1997) examined whether investments in advanced manufacturing technologies lead to an improvement in firm performance if made in conjunction with complementary investments. Results from their hierarchical regression suggest that there is an “instrumental interaction” between the adoption of new AMT and investments in infrastructure. Investment in new AMT led to enhanced performance only when complemented by supporting infrastructure. Thus, their data suggests that appropriate organizational structures are crucial to realizing the potential of technological investments.

Investment in IT for services firms, in many respects, is comparable to investments in AMT for manufacturing firms. Specifically, as in the case of AMT adoption, IT initiatives are difficult and frequently fail (Brynjolfsson, Hitt and Yang, 2002). If Boyer et al. (1997) found that an instrumental interaction with supporting infrastructure is necessary for “unlocking the potential” benefits of technological advancements in manufacturing; one can then reason that services firms require similar co-investment to fully capitalize on their investments in IT. To assess whether the strategic interaction effect is necessary for harnessing the advantage of the IT, I investigate HRM’s capacity to serve as the moderating instrument. I therefore put forth the following hypotheses:

***H3: Human resource management moderates the positive relationship between information technology and firm level operational performance (H3a) and financial performance (H3b).***

### **2.3. Mediation**

Social scientists have long recognized the fundamental importance of mediating variables, and already in 1928 Woodworth introduced a simple model wherein a dynamic entity mediates between stimulus and response (see figure 1b). This same model can be used to demonstrate whether the relationship between IT and performance is made clear by an apposite mediator.

Broadly, new technologies change the way that work is controlled, measured and reported (Baker and Hubbard, 1999). Merely purchasing and plugging in new PCs and telecommunications equipment does not account for the performance gains from IT; rather research has shown successful implementations mandate new work systems, organizational redesign, and business process reengineering (Bresnahan, Brynjolfsson and Hitt, 2002; Brynjolfsson and Hitt, 2003, 2000 and 1999). In a similar vein, research has shown that several of the skill, wage and other organizational effects of IT depends on the extent to which firms couple computer investment with organizational redesign and other managerial decisions (Hunter, Bernhardt, Hughes and Skuratowitz, 2000; Murnane, Levy and Autor, 1999). From this perspective the implementation of IT is assumed to cause organizational change, suggesting that such change serves as the intervening mechanism that mediates IT's relationship with firm performance.

With mediated relationships, there are often multiple mediators (Baron and Kenny 1986); organizational design, business process engineering, new work systems and managerial decisions are not one mediator but many. To investigate a mediated relationship between IT and firm performance I again concentrate explicitly on one central component, human resource management, allowing us to more narrowly address the relationship and to present more precise findings. Consistent with the idea that investment in IT is associated with a greater demand for human capital, thus causing investment in human enabling HRM, a host of studies have shown a strong connection between investment in new technological equipment and increased demand for specially skilled and educated workers and greater decentralization (Black and Lynch, 2001; Bresnahan, Brynjolfsson and Hitt, 2000, 2002; Brynjolfsson and Hitt, 2000, 2003; Brynjolfsson, Hitt and Yang, 1999, 2002). Furthermore, exploring HRM as a mediator is conceptually sound as it is managed humans that actually utilize IT to transform inputs into outputs; hence, investments in IT naturally cause complementary investments in HRM. This leads to the following hypotheses:

***H4: Human resource management mediates the positive relationship between information technology and operational performance (H4a) and financial performance (H4b).***

### **3. Dataset**

#### **3.1. Data Collection**

The data to test the hypotheses in this study were obtained from the European subset of the International Service Study (ISS). Started in 1996, the ISS is a collaborative research initiative designed to determine state-of-the-art service management practices and to investigate a wide set of factors hypothesized to influence performance (Roth, Chase, and Voss 1997; Voss et al. 1997). The ISS research framework, drew on a range of sources, the most central of which was the "service profit chain" (Heskett et al., 1994), which postulates a chain of interaction from management of the workforce, through productivity, service quality, customer satisfaction, customer retention, to profitability. The questionnaire was designed specifically to determine cutting edge service management practices and to investigate a wide set of factors hypothesized to influence performance (Roth, Chase, and Voss, 1997; Voss, Blockmon, Chase, Rose and Roth, 1997).

To increase the validity of the overall model, it was tested against three established practitioner models: the Malcolm Baldrige National Quality Award (NIST 1996), the European Quality Award (European Foundation for Quality Management 1996), and from the United Kingdom, the Citizens' Charter (1996). All three were widely used and accepted by commercial and non-commercial service organizations at the time of the study. The Baldrige model has been shown to have content, construct, and predictive validity; it is also broader than other models in these areas (Pannirselvam, Siferd, and Ruch, 1998).

Overall, 80 questions were developed for the ISS survey. The structure of the questionnaire and a list of the individual question topics are available in Roth, Chase, and Voss (1997). Each was assessed on a 5-point scale, and each had a question descriptor. The scales also had descriptors of the states of

practice or performance, ranging from 1 to 5, where 1 indicated low (poor) levels of best practices (performance) and 5 indicated state-of-the-art (outstanding) levels of practices (performance). Descriptors 2, 3, and 4 represented intermediate points. All questions were field tested, reviewed by subject experts, and where appropriate, revised before final use, based on tentative reliability and validity.

Sample firms were selected from a variety of sources, including trade directories and government sources. The sample was stratified to envelop a wide range of organizational sizes; very small services were excluded from the study. Although the resulting sample is somewhat biased toward leading service organisations, such sampling is suitable for exploratory research investigating unique or complex phenomena (Pinosonneault and Kraermer, 1993).

Data was collected by interview. At each site a 'diagonal slice' team was formed of knowledgeable people from a range of departments, ranging from front line employees to senior management. Each answered the questionnaire individually, and then met to form a consensus. One or two researchers or facilitators met with the team. The scores used in this analysis were determined by the research interviewers based on structured discussion of areas of disagreement among the individual responses, extensive probing for clarification and supplemental data collected to validate individual responses. The use of interviews rather than survey methods for data collection addressed the difficulties associated with the use of single respondents (Huber and Power, 1985), and greatly reduced the possibility of both response and common method bias (Flynn et al., 1990). To minimize the effect of response bias and to minimize any interviewer effects, the interviewers were exposed to a wide range of firms and their assessment scoring of organisations were cross-evaluated for calibration and consistency. Because common method bias is a potential problem in survey research, Harmon's one-factor test (Podsakoff and Organ, 1986) was used to check whether common method bias was present. Five factors with eigenvalues greater than one were extracted from all the measures in this study and in

total accounted for 61% of the variance. The first factor accounted for 26% of the variance. A single factor did not emerge and one-factor did not account for most of the variance, suggesting that the results were not due to common-method bias.

### **3.2. Scale Development**

Multi-item scales have been constructed to capture each construct enabling finer distinctions among respondents to be drawn (Boyer and Pagell, 2000; Flynn et al. 1990). Each of the scales has been empirically validated with factor analysis using maximum likelihood extraction. To further establish the reliability of the scales, Cronbach's alpha was used to measure the degree of internal consistency. Conventional wisdom holds that values greater than or equal to 0.70 are preferred but values above 0.60 to be acceptable (Boyer and Pagell, 2000; Churchill, 1979; Flynn et al., 1990). All of the tests for internal validity were satisfactory; the scales measuring the study's independent variables Cronbach's alpha exceeded 0.80 (IT, HRM and infra), and all exceeded 0.60. Finally, a thorough analysis of the literature helps to ensure content validity. The full operationalization of the scales is outlined in Appendix A.

### **3.3. Independent Variables**

This study employs two multi-item indices, "IT" and "HRM", to capture the study's explanatory variables.

*Information technology* (IT) is employed to measure the degree and intensity of firms' information technology implementation. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.89.

*Human resource management* (HRM) assesses the nature of firms' human resource management systems, emphasizing the four most universally accepted areas of HRM: staffing, training, performance and appraisal (Youndt, Snell, Dean and Lepak 1996). Higher scores on this scale are indicative of a human enabling HRM system, whereas low scores indicate a

human controlling structure. Again, Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.84.

### **3.4. Dependent Variables**

The study will assess firm performance on two levels of measurement, operational and financial performance, with multi-item indices.

*Operational performance* assesses firms' relative productivity, internal productivity and operating costs. The reliability of the performance measure was assessed with Cronbach's alpha. The result of 0.62 was less than desirable but satisfactory.

*Financial performance* assesses firms' relative margins, return on net assets and cashflow. The reliability of *financial performance* was assessed with Cronbach's alpha. The result of 0.64, again, was less than desirable but satisfactory.

### **3.5. Control Variables**

Firms may have varying levels of success implementing new technologies because they have disparate levels of supporting infrastructures, thus making incremental investments in IT more or less difficult (Brynjolfsson and Hitt, 2003). Firms with more extensive supporting infrastructure may be better able to capitalize on their IT implementations than firms with less robust support. Therefore, all of the models will control for any extraneous effects of such supporting infrastructure.

*Infrastructure* assesses firms' level supporting infrastructure. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were quite satisfactory at 0.81.

Growing firms may be more likely to have further developed IT implementations and HRM systems than stagnant or shrinking firms, therefore all of the models will control for any extraneous effects of *growth*.

Firms' country of origin may have a large impact on their ability to successfully implement IT, therefore all of the models will control for any extraneous effects related to country of origin. Specifically I control for country affects from the *United Kingdom, Ireland and Cyprus*.

#### 4. Methods

To test the hypothesized direct, mediated and moderated relationships, I employ order of least squares regression (OLS). Additionally, to ensure that the presence of endogeneity has not caused the OLS estimates to be biased or inconsistent, I run instrumental variables regression (IVREG) and a series of diagnostic tests (Wooldridge, 2002).

Before testing hypotheses 1 through 4, I examined the descriptives and tested specifically for multicollinearity, heteroscedasticity and omitted variables (see Table 1).

Variable	Obs.	Mean	Std. Dev.	Min	Max
IT	188	2.974332	.6716424	1.3333	4.3333
HRM	188	2.797644	.6119029	1.3333	4.3333
Infra	188	2.755318	.8764093	.3333	5
IT*HRM	188	.1186894	.4495024	-.7707	2.4029
Growth	188	3.468085	.6891385	1	5
Perf	188	3.189718	.5675424	1.6667	4.6667

To identify potential multicollinearity, I first examined the correlation matrix of independent variables (see Table 2a). Not finding any correlations near 0.90 (the traditional benchmark), I felt confident that multicollinearity was not an

	IT	HRM	Infra-structure	Growth	IT*HR	Financial Performance	Operational Performance
IT	1.00	0.29	0.21	0.06	-0.12	0.18	0.23
HRM	0.29	1.00	0.48	0.17	-0.10	0.26	0.55
Infrastructure	0.21	0.48	1.00	0.03	-0.08	0.19	0.37
Growth	0.06	0.17	0.03	1.00	0.05	0.34	0.33
IT*HRM	-0.12	-0.10	-0.08	0.05	1.00	-0.05	0.03
Financial Performance	0.18	0.26	0.19	0.34	-0.05	1.00	0.38
Operational Performance	0.23	0.55	0.37	0.33	0.03	0.38	1.00

\* All correlations are significant at .01 (2-tailed)

issue in the model.

However, to assess pairwise and multiple variable collinearity, I calculated the tolerance values, and its inverse, the variance inflation factors (VIF). A common cut-off threshold of tolerance is .10, which corresponds to a VIF above 10 (Hair et al., 1998). Upon examination of the VIF table, multicollinearity does not appear to be a concern in the data as no VIF is above 1.49 (see Table 2b). Moreover, for testing the moderation hypotheses, the appropriate variables were mean centered to break up the high correlations between each of the main effect variables and the interaction term and reduce the threat of multicollinearity (Aiken and West, 1991).

Variable	VIF	1/VIF
Infra	1.53	0.654931
HRM	1.43	0.700723
UK	1.40	0.715795
Growth	1.22	0.818373
IT	1.12	0.893471
Ireland	1.06	0.946653
Cyprus	1.03	0.973455
IT*HRM	1.03	0.973606
Mean VIF	1.23	

The assumption of homoscedasticity (equal variances in the error term) is critical to the correct implementation of linear regression, and the presence of heteroscedasticity (unequal variances in the error term) can be easily identified through an investigation of the residual plots or through basic statistical tests (Hair et al., 1998). Having inspected the residuals and implemented the Breusch-Pagan and Cook-Weisberg test, heteroscedasticity does not appear to be a concern in the data (H0: Constant variance, Variables: fitted values of operperf,  $\chi^2(1) = 0.55$ , Prob >  $\chi^2 = 0.4573$ .)

For robustness, I addressed the issue of functional form misspecification. Such misspecification results in regression models that fail to properly account for the relationship between predictor and explanatory variables (Wooldridge, 2002). Results from the Ramsey (1969) regression specification error test (RESET) indicate that omitted variables do not appear to be a problem in the data (Ramsey RESET test using powers of the fitted values of operperf; H0: model has no omitted variables  $F(3, 177) = 0.61$ , Prob > F = 0.6118).

## 5. Results

After checking the data and clarifying some potential problems, I estimate a series of equations to test for mediation and moderation as outlined by Baron and Kenny (1986). I also test for direct relationships.

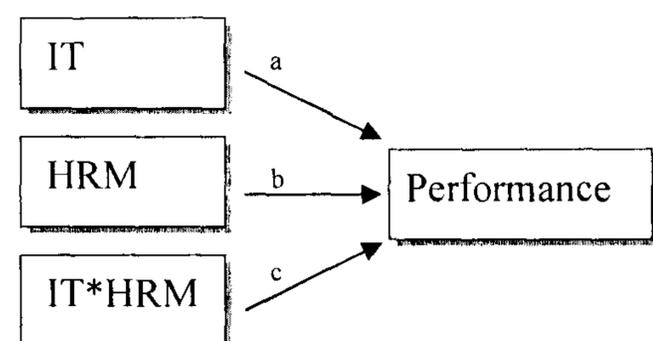
### 5.1. Direct Link

To test H1 and H2, both operational performance and financial performance were regressed on IT and HRM, controlling for supporting infrastructure and growth. The effect of IT on operational performance was highly significant ( $p < 0.05$ ), even when the control variables were added to the model, providing strong support for H1a. However, the regression implicated that IT did not have a direct link with financial performance, lending no support to H1b, as the relationship was insignificant.

The analysis supported the positive relationship between both HRM and operational performance and HRM and financial performance as envisaged by H2a and H2b. The relationship was highly significant ( $p < 0.01$ ) in the former model, and significant ( $p < 0.10$ ) in the latter. The distinction between the strength of the relationships is as expected.

### 5.2. Moderation

The figure presented outlines the paths that I have examined to test for moderation. The moderator hypothesis is supported if the interaction (path c) is significant.



It is desirable that the moderator variable is uncorrelated with both the dependent and independent variables for clear interpretation, and in fact, they do not show any strong correlation (see correlation table). Furthermore, to reduce potential multicollinearity, I have centred the variables.

The moderation effect of HRM on the positive relationship between IT and operational performance as predicted by H3 was not supported. More specifically, the interaction effect of IT and HRM was not significantly related to either operational or financial performance (see Table 3, models 3 and 4).

**Table 3: Direct Effect and Moderation (OLS Regression)**

Results from regression (N=188).

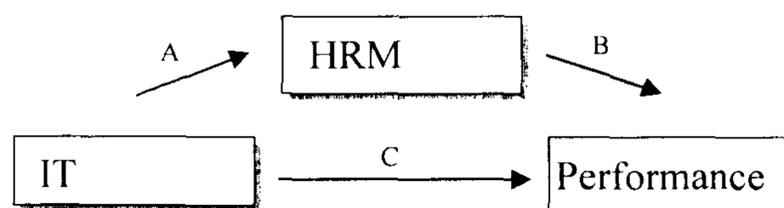
Variable	Hypotheses 1 and 2		Hypothesis 3	
	Operational Performance 1	Financial Performance 2	Operational Performance 3	Financial Performance 4
<b>IT*HRM</b>			<b>0.053</b> (.985)	<b>-0.021</b> (-.303)
<b>IT</b>	<b>.129**</b> (2.291)	<b>0.100</b> (1.403)	<b>.133**</b> (2.361)	<b>0.098</b> (1.372)
<b>HRM</b>	<b>.359***</b> (5.581)	<b>.141*</b> (1.740)	<b>.364***</b> (5.641)	<b>.139*</b> (1.706)
Infra	0.312*** (4.726)	0.109 (1.315)	0.313*** (4.737)	0.109 (1.308)
Growth	.145** (2.506)	.281*** (3.845)	.141** (2.430)	.282*** (3.847)
UK	-.342*** (-5.523)	-.074 (-.953)	-.342*** (-5.523)	-.074 (-.951)
Ireland	0.006 (.116)	.000 (-.002)	0.009 (.158)	-0.001 (-.015)
Cyprus	-.116** (-2.138)	.093 (1.360)	-.115** (-2.122)	.092 (1.352)
F-stat	24.56	6.029	21.607	5.26
R-Square	0.49	0.191	0.493	0.191

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01; two-tailed tests. (t-statistics in parentheses).

Note: ict and hrm centered in models 3 and 4

### 5.3. Mediation

To test for mediation, I analyze three equations: (1) regress the mediator on the independent variable; (2) regress the dependent variable on the independent variable; (3) regress the dependent variable on both the independent variable and the mediator.



Upon examination of the results, there is strong support for the notion that HRM mediates the positive impact of IT on both operational and financial performance as predicted in H4a and H4b. In both analyses, all of the criteria outlined by Baron and Kenny (1986) to establish mediation were met (see Table 4, models 7 through 13). In fact, the results suggest that HRM clearly mediates the relationship between IT and financial performance, as IT becomes insignificant when HRM is controlled in the third step of the procedure (model 13). Though not demonstrating the same degree of mediation as in the case of financial performance, it is noteworthy that all of the fundamental relationships that indicate a mediate relationship were highly significant ( $p < 0.01$ ) in the operational performance models (models 8 through 10). Of particular importance for demonstrating mediation, the significance of

**Table 4: Mediation (OLS Regression)**

Results from regression (N=188).

Variable	Hypotheses 4a and 4b						
	HRM	Operational Performance			Financial Performance		
	7	8	9	10	11	12	13
<b>IT</b>	<b>.208***</b> (3.271)	<b>.204***</b> (3.442)		<b>.129**</b> (2.291)	<b>.129*</b> (1.858)		<b>0.100</b> (1.403)
<b>HRM</b>			<b>.394***</b> (6.230)	<b>.359***</b> (5.581)		<b>.168**</b> (2.128)	<b>.141*</b> (1.740)
Infra	.472*** (6.939)	.481*** (7.596)	.317*** (4.755)	.312*** (4.726)	.176** (2.367)	0.113 (1.362)	0.109 (1.315)
Growth	.128* (1.925)	.191*** (3.084)	.150** (2.555)	.145** (2.506)	.299*** (4.111)	.284*** (3.884)	.281*** (3.845)
UK	-0.085 (-1.183)	-0.372*** (-5.587)	-0.331*** (-5.301)	-0.342*** (-5.523)	-0.086 (-1.104)	-.066 (-.846)	-.074 (-.953)
Ireland	-0.085 (-1.340)	-.024 (-.408)	.009 (.166)	.006 (.116)	-.012 (-.175)	.002 (.030)	.000 (-.002)
Cyprus	-0.041 (-.654)	-.130** (-2.233)	-.110** (-2.008)	-.116** (-2.138)	.087 (1.270)	.097 (1.425)	.093 (1.360)
F-stat	13.493	20.097	27.138	24.560	6.456	6.669	6.029
R-Square	0.310	.401	0.475	0.490	0.177	0.182	0.191

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ; two-tailed tests. (t-statistics in parentheses).

Note: standardized beta coefficients

IT was substantially reduced when controlling for HRM.

#### 5.4. Additional tests for robustness

Because managers choose not only whether or not to invest in IT, but also what types of applications in which to invest and to what scope and scale to implement them, endogeneity is a potential concern in this analysis. An explanatory variable, in this case IT, is said to be endogenous in the event that it is correlated to the error term ( $u$ ). Endogeneity results in estimators being biased and inconsistent. To determine whether OLS is a suitable estimator for this study, I estimate the most complete model with both IVREG and OLS and then perform a series of diagnostic tests. The Hausman test is employed to assess the consistency of estimating the study's models with order of least squares, while Davidson and MacKinnon's (1993) augmented regression is implemented to more directly examine IT's endogeneity.

Given the cross-sectional nature of this dataset, without transforming the continuous endogenous explanatory variable (IT) into a dichotomous variable, there are at least 3 ways to deal with the prospect of omitted variable bias (unobserved heterogeneity) in the analysis: (1) ignore the problem and accept the potential consequences of biased and inconsistent estimators; (2) seek and apply a suitable proxy variable for the unobserved variable; (3) leave the unobserved variable in the error term and apply instrumental variables regression (Wooldridge, 2002). For robustness, instrumental variables regression (IVREG) was employed to address potential endogeneity in this study.

Incorporating instrumental variables in the first stage of the regression model, IVREG utilizes an estimation method of two stage least squares that recognizes the existence of unobserved heterogeneity (Wooldridge, 2002). Under the assumption that the instrumental variables  $z$  are uncorrelated with  $u$ ,  $\text{Cov}(z,u) = 0$ , and that they are correlated to  $x$ ,  $\text{Cov}(z,x) \neq 0$ , the  $z$  variables provide missing information to the two stage equation. Three variables serve as instrumental variables ( $z$ ) for IT ( $x$ ) in the first stage of the instrumental variables regression models. Whereas most variables in the dataset demonstrated a stronger correlation to the performance measures than to IT, suggesting the above assumptions would not be met, organizational learning

(*learning*), the role of innovation (*inovrole*) and innovativeness (*innov*) are well suited to serve as instrumental variables as they are at least moderately correlated to IT, 0.50, 0.33 and 0.31 respectively and only slightly correlated to financial performance, 0.09, 0.08 and 0.14, and operational performance, 0.09, 0.20 and 0.26. Having estimated the full model with IVREG, I continued to run diagnostic tests to determine the suitability of OLS.

The application of the Hausman test examines whether there is ample difference between the coefficients of the instrumental variables regression (IVREG) and those of OLS to determine that OLS is an inconsistent estimator for the model. The null hypothesis of the test is that an OLS process generated the model, and the test is carried out under the assumption that the IVREG estimates are consistent. The Hausman test clearly fails to indicate that the coefficients generated with IVREG are systematically different from those of OLS and that OLS is an inconsistent estimator for this equation (see Table 5). In fact, the coefficients produced by the competing equations are practically identical.

<b>Table 5: Hausman Test</b>				
---- Coefficients ----				
Operational Performance	(b) ivreg	(B) ols	(b-B)	(S.E.)sqrt(diag(V_b-V_B))
IT	.0911462	.1095095	-.0183633	.0772435
HM	.3383387	.3329111	.0054275	.022891
Infra	.2023294	.2017502	.0005792	.0027271
Growth	.0876135	.0871612	.0004523	.0021484
UK	-.4206669	-.4229208	.0022539	.0097311
Ireland	.0375865	.0349375	.002649	.0141143
Cyprus	-.8905002	-.8981721	.0076719	.0344461

b = consistent under Ho and Ha; obtained from OLS

B = inconsistent under Ha, efficient under Ho; obtained from IVREG

Test: Ho: difference in coefficients not systematic

$\chi^2(7) = (b-B)'[(V_b-V_B)^{-1}](b-B) = 0.06$

Prob> $\chi^2=1.0000$

As opposed to a direct test of IT's endogeneity, Davidson and MacKinnon (1993) argue that the Hausman test should be viewed as a tool for evaluating whether OLS is an inconsistent estimator for the model and they propose an

augmented regression test, based on the same asymptotic requirements, as an alternative to the Hausman examination. I structure the augmented regression by including the predicted values of IT, the endogenous right-hand-side (rhs) variable, as a function of all exogenous variables, in a regression of the original model. The augmented regression plainly illustrates that the correction for endogeneity,  $IT_{\hat{}}$ , is insignificant, thus implicating that endogeneity is not a concern to the analysis (see Table 6). Again, under the assumption that the instrumental variables estimator is a consistent estimator for the model, the test fails to show that OLS is inadequate for the analysis.

operalt	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
IT	.11655	.056372	2.07	0.040	.0053067	.2277934
HRM	.3383387	.0640376	5.28	0.000	.211968	.4647093
Infra	.2023294	.0428682	4.72	0.000	.1177342	.2869246
Growth	.0876135	.0349208	2.51	0.013	.0187014	.1565256
UK	-.4206669	.077359	-5.44	0.000	-.5733257	-.268008
Ireland	.0375865	.3027971	0.12	0.901	-.5599476	.6351206
Cyprus	-.8905002	.4223743	-2.11	0.036	-1.724006	-.056995
<b>IT_hat</b>	<b>-.0254038</b>	<b>.1070805</b>	<b>-0.24</b>	<b>0.813</b>	<b>-.2367145</b>	<b>.1859069</b>
_cons	1.603189	.2527551	6.34	0.000	1.104407	2.101971

Finally, enhanced financial performance is ultimately the end goal of new initiatives adopted by firms. Because the results demonstrate that IT is directly related to firm level operation performance but not financial performance, I split the dataset into two equal halves, high financial performers and low financial performers, in order to gain insights into the composition of more successful firms. The analysis returned strong evidence that superior performing firms invest more heavily in both IT and human enabling HRM systems than their counterparts with inferior performance. Clearly, these findings have strong managerial implications. Although the results don't demonstrate causality, they strongly indicate the fundamental roles that IT and human resource management play. Not only do IT and human enabling HRM systems relate to operational and financial performance in the study, but also firms that invest more heavily in IT and human resource

management outperform their competitors. Failing to adequately invest in information technology and progressive human resource management practices may have dire consequences on firm performance.

Table 7: T-Test for Equality of Means

High/Low Financial Performance				t-test for Equality of Means			
Scale	Sector	Mean	Standard Deviation	t-stat	df	Significance (2-tailed)	Mean Difference
IT	High	3.0957	0.67135	2.51351	186	0.013	0.2428
	Low	2.8529	0.65312				
HRM	High	2.9023	0.63888	2.3729	186	0.019	0.2092
	Low	2.6930	0.56797				
Infra	High	2.7908	0.91579	0.55375	186	0.580	0.0709
	Low	2.7199	0.83859				
Growth	High	4.0108	0.87842	5.55077	185	0.000	0.7129
	Low	3.2979	0.87780				
Operational Performance	High	3.5319	0.61507	3.45751	186	0.001	0.2872
	Low	3.2447	0.52003				
Financial Performance	High	4.0532	0.41852	17.3063	186	0.000	1.1631
	Low	2.8901	0.49943				

## 6. Discussion

Based on a sample of 188 service firms, I find strong empirical support for the hypotheses linking both information technology and human resource management to firm level performance, leaving broad contributions and robust managerial implications. Moreover, and perhaps more pronounced, this work provides meaningful insights to the unravelling of the productivity paradox, lending particular support for the proponents of the positive link between technology and productivity.

Specifically, the regression models indicate that IT has a direct effect on operational performance and HRM has a direct impact on both operational and financial performance. Moreover, I find that IT has an indirect effect, when mediated by human enabling human resource management, on both operational and financial performance. The data however fails to support that IT has a direct impact on the sample firm's financial performance or that the

interaction effect of IT and HRM has a positive relationship with either of the performance measures.

Numerous researchers have argued in the past that new technology is in fact associated with enhanced performance (Brynjolfsson and Hitt, 2003, 1996 and 1995; Lichtenberg, 1995); however, a host of competing authors have effectively refuted the claim, proposing non-existent and even negative relationships (Loveman, 1994; Roach, 1987; Franke, 1987). Through the careful examination of information technology and human resource management's impact on firm level performance, this study sheds much light on the debate, finding the presence of a direct and positive relationship. Moreover, through the investigation of potential mediated and moderated relationships in attempt to fully understand the elusive relationship between IT and firm performance, this work indicates the existence of mechanisms that enable further positive relationship.

Although not finding a positive interaction effect prevents us from making claims with regard to when IT will impact firm performance, the outcome of the mediation analysis illuminates why and how the two variables are positively related. In order to establish mediation the following conditions should occur: (1) the independent variable, IT, must affect the mediator, HRM, (see model 7); (2) the independent variable, IT, must affect the dependent variable, operational performance and/or financial performance, (see models 8 and 11); and (3) the mediator, HRM, must affect the dependent variable, operational performance and/or financial performance, (see models 10 and 13). Because the conditions outlined above all hold, and in the predicted direction, the presence of mediation is supported as the effect of information technology on operational and financial performance has lessened from the second to the third equation.

These findings are of particular importance for service firms interested in improving their performance through employing IT and human resource management systems. Quite simply, both IT and human-enabling human resource management are related to firm performance. These results are consistent with earlier resource based view research where authors have

argued and found support for the notion that increased productivity and firm performance is dependent upon the contribution of employees of the firm (Youndt et al., 1996), and that employees enabled via a human enabling HRM system are better able to contribute to the goals of the firm than employees deprived of such power (Arthur 1992, 1994). ). Additionally, econometric findings have indicated that firms that adopt decentralized organizational structures do appear to have a higher contribution of IT to productivity (Bresnahan, Brynjolfsson and Hitt, 2002). This suggests that enabled employees equipped with new technologies can make an even greater contribution (Youndt et al., 1996) to the firm and productivity in general.

Having estimated models with both OLS and IVREG and implemented both the Hausman and Davidson and MacKinnon augmented regression tests, I have determined that OLS is indeed a satisfactory and consistent estimator. In general, IVREG's coefficients are largely the same but its standard errors are substantially larger. This, however, is not particularly surprising. Given the nature of IVREG, its variance and standard errors are larger than those of OLS, and even more so when  $z$  (instrumental variable) and  $x$  are only moderately correlated, as in this case. Therefore, the results from the OLS models are not only sound but also serve as an appropriate method for testing the research hypotheses in this study.

When attempting to assess the relationship between IT and performance it is worthwhile to imagine that "IT is the catalyst but organizational design is the bulk of the iceberg". In fact, research has indicated that organizational assets, specifically human capital, business processes and culture, are more important to the relationship than the new technology itself (Brynjolfsson 2003) and investments in such complements warrant up to 10 times the size of the investment as the new technology (Brynjolfsson and Yang, 1999; Brynjolfsson, Hitt and Yang, 2002). Thus it is not surprising that the findings indicate that HRM is more important in explaining the link between IT and both operational and financial performance than IT itself. It is noteworthy that the existence of a moderated relationship, wherein HRM moderated the link between operational or financial performance and IT is not supported by the

data. This is surprising because this type of relationship is both theoretically grounded and has been validated in other research (Boyer et al.1997; Saraph and Sebastian 1992; Meredith, 1987; Ettlíe, 1988; and Zuboff, 1988).

Finally, as with any piece of research, this study is subject to some limitations. A potential limitation of this study arises from the cross-sectional nature of the data. While the study sheds some light regarding the relationships among information technology, human resource management systems and firm performance, the employed measures record only one point in time. Longitudinal research is needed to establish causality and to assess the particular order of the sequence of events.

All of the variables employed in this study were constructed with multi-item scales to allow greater richness of the constructs. Cronbach's alpha exceeded the minimum requirements as prescribed in the literature for all of the scales, but the measures could be improved with further development.

The list of items used to measure information technology is far from exhaustive and could be improved with further development.

## 6. Research Essay II

# **Knowledge Acquisition and Transfer: An Empirical Investigation of Service Quality and Performance in the Hedge Fund Industry**

### **Abstract**

Integrating the knowledge-based view and service operations research, this paper investigates empirically the impact of knowledge management on firm performance. Effective acquisition and transfer of knowledge are shown to hinge upon incorporating both tacit and explicit knowledge. The research framework is built upon a theoretical framework that argues that the interaction of knowledge management practices link together to create new organizational knowledge. This research posits that such systems will link directly into the service profit chain, more clearly explaining how managerial choices can lead to enhanced service quality, and ultimately, to improved firm performance. The path and validity of these relationships are tested using hierarchical regression analysis. These findings have important implications for the academe and service firms interested in improving performance through the more efficient use of existing knowledge-based assets, shedding light on methods that lead to managerial and financial success in a poorly understood segment of the services sector, the hedge fund industry.

**Keywords:** knowledge management, knowledge acquisition, knowledge transfer, service quality, empirical research

## 1. Introduction

The research in this paper examines empirically the roles of knowledge acquisition and transfer as drivers of service quality and financial performance in the hedge fund industry. The ability to continuously develop new and improved service is essential to the survival of service organizations, thus requiring the adoption of innovative routines, systems and procedures in order to move faster than competitors. Learning and unlearning capabilities (Hedberg, 1979; Senge, 1992) are of utmost importance to any service firm in this economic landscape. Complicating matters yet further, the knowledge necessary to develop a competitive customer offering is declining in durability. To develop and deliver high levels of service and performance, knowledge must now be combined and recombined across geographical, organizational, technological, and in some cases, across institutional borders (Ridderstrale and Engstrom, 2000). While this development presents a manageable task, the time available to accomplish it is scarce, thus further complicating the task of systematizing these actions.

The theoretical link between knowledge and service operations has not been adequately explored and is not clearly understood. Although operations researchers have contemplated knowledge, their work has diverse and generally an incomplete use of knowledge (Linderman et al., 2004). There exists limited academic research connecting organizational knowledge and quality management. For example, Ahire et al. (1995) and Sousa and Voss (2002) provide comprehensive literature reviews of the quality management literature, however neither identified any papers specifically relating quality management to knowledge. Linderman et al. (2004) provides a basis for understanding the relationship between quality and knowledge, and from a knowledge perspective develops insights into how effective deployment of quality management practices lead to improved performance. This work provided an important theoretical contribution but does not provide quantitative evidence that these relationships hold under scientific scrutiny. Moreover, prior studies have only considered incomplete views of knowledge,

often focusing on only tacit or explicit knowledge and rarely considered the knowledge creation process (Lindeman et al., 2004).

Theory for integrating quality and knowledge must consider both the epistemological and ontological dimensions of knowledge. This would allow insights into what it means to effectively deploy quality management practices. Organizations maintaining a set of quality management practices that support the knowledge creation processes should be more effective at deploying quality management. This helps illuminate what effective deployment of quality management means. This research indicates that quality management practices should be bundled around knowledge creation processes (Lindeman et al., 2004). Nonaka's foundational work on knowledge creation provides a useful theoretical lens since it considers not only individual and organizational knowledge, but also tacit and explicit knowledge. And as Dooley (2000) suggested, the future of the quality management discipline will require a greater understanding of the role of tacit knowledge. This re-enforces the importance of using knowledge management frameworks that consider tacit knowledge when understanding quality management practices. Several references have been made in the quality literature, but none of them explicitly consider both tacit and explicit knowledge and the interrelationships between these epistemological domains. Since quality management is an organizational wide approach to improvement (NIST, 2000), it is imperative to consider comprehensive theories of knowledge in understanding quality.

Previous empirical research has established the importance of effective deployment of quality management, but has not developed a complete understanding of what effective deployment means. Quality frameworks like the Baldrige Award increasingly recognize the importance of knowledge (e.g. the MBNQA category "Information and Analysis" was recently changed to "Measurement, Analysis, and Knowledge Management"), but do not incorporate knowledge into the logic of deploying quality management practices. This knowledge perspective presents an opportunity for future refinements of the MBNQA. In addition, deploying quality from a knowledge-based view seems more consistent with the underlying philosophy of quality

thought leaders such as Deming (1994) and Juran (1995). A comprehensive knowledge perspective of quality helps enlighten what effective organizational-wide deployment of quality management means. The knowledge-based view of the firm also helps understand how quality management practices lead to firm performance.

“Future research should focus on testing and refining the proposed theory” (Linderman et al. 2004), and the purpose of this paper is to answer their call, empirically examining fundamental links of their theory integrating quality management practices with knowledge management. From the lens of the knowledge based view of the firm, this research focuses on tacit and explicit concepts, integrating quality management practices with a knowledge perspective. Our understanding of quality management becomes clearer from the vantage point of the Knowledge perspective. In this vein, “ideas are...the critical input in the production of more valuable human and nonhuman capital,” (Romer, 1993). While investments in equipment, technological infrastructures and human resources are associated with economic growth (DeLong & Summers, 1991), it is the ideas of what to put those investments to use on – ideas developed through education, research, and experimentation – that both drives the investments and provides the mechanisms through which economic growth occurs (Freeman, 1982). This purpose of this paper is to probe deeply into the components of knowledge, exploring how “the strategically most important assets of the firm” (Spender, 1996) can lead to enhanced business performance in the services sector. The value of managing firm knowledge is commonly held, however this framework is designed to examine specifically how service firms can improve their performance through the acquisition and transfer of both tacit (know-why) and explicit (know-how) knowledge. This differentiates it from much of the earlier work that concentrates on either tacit or explicit knowledge, but rarely both. Finally, it has been proposed that integrating quality management practices with organizational knowledge concepts can provide insights into how knowledge management leads to improved performance (Linderman et al., 2004). This author believes that such systems will link directly into the service

profit chain, more clearly explaining how internal service quality ultimately drives firm performance, but this theory must be further developed and tested.

## **2. Theoretical Foundation and Hypotheses**

Any discussion of the potential advantages of harnessing knowledge, must carefully define what precisely is meant by the term knowledge and the core principles of knowledge management. It is important to keep in mind that knowledge is certainly not limited to data and information, though the two are fundamental building blocks of knowledge. For purposes of this paper, the following definitions of knowledge, knowledge management, knowledge capture and knowledge transfer, as presented by Newman and Conrad (1999) at the knowledge management forum, will be used. "Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms."

In developing an understanding as to how firms manage what they know, it is important to underscore the distinction between explicit and tacit knowledge. Whereas explicit knowledge, such as unequivocal facts, figures, symbols and axiomatic propositions, is readily transmittable once put in formal, systematic language (Kogut and Zander, 1992), tacit knowledge is far subtler. Simply put, at the individual level "we know more than we can tell" (Polanyi, 1962) and at the organizational level "organizations know more than what their contracts say" (Kogut and Zander, 1992). Tacit knowledge is the non-verbalized and unarticulated (Polanyi 1962) knowledge that embodies "the way things are done around here" (Spender 1996b). While a shortcoming of explicit knowledge is that it is easily imitated by competitors (Zander and Kogut, 1995) and can be readily purchased in the market, tacit knowledge is highly personalized, idiosyncratic, and perhaps most importantly, difficult to imitate (Spender 1996b). However, as with individual knowledge, tacit is inherently fragile and perishable knowledge. If it is not transferred to other

individuals and groups it largely irrelevant (Con Krogh et al. 1994), specifically from the point of view that when individuals leave the organization, so too does their tacit knowledge that has not been transferred. A fundamental challenge faced by firms is the conversion of tacit knowledge to explicit knowledge (Nonaka and Takeuchi 1995), for highly personal tacit knowledge has little value if it cannot be transformed into explicit knowledge that the firm can share.

Knowledge management is a discipline that seeks to improve the performance of individuals and organizations by maintaining and leveraging the present and future value of knowledge assets. Knowledge flows encompass the set of processes, events and activities through which data, information and knowledge are transformed from one state to another (Newman and Conran, 1999). Knowledge management practices are employed to promote, facilitate, regulate and monitor the flows of knowledge throughout the organization. Knowledge management includes the gamut of procedures and techniques used to maximize the impact of an organization's tacit and codified know-how (Teece, 2000). Although defined in many different contexts ways, knowledge management generally refers to how organizations create, retain, and share knowledge (Argote, 1999; Huber 1991). The study of knowledge sharing, which is the means by which an organization obtains access to its own and other organizations' knowledge, has emerged as a key research area from a broad and deep field of study on technology transfer and innovation, and more recently from the field of strategic management. Increasingly, knowledge-sharing research has moved to an organizational learning perspective.

In a sense, firms are repositories of knowledge (Inkpen and Dinur 1998). Absorptive capacity refers to firms' ability to "absorb" through its internal knowledge structures (Boynton, Zmud and Jacobs, 1994); this captured knowledge in turn can be reapplied to support strategic and operational activities (Cohen and Levinthal, 1990). Information technology and IT-related processes and applications represent a major component of firms' absorptive capacity (Boynton, Zmud and Jacobs, 1994); such electronic knowledge

management activities are apposite for recording unambiguous knowledge. Knowledge acquisition “includes all activities that preserve knowledge and allow it to remain in the system once introduced. It also includes those activities that maintain the viability of knowledge within the system.” Explicit and “objectified” knowledge is captured and stored in repositories, reference manuals and standardized operating procedures (Spender 1996b; Malone et al., 1999). “Automatic capturing” of this type of knowledge results in computer-resident memories with even greater precision and completeness than that of their human counterparts (Huber, 1991).

Knowledge repositories have been employed by a growing number of firms to create detailed process maps, including notes, crucial concepts and trouble shooting advice for the gamut of business activities (Malone et al., 1999; Sheer 1994; Winograd and Flores 1986). Proponents argue that it is not a question whether such knowledge acquisition efforts are useful, but rather how to improve upon them (Malone et al., 1999) in order to make them more useful and user-friendly. However, overemphasizing explicit knowledge and the formation of hierarchical management, static systems and widespread standardization diminishes firms’ potential to create and share new knowledge (Hedlund and Nonaka 1993), thus inhibiting their ability to learn. Polanyi’s notion of tacit knowledge and his famous maxim that “...we know more than we can tell” (Polanyi, 1967: 4), reminds us that established firms not only possess product and process knowledge that can be documented and recorded (and rendered useless), but that they also know the intangible and interdependent complementary knowledge that helped them get where they were going. For Polanyi, explicit knowledge in the form of what can be seen, read or communicated only takes on meaning within the context of tacit knowing. Even mundane acts are dependent upon tacit knowledge because the individual is unable to provide every detail as to how the act was performed (Polanyi, 1962). Therefore, this stream of research does not suggest that organizations benefit directly from capturing only explicit knowledge but rather the presence of tacit knowledge is positively impacted by the recording of such equivocal knowledge. Rich organizational

knowledge, even tacit knowledge that is often non-articulated, can be catalogued (Teece, 1998). This leads to the following hypotheses:

***H1: Acquisition of explicit knowledge is positively related to firm performance.***

***H2: Acquisition of tacit knowledge is positively related to firm performance.***

Knowledge codification tools support the representation of knowledge so that it can be accessed, transferred and absorbed into firms' inner knowledge structures (Boynton, Zmud and Jacobs, 1994). Unlike data and information, knowledge contains judgment. Not only does knowledge facilitate the judgment of new situations and information in light of what is already known, it allows refined judgment in response to new situations and information. Likening knowledge to a living thing, Davenport (1998), describes the capability of knowledge to grow and change as it interacts with the environment. Because knowledge is organic by nature and humans' ability to judge and take appropriate becomes more sophisticated as they acquire more knowledge, successful firms empower their employees to take advantage of their power to judge. "Knowledge transfer refers to activities associated with the flow of knowledge from one party to another. This includes communication, translation, conversion, filtering and rendering. Knowledge management systems encompass both human and automated activities and their associated artifacts." The transfer of knowledge has been conceptualized in terms of communication intensity, and specifically, the degree of frequency, informality and openness (Gupta and Govindarajan, 1991; Jablin, 1979; Tushman, 1977). The quality and speed of knowledge transfer is considerably improved with the support of technologies (Ruggles, 1998). Common IT applications employed by firms include intranets, knowledge repositories and group decision support systems. KM tools can be classified into three general categories: generation, codification, and transfer (Ruggles, 1997). Knowledge transfer tools alleviate the temporal, physical, and social distances in knowledge sharing (Ruggles, 1997). Following naturally, effective knowledge management requires organizational exodus from the traditional logic of

hierarchical structures (Hedlund, 1994) and adoption of some of the logic of an “N-form” organization, embracing combinations of business units, lateral communication and managers as catalysts of knowledge.

Knowledge transfer is facilitated through the connections of formal and informal relationships among individuals and groups (Inkpen, 1996; Gupta and Govindarajan, 2000, 1991; Galbraith, 1977, 1973). When individual or group knowledge is connected with other individuals and groups it can be debated and discussed and before it is transferred, fine-tuning the existing and creating even greater amounts of knowledge in the process.

Organizational structures can be designed and implemented to maximize the efficiency of the integration (Grant, 1996) as specialized technological gatekeepers (Katz and Tushman, 1980) and specific structures and groups have proven to have a significant impact on the transfer of information (Katz and Allen, 1988). Research has shown that communication patterns are an important determinant of organizational effectiveness (Allen and Cohen, 1969; Tushman, 1977; Van de Ven, 1986). Broadly, successful transfer requires ample information processing capacity in the system wherein such capacity is function of the intensity of the communication patterns (Gupta and Govindarajan, 1991). More intense communication patterns based on these criteria create greater information processing capacity (Ghoshal and Bartlett, 1988; Katz and Tushman, 1979; Gupta, 1987; Gupta Govindarajan, 1991), thus enabling firms to become more effective at realizing the gamut of organizational goals. Thus I propose the following hypotheses:

***H3: Transfer of explicit knowledge is positively related to firm performance.***

***H4: Transfer of tacit knowledge is positively related to firm performance.***

Academics have only just begun to formally integrate quality management to knowledge perspective concepts (Linderman et al., 2004). One of the first attempts by Fine (1986) employed analytic models to exemplify the relationship between quality and learning. The crux of his findings was that

the optimal quality level increases over time due to learning – ‘learning by doing’. Similar analytical studies followed linking learning to quality control (Tapiero, 1987; Dada and Marcellus, 1994; Hatch and Mowery, 1998; Li and Rajagopalan, 1998; Zangwill and Kantor, 1998). More recently, researchers have developed theory and conceptual models that relate quality management to knowledge. Sitkin et al. (1994) for example theorized that TQM consists of both Total Quality Control and Total Quality Learning. They hypothesized that under conditions of great ambiguity and complexity, a ‘Total Quality Learning’ approach is more effective than a ‘Total Quality Control’ approach. Consistent with this work, Linderman et al. (2004) make significant progress explaining the theoretical link between knowledge and quality. The authors present a conceptual model relating quality management practices to well supported components of knowledge creation and ultimately to organizational performance. Developing strong theory linking quality management practices to the knowledge perspective, they conclude their study with a call for empirical testing.

Based on the service profit chain (see for example Heskett 1991b and 1994), I also posit that firms’ ability to transfer knowledge is a fundamental driver in delivering high levels of service quality. A comprehensive knowledge perspective helps enlighten what effective organizational-wide deployment of management practices aim to accomplish. Specifically, it provides insights into the relationship between knowledge, service quality and firm performance. For example, organizations maintaining a set of management practices that support knowledge creation foster ‘socialization’ between customers and employees providing a basis for learning (Bitner and Booms, 1990; Lengnick-Hall, 1996). These firms should be better able to understand the spoken and unspoken needs of their customers (Dean and Bowen, 1994) cultivating higher levels of service quality. This research indicates that quality management practices should be bundled around knowledge transfer processes. I therefore propose the following hypotheses:

***H5: Transfer of explicit knowledge is positively related to service quality.***

***H6: Transfer of tacit knowledge is positively related to service quality.***

Service quality is central to the success of all organisations (Zeithaml et al., 1990) and is a “cornerstone of marketing strategy” (Asubonteng, McCleary and Swan, 1996). Customers ultimately buy quality results, not merely products or services (Heskett, 1986), and higher levels of service quality results in greater customer satisfaction, customer loyalty, and ultimately, greater firm results (Heskett et al., 1994). The knowledge-based view (KBV) of the firm offers a unique theoretical perspective in better understanding how quality management is related to performance. According to KBV theorists, knowledge is the strategically most important resource of firms and a potential source of competitive advantage (Davenport and Prusak, 1998; Grant, 1996; Kogut and Zander, 1992, 1996; Spender, 1996). From this point of view, if quality management practices are seen as yet another means of knowledge creation, then the relationship between quality management and firm performance can be better explained. Explicitly, quality management becomes a basis of knowledge creation that ultimately results in a competitive advantage. I therefore propose the following hypothesis:

***H7: Service quality is positively related to firm performance.***

### **3. Dataset**

#### **3.1. Data Collection**

The data to test the hypotheses comes from the International Hedge Fund Research Centre (IHFRC) dataset, a research effort designed to assess dynamic practices that lead to managerial and financial success in a poorly understood segment of the services sector, the hedge fund industry.

Commencing in 2004, the IHFRC is a focused research initiative designed to determine pioneering management practices and to investigate a wide set of factors hypothesized to influence performance. The IHFRC questionnaire was strategically designed to determine cutting edge knowledge management practices, assessing the acquisition and transfer of tacit and explicit knowledge, and to investigate a variety of factors hypothesized to impact hedge fund performance. It draws from service operations research (Roth,

Chase, and Voss 1997; Voss et al.1997). From a universe of over 7000 hedge funds operating around the globe, including firms from North America, South America, Europe and Asia, a large sample of hedge funds are investigated in order to obtain the study's dataset. Measuring at the firm level, multiple respondents from each hedge fund were asked to participate in the study. The investigation focuses on these financial services companies for two primary reasons: (1) due to the opaque nature of most hedge funds, their operations are little explored and research is scant; and (2) given the knowledge intensive nature of this segment of the services industry, successfully managing new and existing knowledge is mission critical in order to compete.

In aggregate, over 45 focused questions were developed for the IHFR survey. A subset of the individual questions employed in this study is available in Appendix A of this work. Each was assessed on a 5-point Likert scale, and each had a question descriptor. The scales also had descriptors of the states of practice or performance, ranging from 1 to 5, where 1 indicated low (poor) levels of best practices (performance) and 5 indicated state-of-the-art (outstanding) levels of practices (performance). Descriptors 2, 3, and 4 represented intermediate points. All questions were field tested, reviewed by subject experts, and where appropriate, revised before final use, based on tentative reliability and validity.

Sample firms were selected from a variety of sources, including trade journals and industry databases known to be comprehensive. The sample was stratified to envelop a wide range of organizational sizes; very small funds were excluded from the study. Although the resulting sample is somewhat biased toward top performing hedge funds such sampling is suitable for exploratory research investigating unique or complex phenomena (Pinosonneault and Kraermer, 1993; Roth et al., 1997; Voss et al., 1997).

Data was collected by interview. At each site a 'diagonal slice' team was formed of knowledgeable people from a range of departments, ranging from back office operations employees to employees to senior management. Two or three researchers or facilitators met with the team. The scores used in this analysis were determined by the research interviewers based on structured

discussion of areas of disagreement among the individual responses, extensive probing for clarification and supplemental data collected to validate individual responses. The use of interviews rather than survey methods for data collection addressed the difficulties associated with the use of single respondents (Huber and Power, 1985), and greatly reduced the possibility of both response and common method bias (Flynn et al., 1990). To minimize the effect of response bias and to minimize any interviewer effects, the interviewers were exposed to a wide range of firms and their assessment scoring of organisations were cross-evaluated for calibration and consistency. Because common method bias is a potential problem in survey research, Harmon's one-factor test (Podsakoff and Organ, 1986) was used to check whether common method bias was present. Five factors with eigenvalues greater than one were extracted from all the measures in this study and in total accounted for 62% of the variance. The first factor accounted for 22% of the variance. A single factor did not emerge and one-factor did not account for most of the variance, suggesting that the results were not due to common-method bias.

### **3.2. Scale Development**

Multi-item scales have been constructed from the IHFRC dataset to capture each construct enabling finer distinctions among respondents to be drawn (Boyer and Pagell, 2000; Flynn et al., 1990). Each of the scales has been empirically validated with confirmatory factor analysis using maximum likelihood extraction. Each solution demonstrated satisfactory unidimensional qualities, producing only one factor with an eigenvalue greater than 1.0 and accounting for at least 60 percent of the total variance (Hair, Anderson, Tatham and Black, 1998). To further establish the reliability of the scales, Cronbach's alpha was used to measure the degree of internal consistency. Conventional wisdom holds that values greater than or equal to 0.70 for existing scales and 0.60 for new scales to be acceptable (Churchill, 1979; Flynn et al., 1990). All of the tests for internal validity were highly satisfactory; Cronbach's alpha for the multi-item scales measuring the study's independent variables, all exceeded 0.80, and Cronbach's alpha for the dependent variable

exceeded 0.90. Finally, a thorough analysis of the literature helps to ensure content validity. The full operationalization of the scales is outlined in Appendix B.

### **3.3. Independent Variables**

This study employs the following multi-item indices to capture the study's explanatory variables.

*Explicit knowledge acquisition* (exacqst) is employed to measure the degree and intensity of firms' explicit knowledge acquisition. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.86.

*Tacit knowledge acquisition* (tacacqst) is employed to measure the degree and intensity of firms' information technology implementation. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.84.

*Explicit knowledge transfer* (extran) is employed to measure the degree and intensity of firms' efforts to transfer explicit knowledge. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.89.

*Tacit knowledge transfer* (actran) is employed to measure the degree and intensity of firms' ability to transfer tacit knowledge. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were satisfactory at 0.85.

### **3.4. Dependent Variables**

The study will assess firm performance on two levels of measurement, service quality and financial performance; the former with a multi-item index and the latter with hard financial data.

*Service quality* (servqual) has been conceptualized in the following five separate dimensions: tangibles, reliability, responsiveness assurance and

empathy (Parasuraman, Zeithaml and Berry, 1988). This conceptualization has been validated a number of times in the literature. Capturing these dimensions, this study employs one multi-item scale, "servqual", to measure firms' ability to deliver service quality. The reliability of the performance measure was assessed with Cronbach's alpha. The result of 0.91 was highly satisfactory.

*Financial performance* (finperf) is a measure of actual net financial performance. The data is representative of the annualised performance for each hedge fund in the study over a trailing 24 months period. The performance figures for each hedge fund are prepared by independent third-party administrators and verified by independent third-party auditors.

### **3.5. Control Variables**

Hedge funds may have varying performance and levels of development in deploying knowledge and quality management initiatives for a wide range of structural reasons. Consistent with the seminal research from finance scholars, all models in this study will control for any extraneous effects of size (assets under management), fee structure (management fees and incentive fees) and investment strategy. The theoretical justification of the use of these controls is outlined in Appendix B.

## **4. Methods**

To test the hypothesized relationships, order of least squares regression (OLS) is employed. Before testing hypotheses 1 through 6, I examined the descriptives and tested specifically for multicollinearity, heteroscedasticity and omitted variables.

**Table 1: Descriptive Statistics**

	Observations	Mean	Standard Deviation	Minimum	Maximum
exaqstn	135	3.4481	0.85633	1.75	5
tacaqstn	135	3.2519	0.90279	1	5
extran	135	3.4207	0.87324	1	5
tactran	135	3.2089	0.65965	1.6	4.6
servqual	135	3.6667	0.78455	1.8	5
finperf	135	12.1758	13.68871	-54.18	64.94

To identify potential multicollinearity, I first examined the correlation matrix of independent variables (see Table 2a).

**Table 2a: Correlation Matrix**

	exaqstn	tacaqstn	extran	tactran	servqual	finperf
exaqstn	1.00	.459**	.434**	.336**	.308**	.370**
tacaqstn	.459**	1.00	.366**	.164	.192*	.266**
extran	.434**	.366**	1.00	.598**	.581**	.581**
tactran	.336**	.164	.598**	1.00	.671**	.745**
servqual	.308**	.192*	.581**	.671**	1.00	.764**
finperf	.370**	.266**	.581**	.745**	.764**	1.00

\*\* Correlation is significant at .01 (2-tailed)

\* Correlation is significant at .05 (2-tailed)

Not finding any correlations near 0.90 (the traditional benchmark), I felt confident that multicollinearity was not an issue in the model. However, to assess pairwise and multiple variable collinearity, the tolerance values were calculated, and its inverse, the variance inflation factors (VIF). A common cut-off threshold of tolerance is .10, which corresponds to a VIF above 10 (Hair et al., 1998). Upon examination of the VIF table, multicollinearity does not appear to be a concern in the data as no VIF is above 2.15 (see Table 2b).

**Table 2b: Variance Inflation Factors**

	VIF	Tolerance
exaqstn	1.811	0.552
tacaqstn	1.723	0.580
extran	2.145	0.466
tactran	2.038	0.491
mgmtfee	1.330	0.752
incfee	1.976	0.506
aum	1.186	0.843

The assumption of homoscedasticity (equal variances in the error term) is critical to the correct implementation of linear regression, and the presence of heteroscedasticity (unequal variances in the error term) can be easily identified through an investigation of the residual plots or through basic statistical tests (Hair et al., 1998). Having inspected the residuals and implemented the Breusch-Pagan and Cook-Weisberg test, heteroscedasticity does not appear to be a concern in the data. For robustness, the issue of functional form misspecification was addressed. Such misspecification results in regression models that fail to properly account for the relationship between predictor and explanatory variables (Wooldridge, 2002). Results from the Ramsey (1969) regression specification error test (RESET) indicate that omitted variables do not appear to be a problem in the data.

## 5. Results

After checking the data and clarifying some potential problems, I estimated a series of equations to test the research hypotheses. Hierarchical regression analysis is employed to assess the validity of hypotheses and to examine the relative explanatory power and significance of the independent variables. Specifically, I run the following models:

- Model 1 will include the control variables (strategy, size and fees)
- Model 2a (b) will add knowledge acquisition (knowledge transfer)
- Model 3 is the full model including control variables, knowledge transfer and knowledge acquisition.

The full regression model (model 3) to assess the impact of knowledge on firm results:  $\text{Firm results} = b_0 + b_a * \log \text{Fund size} + b_b * \log \text{Fund Management Fees} + b_c * \log \text{Fund Incentive Fees} + b_d * \text{Fund Strategy} + b_1 * \text{Knowledge Acquisition (explicit)} + b_2 * \text{Knowledge Acquisition (tacit)} + b_3 * \text{Knowledge Transfer (explicit)} + b_4 * \text{Knowledge Transfer (tacit)}$

To test hypotheses H1 through H4, financial performance was regressed on knowledge acquisition (explicit and tacit) and knowledge transfer (explicit and

tacit), controlling for fund strategy, size and fees. Hierarchical regression analysis is employed to assess the relative explanatory power of knowledge acquisition and knowledge transfer (see Table 3).

**Table 3: Hierarchical Regression**

Results from regression (N=135).

Variable	Hypotheses 1-4				
	finperf 1	finperf 2a	finperf 3a	finperf 2b	finperf 3b
exacqsn		.230** (2.340)	0.062 (0.875)		0.062 (0.875)
tacacqsn		.170* (1.819)	0.091 (1.305)		0.091 (1.305)
extran			.175** (2.257)	.240*** (3.378)	.175** (2.257)
tactran			0.63*** (8.322)	.628*** (8.296)	0.63*** (8.322)
mgmtfee	-.167* (-1.831)	-.162* (-1.883)	-.190*** (-3.103)	-.196*** (-3.183)	-.190*** (-3.103)
incfee	0.138 (1.269)	0.117 (1.135)	-.007 (-.096)	-0.002 (-0.025)	-.007 (-.096)
aum	-.03 (-.352)	-.034 (-.414)	.043 (0.751)	.048 (-.832)	.043 (0.751)
F-stat	2.413	3.328	11.602	12.391	11.602
R-Square	0.261	0.357	0.685	0.674	0.685
Δ R-Square		0.096**	0.328***	0.413***	0.011

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01; two-tailed tests. (t-statistics in parentheses).

The first model included only the control variables. Noteworthy, the effect of management fees on financial performance was negative and significant (p<0.10). In the second model (model 2a), both explicit and tacit knowledge acquisition were added to equation. Their effects were highly significant (p<0.05) and significant (p<0.10), respectively, and r-square increased to 0.357 from 0.261 in the base model. In the next model (model 2b), explicit and tacit knowledge transfer were added to the control variables and the equation was run. Their effects were highly significant (p<0.01), and r-square increased sharply to 0.674 from 0.261 in the base model. In the third model (model 3), the full equation including knowledge acquisition (explicit and tacit), knowledge transfer (explicit and tacit) and the control variables, was run. The

effect of both explicit and tacit knowledge remained highly significant, ( $p < 0.05$ ) and ( $p < 0.01$ ), respectively, whereas the effect of both explicit and knowledge acquisition became insignificant. Furthermore, the r-square increased to 0.685, rising dramatically from 0.357 (model 2a) and only marginally from 0.674 (model 2b).

To test hypotheses H5 and H6, service quality was regressed on explicit knowledge transfer and tacit and knowledge transfer, controlling for knowledge acquisition (explicit and tacit), fund strategy, size and fees. Again hierarchical regression is used to assess the relative explanatory power of explicit knowledge transfer and tacit knowledge transfer (see Table 4).

**Table 4: Hierarchical Regression**

Results from regression (N=135).

Variable	Hypotheses 5-6				
	servqual 4	servqual 5a	servqual 6	servqual 5b	servqual 6
<b>extran</b>		<b>.434***</b> (4.823)	<b>.211**</b> (2.314)		<b>.211**</b> (2.314)
<b>tactran</b>			<b>0.470***</b> (5.275)	<b>.565***</b> (7.025)	<b>0.470***</b> (5.275)
exacqsn	0.152 (1.535)	0.061 (0.657)	0.01 (0.124)	0.035 (0.414)	0.01 (0.124)
tacacqsn	0.130 (1.383)	-0.001 (-.009)	0.047 (.575)	0.107 (1.352)	0.047 (.575)
mgmtfee	-0.007 (-.081)	-0.047 (-0.592)	-0.035 (-.487)	-0.017 (-0.235)	-0.035 (-.487)
incfee	0.161 (1.544)	0.168* (1.761)	.069 (.792)	0.047 (0.528)	.069 (.792)
aum	-0.074 (-.908)	-0.052 (-.694)	-0.013 (-.189)	-0.013 (-.194)	-0.013 (-.189)
F-stat	3.155	4.745	6.917	6.736	6.917
R-Square	0.345	0.456	0.565	0.544	0.565
$\Delta$ R-Square		0.111*	0.109	0.199***	0.021

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ ; two-tailed tests. (t-statistics in parentheses).

The first model (model 4) included only the control variables. Noteworthy, the effect of the control variables, knowledge acquisition (explicit and tacit), were insignificant. In the second model (model 5a), explicit knowledge transfer was

added to the equation. The effect was highly significant ( $p < 0.01$ ) and r-square increased to 0.456 from 0.345 in the base model. In the next equation (model 5b), tacit knowledge transfer was added to the control variables. Its effect too was highly significant ( $p < 0.01$ ) and r-square increased to 0.544 from 0.345 in the base model. In the next model (model 6), the full equation including explicit knowledge transfer, tacit knowledge transfer and the control variables was run. The effect tacit knowledge transfer remained highly significant ( $p < 0.01$ ), whereas the effect of explicit knowledge transfer, while still significant ( $p < 0.05$ ), was reduced. Furthermore, the r-square increased to 0.565, rising significantly from 0.456 (model 5a) and only marginally from 0.544 (model 5b).

Finally, to test hypothesis H7, firm performance was regressed on service quality controlling for knowledge acquisition (explicit and tacit), fund strategy, size and fees. The effect of service quality was highly significant ( $p < 0.01$ ). The impact of the control variables, knowledge acquisition (explicit and tacit), were insignificant. Of note, the effect of management fees on service quality was negative and significant ( $p < 0.05$ ).

The results of the regression analysis produced solid support for most the research hypotheses. The analysis initially supports the positive relationship between knowledge acquisition (explicit and tacit) and financial performance as envisaged H1 and H2. Specifically, upon adding these variables to the base model (model 2a) their relationships were highly significant and their inclusion resulted in a significant increase in R-square. However, when added to the model already incorporating explicit and tacit knowledge transfer (model 3), their relationships became insignificant and their inclusion resulted in only a marginal increase in R-square. This result indicates that instead of having a direct relationship with financial performance, rather it is a mediated one. The finding of a positive relationship upon regressing knowledge transfer on knowledge acquisition would provide further evidence of mediation. As a result, H1 and H2 are only partially supported.

To test for mediation, I ran the following three equations: (1) regress the mediator on the independent variable; (2) regress the dependent variable on

the independent variable; (3) regress the dependent variable on both the independent variable and the mediator (see Table 5). In order to establish mediation the following conditions should occur: the independent variable, knowledge acquisition, must affect the mediator, knowledge transfer; the independent variable, knowledge acquisition, must affect the dependent variable, financial performance, and the mediator, knowledge transfer, must affect the dependent variable, financial performance.

**Table 5: Mediation**

Results from regression (N=135).

Variable	extran 7	finperf 8	finperf 9	finperf 10
<b>exacqsn</b>	<b>.210**</b> (2.229)	<b>.230**</b> (2.340)		<b>0.13</b> (1.450)
<b>tacacqsn</b>	<b>.302***</b> (3.368)	<b>.170*</b> (1.819)		<b>0.027</b> (0.303)
<b>extran</b>			<b>.535***</b> (6.883)	<b>.474***</b> (5.422)
F-stat	4.112	3.328	5.822	5.436
R-Square	0.407	0.357	0.477	0.49

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01; two-tailed tests. (t-statistics in parentheses).

Because the conditions outlined above all hold, and in the predicted direction, the presence of mediation is supported as the effect of knowledge acquisition on financial performance has lessened from the second to the third equation. Upon examination of the results, there is strong support for the notion that knowledge transfer mediates the positive impact of knowledge transfer on financial performance. In the analyses, all of the criteria outlined by Baron and Kenny (1986) to establish mediation were met. In fact, the results suggest that knowledge transfer clearly mediates the relationship between knowledge acquisition and financial performance, as knowledge acquisition becomes insignificant when knowledge transfer is controlled in the third step of the procedure.

## 6. Discussion

Based on a sample of 135 hedge funds, I find: strong empirical support for the hypotheses linking knowledge transfer (explicit and tacit) to service quality and financial performance; mixed support for the hypotheses linking knowledge acquisition (explicit and tacit) to financial performance; and strong support for the hypothesis linking service quality to firm performance, leaving a broad academic contribution and robust managerial implications.

Specifically, the regression models indicate that knowledge transfer, both explicit and tacit, have a direct effect on service quality and financial performance. Results also indicate that tacit knowledge is ironically more important than explicit. Furthermore, results indicate that knowledge acquisition has an indirect effect, when mediated by knowledge transfer, on financial performance. Finally, the regression indicates service quality has a direct effect on financial performance. The data however fails to support that either explicit knowledge acquisition or tacit knowledge acquisition has a direct impact on the sample firm's financial performance. And as expected, the data also failed to show a relationship between knowledge acquisition and both service quality and financial performance.

Employing a robust knowledge framework, this research demonstrates empirically the theorised importance of knowledge in improving service quality and financial performance. These findings have important implications for service firms interested in improving their performance through the harnessing of knowledge. Broadly, both knowledge acquisition and knowledge transfer are related to firm performance, and firms that acquire and transfer knowledge better than their competitors outperform them. Interestingly, tacit knowledge, the acquisition and transfer thereof, appears to have a greater impact on firm results than explicit knowledge. This reinforces the importance of using knowledge management frameworks that consider tacit knowledge when understanding quality management practices, upholding the work of Dooley (2000) who emphasised that the future of the quality management field will mandate a more complete understanding of the role of tacit knowledge. Several references have been made in the quality literature, but none of them

explicitly consider both tacit and explicit knowledge and the interrelationships between these epistemological domains.

It is noteworthy that the existence of a positive relationship between knowledge acquisition (explicit and tacit) and service quality is not supported by the data. Moreover, the results indicate that the positive relationship between knowledge acquisition (explicit and tacit) and financial performance is one of mediation, as the relationship becomes insignificant when knowledge transfer (explicit and tacit) is entered into the equation. This is consistent with the pioneering work of Polanyi (1962), who argued that explicit knowledge in the form of what can be seen, read or communicated only takes on meaning within the context of tacit knowing. To Polanyi, Even mundane acts are dependent upon the transfer of tacit knowledge because the individual is unable to provide every detail as to how the act was performed. Consistent with this view, Con Krogh et al. (1994), emphasizes the necessity of knowledge transfer, maintaining that if it is not transferred to other individuals and groups it largely irrelevant (specifically from the point of view that when individuals leave the organization). These findings further underscore the fundamental importance of tacit knowledge, providing further validation of the work of strategic management scholars who argued that a shortcoming of explicit knowledge is that it is easily imitated by competitors (Zander and Kogut, 1995) and can be readily purchased in the market. Tacit knowledge, though inherently fragile and perishable, has been argued to be a source of competitive advantage, as it is highly personalized, idiosyncratic, and difficult to imitate (Spender 1996b).

The transfer of knowledge has long been argued to be a critical means to success for organisations. Linking fundamental concepts of quality management with the heart of the knowledge perspective, the early pioneering work of Taylor (1911) attempted to indentify 'best practices' based on the individual knowledge of specific workers and transfer them through the organisation as standard operating procedures. Of note, the data in this study indicates the transfer of tacit knowledge has a greater impact on service quality and firm performance than the transfer of explicit data. This is

consistent with work of Ishikawa (1985) endorsed the implementation of 'quality circles' to improve organisational performance. The formulation of quality circles is based on five elementary principles, including: voluntarism, self-development, mutual development, participation by all of the members, and continuity. Crucial to the success of quality circles, according to Ishikawa, is an emphasis on teams working closely together on voluntary bases over a long period of time. Although not necessarily stated in such terms, the employment of the quality circles endorsed by Ishikawa, promotes the sharing of tacit knowledge. This implicit and unspoken knowledge, now a hallmark of knowledge management, is extremely difficult to codify and often lost when individuals leave an organisation. The use of quality circles is an apposite method of capturing the elusive tacit knowledge and transferring it throughout an organization, and the results of this study indicate that such transfer has a significant impact on service quality and firm performance.

The study's findings also lend themselves to Nonaka's theory of knowledge creation, illuminating some noteworthy insights. According to Nonaka, knowledge creation occurs through four primary processes - socialization, externalization, combination, and internalization. These knowledge processes can be supported by a variety of quality management practices. Progressive human resource management practices such as team building, for example, promote socialization. Similarly, the implementation of information technology to aid data analysis fosters combination. This implies that organizations can better use existing knowledge, and even create more knowledge, by implementing quality management practices that support components of the knowledge creation processes (Linderman et al., 2004). From this perspective one can reason that central to effective knowledge management is the structuring of systems and employee functions designed to increase interaction and communication patterns rather than the cataloguing of raw axiomatic data that is to be later utilized of its own accord. Organizations maintaining a set of quality management practices that support the knowledge creation processes should be more effective at deploying quality management and driving financial performance. This helps illuminate what effective deployment of quality management means. This author holds that the

fundamental objectives of knowledge management and quality management are the same—create more organizational knowledge so that improvement can occur.

Previous empirical research has established the importance of effective deployment of quality management, but has not developed a complete understanding of what effective deployment means. Important insights into the effective deployment of quality management practices can now be drawn. This research indicates that quality management practices should be bundled around knowledge creation processes. A comprehensive knowledge perspective helps enlighten what effective organizational-wide deployment of management practices aim to accomplish. Specifically, it provides insights into the relationship between knowledge, service quality and firm performance. For example, organizations maintaining a set of management practices that support knowledge creation foster ‘socialization’ between customers and employees providing a basis for learning (Bitner and Booms, 1990; Lengnick-Hall, 1996). These firms should be better able to understand the spoken and unspoken needs of their customers (Dean and Bowen, 1994) cultivating higher levels of service quality.

Academic research empirically connecting organizational knowledge and quality management has been scarce, and this cross-discipline study provides important contributions to the field. Prior studies have largely considered incomplete views of knowledge, often focusing on only tacit or explicit knowledge and rarely considered the knowledge creation process (Lindeman et al., 2004). Moreover, they were largely theoretical and untested arguments. Lindeman et al.’s study proposed theory for integrating quality and knowledge, considering both the epistemological and ontological dimensions of knowledge, and the knowledge creation processes. It concluded that “future research should focus on testing and refining the proposed theory”. Though there is much work yet to be done, the purpose of this paper is to answer their call, empirically examining fundamental links of their theory integrating a robust theory of knowledge with quality management.

## 7. Limitations

Finally, as with any piece of research, this study is subject to some limitations. One potential limitation of this work stems from the measures used to test the research hypotheses. Though all of the variables employed in this study were constructed with multi-item scales to allow greater richness of the constructs, and Cronbach's alpha exceeded the minimum requirements as prescribed in the literature for all of the scales, the measures could be improved with further development. The list of items used to measure knowledge, for example, is far from exhaustive and could be improved with further development.

Another potential limitation of this study arises from the cross-sectional nature of the data. While the study sheds some light regarding the relationships among knowledge, service quality and financial performance, the employed measures record only one point in time. Longitudinal research is needed to establish causality and to assess the particular order of the sequence of events. Moreover, this study made an early attempt to tie knowledge components directly into the service profit chain. Future studies should incorporate path analysis to more accurately test knowledge as a specific link in the chain. Structural equation modelling would be an apt method for such investigation.

Finally, quality frameworks like the Baldrige Award increasingly recognize the importance of knowledge (e.g. the MBNQA category "Information and Analysis" was recently changed to "Measurement, Analysis, and Knowledge Management"). However, these frameworks do have not yet incorporated knowledge into the logic of deploying quality management practices. The findings within this work presents a unique perspective an opportunity for future refinements of the MBNQA.

The theoretical link between quality management practices and firm performance has not been clearly understood. Knowledge-based view of a firm provides an appropriate theoretical lens to establish this link since there is a strong connection between improvement and knowledge creation. However, other theoretical perspectives could also explain the relationship between

quality management and performance. For example, Choi and Eboch (1998) suggest institutional theory can be a useful theory to explain the link between quality management and performance.

## **7. Conclusion**

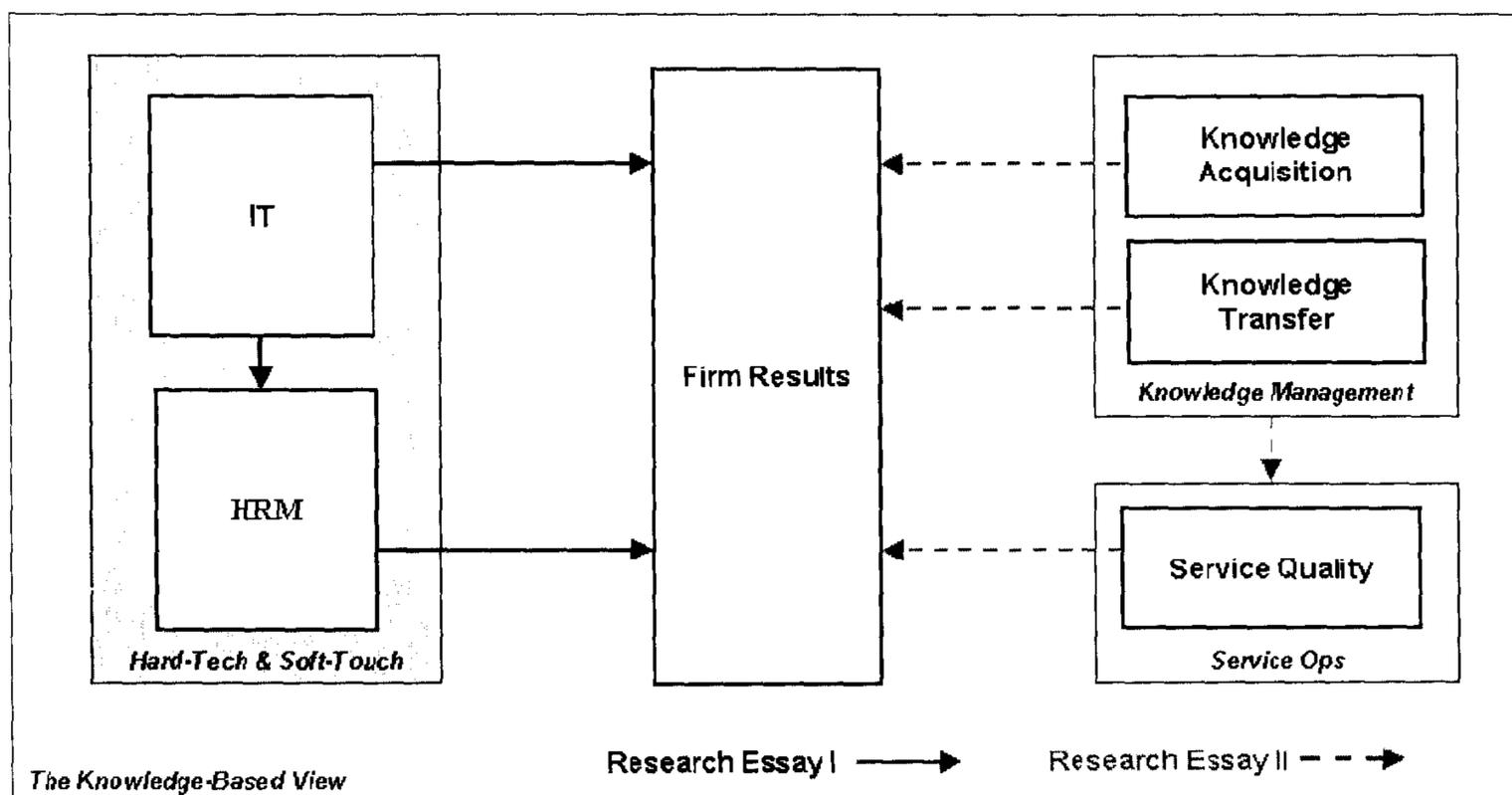
In this chapter I briefly revisit the conceptual research framework, core linkages, hypotheses, results and academic and managerial contribution from both Essays I and II. First, a general overview of the conceptual model, accompanied with an illustrative diagram, provides clear portrayal of the work. Then the specific linkages of the conceptual framework, accompanied with the underlying hypotheses from Research Essays I and II are presented. The nucleus of the theoretical support and the results of the empirical testing of hypotheses are summarized. Finally, answers to gaps in the literature and managerial contributions are highlighted.

### **7.1. Conceptual Model Revisited**

Through a knowledge based view lens, this research investigates if, how and when Hard-Tech IT implementations, Soft-Touch HRM procedures, dynamic knowledge management systems and enhanced service quality can impact firm performance within the services sector. This study is built upon a framework designed to demonstrate empirically how IT implementations and HRM procedures can impact a firm's bottom line in a measurable way. Moreover, it is designed to examine whether firms that are better able to manage their knowledge, via dynamic knowledge management systems designed to acquire and transfer tacit and explicit knowledge, do in fact achieve improved levels of firm performance. Tying into the service profit chain, the impact of service quality, and its ability to mediate the relationship between knowledge and business performance will be assessed.

A diagram representing the conceptual model of this research project is shown below. This framework is designed to examine how service firms can improve their performance through IT initiatives and human-enabling human resource management practices. Furthermore, it has been proposed that integrating service management practices with organizational knowledge concepts can provide insights into how

knowledge management leads to improved performance (Linderman et al., 2004). This author believes that such systems will link directly into the service profit chain, more clearly explaining how internal service quality can lead to external service quality, and ultimately, firm performance.



Conceptual Research Framework (Duplication from Chapter 1)

Accordingly, the proposed research is broken down into two empirical efforts. The first essay investigates specifically the link between IT and firm performance. This work tests for direct, mediated and moderated relationships. On the outset, the author holds that this relationship will be positive and significant. After investigating whether the purported relationship holds, the subsequent examination of HRM's role in the process follows. The second effort probes deeply into the components of knowledge, exploring how "the strategically most important assets of the firm" (Spender, 1996) can lead to enhanced business performance in the services sector. The research framework is designed to examine specifically how service firms can improve their performance through the acquisition and transfer of both tacit (know-why) and explicit (know-how) knowledge. This differentiates it from much of the earlier work that concentrates on either tacit or explicit knowledge, but rarely both. Finally, it has been proposed that integrating quality management practices with

organizational knowledge concepts can provide insights into how knowledge management leads to improved performance (Linderman et al., 2004). This research tests whether such systems will link directly into the service profit chain, more clearly explaining how internal service quality ultimately drives firm performance, but this theory must be tested.

## **7.2. Framework Linkages**

This research endeavour investigates empirically seven hypothesized linkages through the use of robust multivariate methods. The seven linkages are as follows:

- IT has a positive relationship with Firm Results
- IT has a positive relationship with HRM
- HRM has a positive relationship with Firm Results
- Knowledge Acquisition (explicit and tacit) has a positive relationship with Firm Results
- Knowledge Transfer (explicit and tacit) has a positive relationship with Firm Results
- Knowledge Transfer (explicit and tacit) has a positive impact on Service Quality
- Service Quality has a positive impact on Firm Results

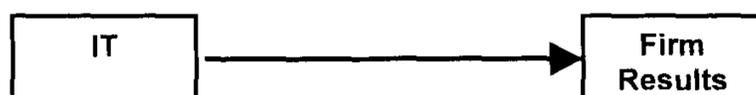
All of the proposed linkages are theoretically justified in a wide body of cross-discipline literature. The theoretical development, research hypotheses and results of empirical testing underlying each of these relationships follows.

### **7.2.1. Link 1: IT and Firm Performance**

Firms of all sizes and functions around the world use information technology in production, distribution, logistics, accounting, marketing and new service development to strip out barriers to communication

(Teece, 1998) and ultimately drive performance. Generally, recent studies advocate that new technological adoption is associated with enhanced firm productivity (Brynjolfsson and Hitt, 2003, 2000, 1999, 1996b, 1995; Lichtenberg, 1995) and even improved financial performance (Boyer et al., 1997). Aside from indirect benefits to the firm, IT can have a direct effect on the organization that is disproportionate to its cost (Brynjolfsson, Hitt and Yang, 2002). The following hypotheses were drawn:

**Information technology intensity is related to firm level operational performance (a) and financial performance (b).**



(Research Essay I: Hypothesis 1)

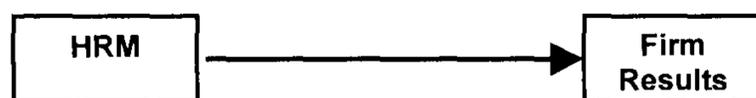
The results from the regression analysis provide mixed support for the hypotheses. The effect of IT on operational performance was highly significant ( $p < 0.05$ ), even when the control variables were added to the model, providing strong support for H1a. Moreover, this finding provided significant support for the technology proponents' side of the productivity paradox debate. However, the regression demonstrated that IT did not have a direct link with financial performance, lending no support to H1b, as the relationship was insignificant.

### **7.2.2. Link 2: HRM and Firm Performance**

Human resources are often considered a company's most valuable resource, and human resource management is the means by which firms manage these precious assets. Previous research has proposed the importance of HRM practices in shaping both employee and organisational outcomes (Delaney and Huselid, 1996). Authors have demonstrated that human resource practices can directly affect both firm productivity and performance (Youndt et al., 1996; Hueslid, 1995). Organisations can implement a wide range of human resource

management practices to augment employee skills. Led by Peters and Waterman's (1982) portrayal of "excellent" organizations, a general awareness of the benefits of progressive HRM practices and systems have emerged (Delaney and Huselid, 1996). Moreover, Meyer and Collier (2001) have proposed that a wide range of human resource management practices, including the improvement of employee training and the measurement of staff well being, should result in increased organizational results. The following hypotheses were drawn:

**Human resource management is related to firm-level operational performance (a) and financial performance (b).**



(Research Essay I: Hypothesis 2)

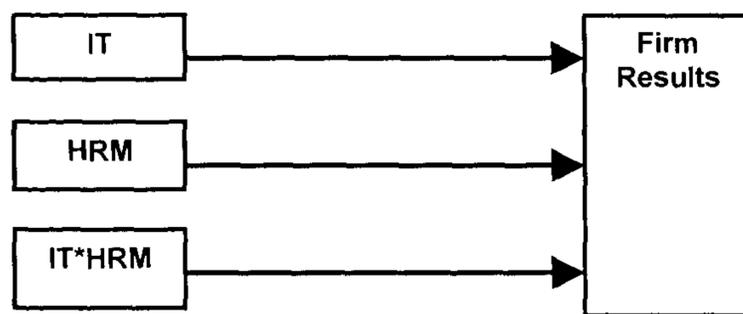
The data found strong support for claim. The analysis supported the positive relationship between both HRM and operational performance and HRM and financial performance as envisaged. The relationship was highly significant ( $p < 0.01$ ) in the former model, and significant ( $p < 0.10$ ) in the latter. The distinction between the strength of the relationships is as expected.

### 7.2.3. Link 3: IT and HRM

With the potential to meet the valuable, rare and inimitable criteria, employees are often considered a company's most valuable resource. Because their value is in part contingent upon their ability to serve as fundamental information resources, their worth increases with the speed and frequency of their circulation (Leonard-Barton 1992; Prahalad and Hamel 1990). IT can enable virtual circulation by providing rich communication flows and complete knowledge transfers to take place between individuals separated by distance and language (Froehle, Roth, Chase and Voss 2000; Kellogg and Chase 1995). The use of IT has been empirically linked to employees' ability to act and react swiftly (Menor, Roth and Mason 1998) and to accelerate the

decision-making processes (Opper and Fersko-Weiss 1992). The role of IT is particularly critical in the services environment, where it is vital to both production and delivery (Froehle, Roth, Chase and Voss 2000). The following hypotheses were drawn:

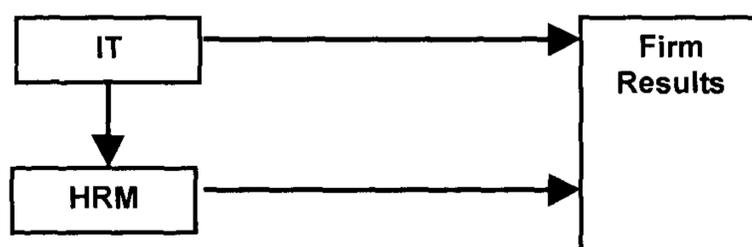
**Human resource management moderates the positive relationship between information technology and firm level operational performance (a) and financial performance (b).**



(Research Essay I: Hypotheses 3a and 3b)

Although the relationship between HRM and firm results was positive and highly significant, the data found no support for a moderation effect of HRM on the positive relationship between IT and firm results. More specifically, the interaction effect of IT and HRM was not significantly related to either operational or financial performance.

**Human resource management mediates the positive relationship between information technology and operational performance (a) and financial performance (b).**



(Research Essay I: Hypotheses 4a and 4b)

The models found strong support for the notion that HRM mediates the positive impact of IT on both operational and financial performance as predicted in H4a and H4b. In fact, the results suggest that HRM clearly mediates the relationship between IT and financial performance, as IT

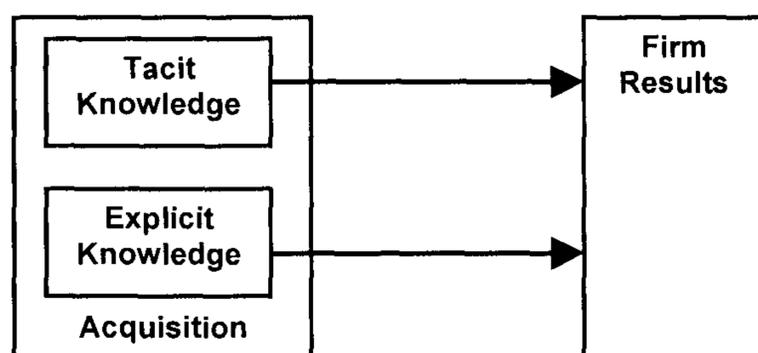
becomes insignificant when HRM is controlled in the final step of the procedure. Though not demonstrating the same degree of mediation as in the case of financial performance, it is noteworthy that all of the fundamental relationships that indicate a mediate relationship were highly significant ( $p < 0.01$ ) in the operational performance models. Of particular importance for demonstrating mediation, the significance of IT was substantially reduced when controlling for HRM.

#### 7.2.4. Link 4: Knowledge Acquisition and Firm Results

In a sense, firms are repositories of knowledge (Inkpen and Dinur 1998). Rich organizational knowledge, even tacit knowledge that is often non-articulated, can be catalogued (Teece, 1998). Knowledge codification tools support the representation of knowledge so that it can be accessed, transferred and absorbed into firms' inner knowledge structures (Boynton, Zmud and Jacobs, 1994). Likening knowledge to a living thing, Davenport (1998), describes the capability of knowledge to grow and change as it interacts with the environment. The following hypotheses are drawn:

**Knowledge acquisition (tacit) is positively related to firm results.**

**Knowledge acquisition (explicit) is positively related to firm results.**



Research Essay II: Hypotheses I and 2

The results of the hierarchical regression analysis produced mixed support for these research hypotheses. The analysis initially supports the positive relationship between knowledge acquisition (explicit and tacit) and financial performance as envisaged. Specifically, upon

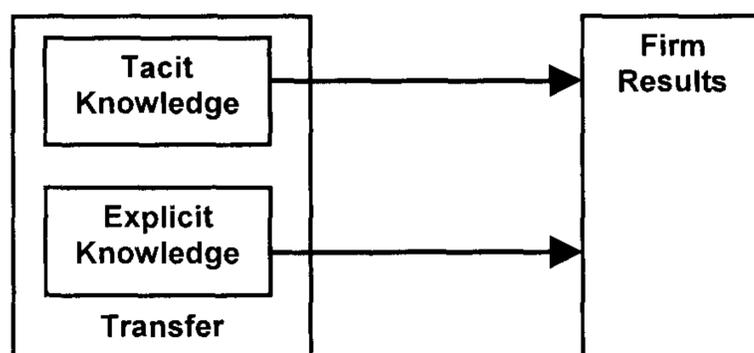
adding these variables to the base model, their relationships were highly significant and their inclusion resulted in a significant increase in R-square. However, when added to the model already incorporating explicit and tacit knowledge transfer, their relationships became insignificant and their inclusion resulted in only a marginal increase in R-square.

#### 7.2.5. Link 5: Knowledge Transfer and Firm Results

The transfer of knowledge has been conceptualized in terms of communication intensity, and specifically, the degree of frequency, informality and openness (Gupta and Govindarajan, 1991; Jablin, 1979; Tushman, 1977). Knowledge transfer tools alleviate the temporal, physical, and social distances in knowledge sharing (Ruggles, 1997). The following hypotheses were drawn:

**H3: Knowledge transfer (explicit) is positively related to firm results.**

**H4: Knowledge transfer (tacit) is positively related to firm results.**



Research Essay II: Hypotheses 3 and 4

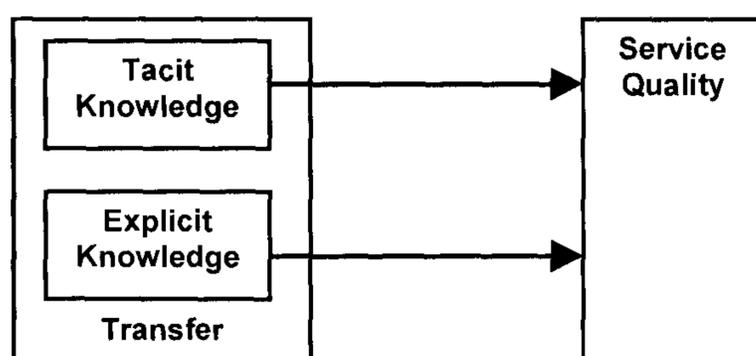
The results of the hierarchical regression analysis produced strong support for the hypotheses surrounding the linkage between knowledge transfer and firm results. The analysis first supports the positive relationship between knowledge transfer (explicit and tacit) and financial performance as envisaged. Moreover, upon adding these variables to the the model already incorporating explicit and tacit knowledge acquisition, their relationships remain highly significant and their inclusion resulted in a substantial increase in R-square.

### 7.2.6. Link 6: Knowledge Transfer and Service Quality

The employment of knowledge management systems is one method employed by managers to capitalize on organizational knowledge while adapting to an increasingly competitive marketplace. The effective acquisition and transfer of tacit and explicit knowledge allows employees to better cope with change and uncertainty (Davenport, 1998). Reflecting this reality, firms implement knowledge management initiatives in order to learn from past successes and failures and to better prepare for the future. This assessment can be interpreted in numerous ways. The service profit chain, for example, proposes that practices designed to support and enable employees result in greater levels of service quality (Heskett et al., 1994). Consistent with IS research that has documented that new technological implementations are often implemented with the aim of better servicing customers (see for example Brynjolfson and Hitt 1996b), knowledge management implementations can be implemented with the intention of improving service quality. The following hypotheses were drawn:

**Knowledge transfer (explicit) is positively related to service quality**

**Knowledge transfer (tacit) is positively related to service quality.**



Research Essay II: Hypotheses 5 and 6

The results of the hierarchical regression analysis found support for the hypotheses surrounding the linkage between knowledge transfer (explicit and tacit) and service quality. However, the relationship between service quality and tacit knowledge transfer is found to be greater than the relationship with explicit knowledge transfer. The

analysis first supports the positive relationship between tacit knowledge transfer and service quality as envisaged. Moreover, upon adding this variable to the model already incorporating explicit and explicit knowledge transfer, the relationships remain highly significant and its inclusion resulted in a substantial increase in R-square.

### 7.2.7. Link 7: Service Quality and Firm Performance

Service quality is central to the success of all organisations (Zeithaml et al., 1990) and is a “cornerstone of marketing strategy” (Asubonteng, McCleary and Swan, 1996). Higher service quality results in greater customer satisfaction, customer loyalty and profitability (Heskett et al., 1994). Presenting a more concentrated view of the service profit chain, the operations capabilities-service quality-performance (C-SQ-P) triad (see Roth and Jackson, 1995) builds upon similar literature highlighting the critical role of these components, highlighting the importance of service quality on firm performance. The following hypothesis was drawn:

#### H7: Service quality is positively related to firm results



Research Essay II: Hypothesis 7

The data found strong support for the hypothesis linking service quality to firm results. The effect of service quality on financial performance was highly significant ( $p < 0.01$ ).

### 7.3. Summary

Increasing our understanding of how service firms can enhance their operations with knowledge-based assets, this study demonstrates empirically how and when the implementation of information technology (IT) initiatives, human resource management (HRM) procedures and knowledge

management (KM) systems enhance service quality and ultimately improve firm results within the services sector. Tying together a cross discipline body of literature, theory is drawn to firmly support the research hypotheses. The research framework is constructed upon a robust framework that argues that the union of knowledge management practices bind together to create new organizational knowledge. This research indicates that such systems have positive relationships with certain links of the service profit chain, more clearly explaining how managerial choices can lead to enhanced service quality, and ultimately, to improved firm performance.

Two separate datasets, both multi-year research efforts designed to gain insights into state of the art managerial practices within the services sector, are employed in this work. Carefully gathered data is tested empirically with robust multivariate statistical methods. The path and validity of relationships are tested using order of least squares regression and hierarchical regression analysis. Supplementing OLS models with the application of instrumental variables regression, this study also addresses the threat of biased and inconsistent estimators caused by endogenous explanatory variables.

This work was designed to help answer four core gaps in the literature: (1) Does IT Matter?; (ii) Can Strategic HRM Drive Performance?; (iii) Does Knowledge Management Drive Performance?; and (iv) What is the Role of Knowledge Creation in the SPC?, and its results provide considerable contributions to each hole. Insights and discoveries with regard to the contribution of new technological adoptions are drawn, helping to clarify the means by which investments in human capital coincide with firms' outcomes. Further demystifying the productivity paradox, this paper demonstrates empirically the positive impact of implementing information technology (IT) on operational and financial performance. Specifically, this study shows how the illusive relationship between IT and firm performance can be made clear by testing for direct, mediated and moderated relationships. Based on a sample of 188 service firms, this work demonstrates that IT does have a direct effect on operational performance and an indirect effect, when mediated by human

enabling human resource management, on both operational and financial performance.

Integrating the knowledge-based view and service operations research, this paper investigates empirically the impact of knowledge acquisition and transfer on firm performance. Strong evidence is found indicating that firms better able to manage their knowledge, via dynamic knowledge management systems designed to acquire and transfer both tacit and explicit knowledge, do in fact achieve improved levels of firm performance. Effective acquisition and transfer of knowledge are shown to hinge upon incorporating both tacit and explicit knowledge. This differentiates the study from much of the earlier work that concentrates on either tacit or explicit knowledge, but rarely both. Furthermore, and tying into the service profit chain, this study empirically demonstrates that the transfer of explicit and tacit knowledge have a positive relationship with service quality. Consistent with theory, the transfer of tacit knowledge has a greater impact. A positive relationship between service quality and financial performance is also supported by the data.

This research makes important contributions to the literature. It further develops the link between the Knowledge Based View and Quality Management and illustrates specific practices that can be used to create knowledge (Lindeman et al. 2004). This helps us understand not only what organizational knowledge is, but also how it can actually be created through specific management practices. Linderman et al. put forth the challenge to the academy to focus on testing and refining the proposed theory, and this work is an early attempt in doing so. Also, Sabherwal and Becerra-Fernandez (2003) employed Nonaka's theory to test propositions about effectiveness of knowledge management in various organizational settings. They developed scales of socialization, externalization, combination, and internalization and tested their model using the structural modeling technique. Their research in part too served as a departure point for testing the theory in this research. Other relevant works include King and Zeithaml (2003) where they deal with the challenge of measuring organizational knowledge. In addition, as one reviewer noted, possibly all four knowledge creation process may not be

equally important. Future research could also investigate the relative importance of different knowledge creation processes in different environmental settings. The proposed theory has provided a theoretical basis for linking quality management and knowledge. It has set the stage for future theory development and empirical research.

In summary, the fruit of this research evidences that firms better able to: (i) manage their knowledge-based assets via dynamic KM systems designed to capture and transfer explicit and tacit knowledge; (ii) deploy IT initiatives to be used by an enabled work force; (iii) promote human-enabling HRM practices; and (iv) foster improved service quality, ultimately achieve increased business performance and profitability. These findings have important implications for the academe and service firms interested in improving performance through the more efficient use of existing knowledge-based assets, shedding light on methods that lead to managerial and financial success in a poorly understood segment of the services sector, the hedge fund industry.

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## 9. Appendix A: Operationalisation of Research Essay I Variables

### Information Technology

(*IT*): This study employs one multi-item scale, "IT", to measure information technology. Three questions were used to build the scale and the descriptors were as follows:

- "Current use of IT." The descriptor for a score of 1 was "IT used only for standard applications", and for a score of 5, "IT and other technologies used to support redesign of business processes in order to change the basis of industry competition".
- "Current use of information technology as a basis for knowledge management." The descriptor for a score of 1 was "fragmented data collection", and for a score of 5, "actively collects data from a variety of sources on customer feedback, quality improvement, and competitors, as a basis of improvement and strategic planning".
- "Current state of information technology integration." The descriptor for a score of 1 was "no attention to business processes", and for a score of 5, "key business processes managed and redesigned where needed; process owners in place; process performed measured".

Cronbach's alpha was used to assess the reliability of the multi-item index. The results were quite satisfactory at 0.89.

### Human Resource Management Practices

(*HRM*): This study constructed one multi-item scale, "HRM", to assess the nature of the human resource management systems. Six questions were used to build the scale and the descriptors were as follows:

- "Recognition and reward." The descriptor for a score of 1 was "no feedback or recognition of service performance at the employee level", and for a score of 5, "recognitions is everyone's responsibility and is based on exceeding internal and external expectations".
- "Skill and job training and education." The descriptor for a score of 1 was "no formal training programme, ad hoc training", and for a score of 5, "established plans with an average of more than 5% of the employee's time devoted to training".
- "Education and training for quality." The descriptor for a score of 1 was "Limited training for quality", and for a score of 5, "comprehensive quality training plan, training in quality values, tools and techniques".
- "Employee involvement." The descriptor for a score of 1 was "blocked by attitudes of both management and employees, limited teamwork", and for a score of 5, "Employees are highly involved and able to make real contributions to business improvement, extensive teamwork".
- "Support for employees." The descriptor for a score of 1 was "Inadequate support (e.g. technology and service design) for staffing in providing customer service", and for a score of 5, "staff feel that they receive adequate support and resources to do their job and to fully satisfy customers".

- "Measurement of employee satisfaction." The descriptor for a score of 1 was "No measurement of employee satisfaction", and for a score of 5, "systematic employee satisfaction measures collected and related to customer satisfaction data".

Again, Cronbach's alpha was used to assess the reliability of the multi-item index. The results were also quite satisfactory at 0.84.

### **Operational Performance**

(*operperf*): This study constructed one multi-item scale, "OPS", to assess firms' overall operational performance. Measurements of relative productivity, internal productivity and operating costs were used to build the scale. The descriptors were as follows:

- "Overall productivity, relative to industry." The descriptor for a score of 1 was "limited productivity gains over last three years", and for a score of 5, "high level of productivity improvement sustained over last three years; productivity among industry leaders".
- "Overall productivity within organisation." The descriptor for a score of 1 was "decreasing", and for a score of 5, "consistently improving; significant gains".
- "Quality performance, relative to industry." The descriptor for a score of 1 was "poor overall quality, compared to industry", and for a score of 5, "achieved a reputation for excellence in quality services and products that is notable in the industry and significantly better than the competition".

The reliability of the performance measure, *operperf*, was assessed with Cronbach's alpha. The result of 0.62 was less than desirable but satisfactory.

### **Financial Performance**

(*finperf*): This study constructed one multi-item scale, "FIN", to assess firms' overall financial performance. Measurements of relative margins, return on net assets and cashflow were used to build the scale. The descriptors were as follows:

- "Margins, relative to industry (Q84)." The descriptor for a score of 1 was "below industry average," and for a score of 5, "above industry average."
- "Return on net assets (Q88)." The descriptor for a score of 1 was "lower than competition," and for a score of 5, "better than competition"
- "Cashflow (Q86)." The descriptor for a score of 1 was "negative," and for a score of 5, "positive."

The reliability of the performance measure, *operperf*, was assessed with Cronbach's alpha. The result of 0.64, again, was less than desirable but satisfactory.

### **Supporting Infrastructure**

(*infra*): This study employs one multi-item scale, "infra", to measure the level of supporting infrastructure. Three questions were used to build the scale and the descriptors were as follows:

- "Organisational structure for new service and product development." The descriptor for a score of 1 was "ad hoc design and development of new services and products", and for a score of 5, "cross-functional staff teams typically develop new services and products".
- "New service design and development process." The descriptor for a score of 1 was "no identifiable process for new service development; ad hoc basis," and for a score of 5, "Formal and reproducible process for developing new and enhancing existing services".
- "Role of back office." The descriptor for a score of 1 was "Provides transaction, administrative, or support only", and for a score of 5, "Proactive and develops superior processes and creates new market opportunities".

Cronbach's alpha was used to assess the reliability of the multi-item index. The results were quite satisfactory at 0.81.

### **Growth**

(*growth*): Growing firms may be more likely to have further developed IT infrastructures and HRM systems, therefore the model will control for any extraneous effects of growth.

- "Market share (or primary services or line of business)." The descriptor for a score of 1 was "Declining", for a score of 3 was "static", and for a score of 5 was "increasing".

### **Instrumental Variables** (used only in instrumental variables regression)

Three variables served as instrumental variables (z) for IT (x) in the first stage of the instrumental variables regression models. They are well suited to serve as instrumental variables as they are at least moderately correlated to IT, 0.50, 0.33 and 0.31 respectively and only slightly correlated to financial performance, 0.09, 0.08 and 0.14, and operational performance, 0.09, 0.20 and 0.26.

- "Organizational learning."
- "The role of innovation."
- "Innovativeness."

## 10. Appendix B: Operationalisation of Research Essay II Variables

The development of the research instruments of this study were based on widely accepted and validated instruments from Knowledge Based View and Operations Management scholars. Employing factor analysis using maximum likelihood extraction, each scale exhibited unidimensionality, with only one eigenvalue greater than 1 and accounting for at least sixty-five percent of the variance. Moreover each scale was found to be reliable in terms of Cronbach's Alpha, with all exceeding 0.80.

### Explicit Knowledge Acquisition

This study constructed one multi-item scale (*exaqstn*) to assess firms' overall ability to capture explicit knowledge. Measurements of explicit knowledge, such as unequivocal facts, figures, symbols and axiomatic propositions (Kogut and Zander, 1992) were used to build the scale. The descriptors were as follows:

- "Data sourcing." The descriptor for a score of 1 was "employees seek and find data on an adhoc basis", and for a score of 5, "the organization subscribes and archives a wide range of news sources and industry databases (e.g. Bloomberg, reuters, datastream, etc)."
- "Data quality." The descriptor for a score of 1 was "data is inaccurate, unreliable and/or out-of-date", and for a score of 5, "data is maintained with accuracy, integrity and reliability".
- "Data availability." The descriptor for a score of 1 was "data is often unavailable", and for a score of 5, "data can be accessed by staff throughout the organization".
- "Data mapping." The descriptor for a score of 1 was "data is not mapped", and for a score of 5, "data is gathered, retained and mapped into an organized and accessible architecture".

The scale was found to be unidimensional; the first component had an eigenvalue of 2.885 and explained 72.10% of the variance. The reliability of the performance measure, *exaqstn*, was assessed with Cronbach's alpha. The result of 0.86 was satisfactory.

### Tacit Knowledge Acquisition

This study constructed one multi-item scale, "*tacaqstn*", to assess firms' overall ability to capture tacit knowledge. Rich organizational knowledge, even tacit knowledge that is often non-articulated, can be catalogued (Teece, 1998). Measurements of personalized, idiosyncratic, difficult to imitate (Spender 1996b) knowledge, were used to build the scale. The descriptors were as follows:

- "Best practices." The descriptor for a score of 1 was "there is little to know monitoring; employees address tasks on an adhoc basis", and for a score of 5, "the organization quickly identifies best practices for carrying out tasks".

- “News and media broadcasts” The descriptor for a score of 1 was "audio and video broadcasts are considered distractions and not available to staff on a regular basis", and for a score of 5, "audio and video broadcasts of news and market developments (e.g., MSNBC, CNN, Bloomberg TV, etc.) are always live and available to staff".
- "Business process mapping." The descriptor for a score of 1 was "processes and procedures for carrying out business activities are not identified or well understood", and for a score of 5, "focus on identifying and recording both critical and non-critical business processes and procedures."

The scale was found to be unidimensional; the first component had an eigenvalue of 2.351 and explained 78.38% of the variance. The reliability of the performance measure, *tacaqstn*, was assessed with Cronbach's alpha. The result of 0.84 was satisfactory.

### **Explicit Knowledge Transfer**

This study employs one multi-item scale, "extran", to measure the transfer of explicit knowledge. The quality, speed and accuracy of knowledge transfer is considerably improved with the support of technologies (Ruggles, 1998). Multiple questions were used to build the scale and the descriptors were as follows:

- "Data sharing." The descriptor for a score of 1 was "employees are responsible for their own data", and for a score of 5, "mapped data is available, shared and distributed to staff throughout the organization".
- "Due diligence questionnaire." The descriptor for a score of 1 was "the organization does not have or provide outside parties any due diligence framework", and for a score of 5, "a comprehensive and factual and objective due diligence framework (e.g. the AIMA due diligence questionnaire) has been carefully constructed and is provided to employees, clients and service providers".
- "Transparency." The descriptor for a score of 1 was "stealth of operations, financial opaqueness, and privacy is built into processes", and for a score of 5, "the organisation provides accurate financial investment exposure reports to employees, clients and to service providers".
- "Web Site." The descriptor for a score of 1 was "the organisation has no website", and for a score of 5, "the corporate website provides contact information, company description and allows the downloading of standardized and objective reports".
- "Intranet." The descriptor for a score of 1 was "the organization has no intranet", and for a score of 5, "the corporate intranet provides regularly updated data to employees, clients and service providers".

The scale was found to be unidimensional; the first component had an eigenvalue of 3.552 and explained 78.38% of the variance. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were quite satisfactory at 0.89.

### **Tacit Knowledge Transfer**

This study employs one multi-item scale, "tactran", to measure the transfer of tacit knowledge. The transfer of knowledge has been conceptualized in terms of communication intensity, and specifically, the degree of frequency, informality and openness (Gupta and Govindarajan, 1991; Jablin, 1979; Tushman, 1977). Multiple questions were used to build the scale and the descriptors were as follows:

- "Organisational structure for decision making." The descriptor for a score of 1 was "managers make most decisions and provide direction", and for a score of 5, "cross-functional staff teams arrive at decisions; employees are empowered and participation is encouraged".
- "Openness." The descriptor for a score of 1 was "dialogue is discouraged", and for a score of 5, "openness supported and encouraged".
- "Teamwork intensity." The descriptor for a score of 1 was "less than 10% of most employees time is spent working in teams", and for a score of 5, "More than 50% of most employees time is spent working in teams".
- "Electronic communication." The descriptor for a score of 1 was "few individuals within the organization use email or engage in conference calls", and for a score of 5, "every employee has email; employees participate in video and/or conference calls on a regular basis".
- "Industry conferences and seminars" The descriptor for a score of 1 was "industry conferences are considered a waste of employees' time and are not attended", and for a score of 5, "staff regularly attend industry conferences and seminars; presentation and active participation at such meetings is encouraged".

The scale was found to be unidimensional; the first component had an eigenvalue of 3.263 and explained 65.26% of the variance. Cronbach's alpha was used to assess the reliability of the multi-item index. The results were quite satisfactory at 0.85.

### **Service Quality**

Service quality (srvqual) has been conceptualized in the following five separate dimensions: tangibles, reliability, responsiveness assurance and empathy (Parasuraman, Zeithaml and Berry, 1988). This conceptualization has been validated a number of times in the literature. From the questions listed below, designed to embrace the above dimensions, this study employs one multi-item scale, "servqual", to measure firms' ability to deliver service quality.

- "Staff responsiveness." The descriptor for a score of 1 was "staff seen as slow to respond to investors (and potential investors)", and for a score of 5, "staff go out of their way to respond to investor needs even when it's beyond the call of duty".
- "Equipment and facilities." The descriptor for a score of 1 was "equipment, infrastructure and facilities are inadequate for the task at hand", and for a score of 5, "state of the art technology and equipment employed throughout the organization".

- “Staff empathy.” The descriptor for a score of 1 was “staff view investor relations as a chore; provide minimum acceptable level of service with poor attitude”, and for a score of 5, “individualized investor relations, served with a smile”.
- “Assurance.” The descriptor for a score of 1 was “poor overall service record, compared to industry”, and for a score of 5, “achieved a reputation for excellence in quality services; notably better than the competition.”
- “Reliability of Reporting.” The descriptor for a score of 1 was “investor reporting is infrequent and sometimes inaccurate” and for a score of 5, “provides investors frequent, accurate reports; offered via a variety of distribution channels”.

The scale was found to be unidimensional; the first component had an eigenvalue of 3.787 and explained 75.73% of the variance. Cronbach’s alpha was used to assess the reliability of the multi-item index. The results were highly satisfactory at 0.91.

### **Control Variables**

**(Strategy)** The empirical relationship between hedge fund strategy and performance has been studied extensively, see for example: Ackermann, McEnally and Ravenscraft (1999); Brown, Goetzmann and Park (2001); and Agarwal, Daniel and Naik (2004). Different hedge fund strategies exhibit different exposures with respect to a range of risk factors, and one cannot assume normal distribution of performance (Signer and Favre, 2002). While testing the hypothesized relationships in this study, each fund’s investment style is controlled with a dummy variable in all models.

**(Size)** Many researchers claim that hedge fund performance is dependent on numerous factors, with fund size playing a role (Ammandd and Moerth, 2005; Hedges, 2004). Some authors have argued an inverse relationship between the absolute amount of assets under management managed by a hedge fund and performance (Mozes and Herzberg, 2003). Moreover larger hedge fund firms may be more likely to have further developed knowledge and quality management practices than smaller firms. To manage this effect, all models in this study control for hedge fund size as measured by assets under management.

**(Fees)** Alignment of incentives is a concern to hedge fund performance for managers and investors alike. Morningstar Inc., the provider of independent investment research, has begun to grade funds on whether their interests are aligned with those of investors. Recent theoretical work by Das and Sundaram (2002) argues that higher incentive fees should result in higher performance; however, the empirical evidence on this is at odds, or at least mixed. Ackermann, McEnally, and Ravenscraft (1999), Liang (1999), and Edwards and Caglayan (2001), for example, all find that hedge funds that charge higher incentive fees are associated with better performance. In contrast, Brown, Goetzmann, and Ibbotson (1999) find that hedge funds charging higher fees do not better than those with lower fees. Consistent with

seminal research from the corporate finance literature, I overcome these limitations by controlling for management and incentive fees.